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Layout Redesign for Cost Reduction and Efficiency Improvement

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Abstract:

In a global competitive market, the manufacturing companies have to produce cost effective products which can be realized by minimized production cost and higher productivity. The effective facility planning can reduce significantly the operational costs of companies. Adequate facility layout can result the productivity improvement of the manufacturing activity. The Facility Layout Problem (FLP) is relating to location of objects (departments, workstations, machines, etc.) on a given site and the material flow between these objects.

The goal of this study is to show the reasons, objectives and steps of a layout redesign process. A described case study, which is a part of an industrial R+D project, shows how can be optimized the arrangement of workstations on the shop floor to reduce movement of raw materials, components, equipment and workers, to minimize the total workflow and the cross material flow in the manufacturing system, to provide free space for other additional value adding activities and to create safe work environment at a real manufacturing system.

Keywords: layout redesign; process improvement; cost reduction

JEL Classification: D24 ; L23 ; C61

Introduction

In the growing market competition, where the customer demands are changing continuously the enterprises have to focus on cost reduction and profitability (Kovács and Kot 2016).

This research study is very important and actual, because the cost reduction and the improvement of productivity are very important goals of all of manufacturing companies. The optimal facility layout is an effective tool in cost reduction by enhancing the productivity. Facility layout design involves a systematic physical arrangement of different departments, workstations, machines, equipment, storage areas and common areas in a manufacturing industry (Stefanescu *et al.* 2008, Naik and Kallurkar 2016).

The article is original and unique, because beside the description of theoretical background relating to the layout redesign, a practical method was also introduced in a case study. In the article a real plant layout redesign was described. More alternatives were planned for the layout and were compared based on 4 indicators (total travel distance of goods, amount of total workflow in the whole assembly process, amount of cross workflow on the shop floor and available free space).

The goal of the study is to show how can be optimized the arrangement of workstations to reduce movement of goods and workers, to minimize the total workflow and the cross material flow in the system, to provide free space on the shop floor and to create safe work environment.

1. Literature review and methodology

The definition of facility layout may be given as the arrangement of machinery and flow of materials from one facility to another, which minimizes material handling costs while considering any physical restrictions on such arrangement (Khoshnevisan *et. al* 2016). Facility layout concerns with the optimum arrangement of workstations with known dimensions in such a way that minimizes materials handling and ensure effective utilization of men, equipment and space (Riyad *et. al* 2014, Naik and Kallurkar 2016).

The most important reasons of redesign of facility layouts are the continuously fluctuating customer demands and changing market environment. Changes in product portfolio, production volume, changes in manufacturing process and technology can result bad utilization of space, huge stock in process at the facility, high material handling distances, bottlenecks at workstations, idle time of facilities and workers, etc. (Naik and Kallurkar 2016, Zhang *et. al* 2009).

There are lot of theoretical methods for design and optimisation of FLPs (Bhowmik 2008, Naik and Kallurkar 2016, Ojaghi *et. al* 2015, Tompkins *et. al* 2010), both for new facility design and for redesign of an existing layout. The article is original and unique, because beside the description of theoretical background relating to the layout redesign, a practical method was also introduced in a case study.

In this article a design method is introduced for re-layout of a manufacturing plant, and confirmed that the layout redesign is an effective tool for process improvement. A detailed facility layout redesign was completed in the frame of an R+D project. The described case study shows how can be improved the efficiency and reduced manufacturing cost of a real life manufacturing system by layout optimization.

2. Facility layout redesign objectives

There are lots of objectives of the facility layout planning which can be the followings:

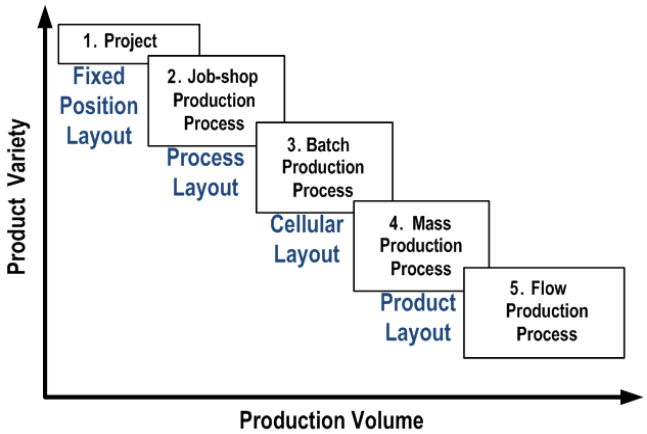
- maximization of production capacity of the company;
- maximal utilization of resources (human, raw material, component, equipment);
- minimization of total movement distance of goods, workers and equipment on the shop floor;
- minimization of space used for the existing manufacturing activity, providing free space for new business;
- minimization of cross material flows;
- establishment of safe and comfortable work environment.

3. General types of facility layouts

There are four main types of facility layout (Figure 1) which are the followings (Kovács 2015, Korhan 2016, Khoshnevisan *et. al* 2016, Ostwald 1997):

- *Fixed Position Layout* is used in project production used for manufacturing of large and individual products *e.g.,* bridge, ships, etc.;
- *Process Layout* is typically used in job shop production used for manufacturing of a low volume of customized products;
- *Cellular Layout* is suitable for producing a wide variety of final products manufactured in medium volume;
- *Product Layout* is used in flow shop production used for manufacturing of a high volume of standard products.

Figure 1. General types of production processes and facility layouts



Source: (own)

In the practice the most common situation is the mixture of the above mentioned layout types.

4. Case study for layout optimization

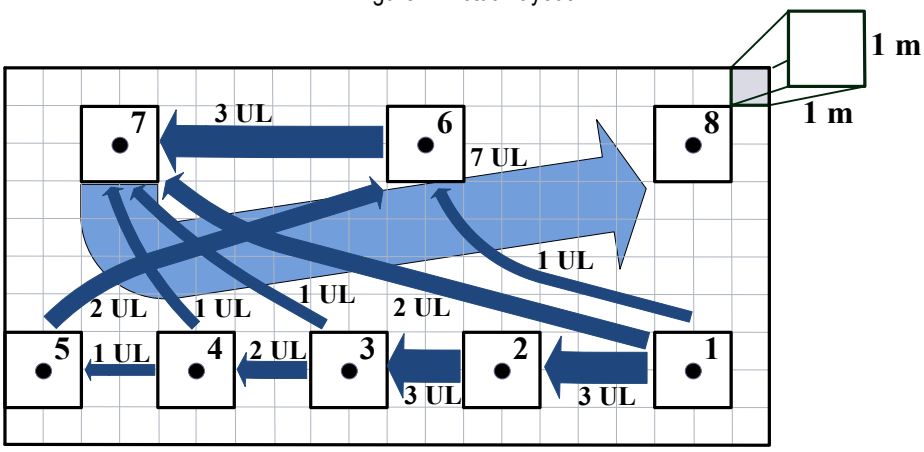
In the next part of the article a case study will be introduced for a layout redesign. The redesign was successfully completed in the frame of an R+D project.

4.1. Description of the actual layout

Actual layout to be redesign can be seen in Figure 2. The main profile of the analyzed company is manufacturing of components and final assembling. The dimension of the shop floor is 20m x 10m (200m2). The manufacturing process is including 8 workstations. All of workstations (No1 – No8) are fixed position. Sankey diagram in Figure 2 shows the material flow between the workstations, the width of the arrows is shows the material flow quantity.

The dimension of the material flow is unit load (UL/shift).

Figure 2. Actual layout



Source: (own)

Reason of the layout redesign: the arrangement of the workstations on the shop floor is not ideal, which can result huge cross material flow in the manufacturing system. This cross flow could be a bottleneck in the manufacturing process and cause problems in component supply and can result accidents.

Goal of the layout redesign is to optimize the arrangement of workstations on the shop floor:

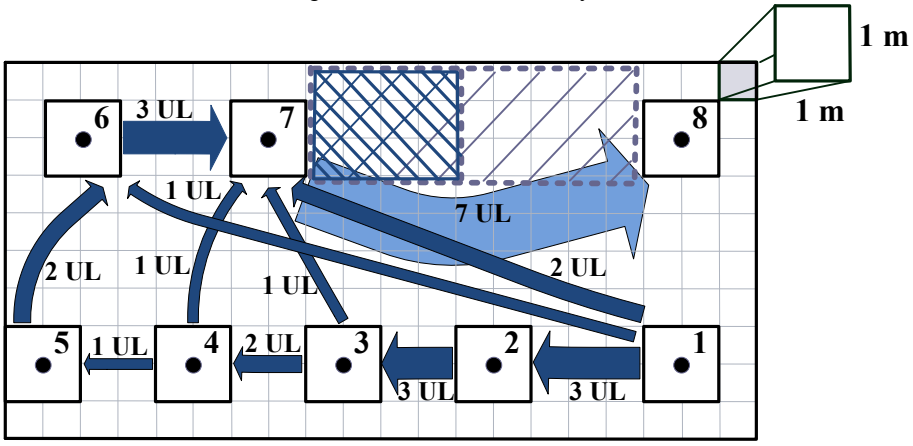
- to reduce movement of raw materials, components, equipment and workers,
- to minimize the cross material flow and the total workflow in the manufacturing system,
- to provide free space for the potential new business,
- to create safe work environment,
- to minimize the cost of rearrangement of workstations.

4.2. Alternative solution for ideal layout

Several alternative layouts were designed during the research, but due to the page limit only the best solution (Figure 3) will be introduced in details.

The location of workstation No 6. and workstation No 7. is changed and moved. The other workstations are in their original locations.

Figure 3. Modified new layout



Source: (own)

The amount of the material flow between the workstations is the same than before the re-layout (Figure 3), because the production technology and the amount of final products to be produced are the same.

4.3. Comparison of the actual and the new layouts

In our case the basis of the comparison of the actual and the new layouts are the following indicators:

- total travel distance of goods in the system;
- amount of the total workflow in the whole assembly process;
- amount of cross workflow in the assembly process;
- available free space for the new potential business or other value adding activities.

Comparison of the actual layout (Figure 2) and the redesigned layout (Figure 3) will be summarized in Table 1 based on the above mentioned 4 indicators.

Material flow efficiency is a common used term for the determination of the amount of workflow. Material flow efficiency is the multiplication of traffic data and distance data.

Material flow (traffic) matrix:

$$Q = (q_{ij}), i = \overline{1,m}, j = \overline{1,n}$$

where: m is the number of sources; *n:* is the number of destinations; q_{ij}*:* is the quantity of material flow from the *i*-th object to the *j*-th object [pieces, pieces of unit loads, *etc.*].

Distance matrix:

$$L = (l_{ij}), i = \overline{1,m}, j = \overline{1,n}$$

where: m is the number of sources; *n:* is the number of destinations; l_{ij} is the distance between the *i*-th object and *j*-th object [in m, cm, *etc.*].

Material flow effectiveness matrix:

$$W = (q_{ij} \cdot l_{ij}), i = \overline{1,m}, j = \overline{1,n}$$

where: m is the number of sources; *n:* is the number of destinations; $q_{ij}l_{ij}$*:* is the material flow efficiency realized by material flow between the *i*-th object and *j*-th object [UL·m, *etc.*]

Minimization of the material flow efficiency is a very often used improvement aim in practice. Material flow efficiency is the multiplication of material flow quantity data and distance data. The total material workflow of the

system can be obtained by summarizing the elements of columns and rows of the *W* matrix. The total material workflow can be reduced by reducing the quantity of material flow (q_{ij}) or reducing the distance of material flow (l_{ij}). In our case the rearrangement of workstations results the modification of the material flow distances.

Material flow in case of our case study can be defined by the followings matrix (the matrix is the same for the actual and for the new layout, because the assembly technology is not modified, only the arrangement of the workstations):

$$\underline{\underline{Q}}_{Act,New} = \begin{bmatrix} 0 & 3 & 0 & 0 & 0 & 1 & 2 & 0 \\ 0 & 0 & 3 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 2 & 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 & 1 & 0 \\ 0 & 0 & 0 & 0 & 0 & 2 & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 3 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 7 \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \end{bmatrix} [\text{UL}]$$

The distances of goods between workstations in case of the actual layout can be defined by the following matrix (the distances of workstations are measured between the geometrical centres of objects, the movement is completed along the coordinate axes):

$$\underline{\underline{L}}_{Act} = \begin{bmatrix} 0 & \boxed{5} & 9 & 13 & 17 & \boxed{13} & \boxed{21} & 6 \\ & 0 & \boxed{4} & 8 & 12 & 8 & 16 & 11 \\ & & 0 & \boxed{4} & 8 & 8 & \boxed{12} & 15 \\ & & & 0 & \boxed{4} & 12 & \boxed{8} & 19 \\ & & & & 0 & \boxed{16} & 8 & 23 \\ & & & & & 0 & \boxed{8} & 7 \\ & & & & & & 0 & \boxed{15} \\ & & & & & & & 0 \end{bmatrix} [\text{m}]$$

The distances of goods between workstations in case of the redesigned new layout can be defined by the following matrix:

$$\underline{\underline{L}}_{New} = \begin{bmatrix} 0 & \boxed{5} & 9 & 13 & 17 & \boxed{22} & \boxed{17} & 6 \\ & 0 & \boxed{4} & 8 & 12 & 17 & 12 & 11 \\ & & 0 & \boxed{4} & 8 & 13 & \boxed{8} & 15 \\ & & & 0 & \boxed{4} & 9 & \boxed{8} & 19 \\ & & & & 0 & \boxed{7} & 12 & 23 \\ & & & & & 0 & \boxed{5} & 16 \\ & & & & & & 0 & \boxed{11} \\ & & & & & & & 0 \end{bmatrix} [\text{m}]$$

4.3.1. Total travel distance of goods in the system

The travel distance of raw materials and components in the manufacturing system can be calculated based on the material flow between the workstations (Figure 2-3). The total travel distance of goods is the sum of those elements of matrix *L*, where real material flow is realised (between No1-No2, No1-No7, No1-No6, No2-No3, No3-No4, No3-No7, No4-No5, No4-No7, No5-No6, No6-No7 and No7-No8). Total travel distance of goods in case of the actual layout is:

$$L_{Act} = 110 \, [\text{m}]$$

Total travel distance of goods in case of the new layout is:

$$L_{New} = 95\ [\mathrm{m}]$$

4.3.2. Amount of the total workflow in the whole assembly process

Material flow efficiency (W) is the multiplication of material flow quantity data and distance data (in matrix W_{Act} and W_{New} only those elements are depicted which have to use in further calculations).

$$\underline{\underline{W_{Act}}} = \begin{bmatrix} . & 15 & . & . & . & \boxed{13} & \boxed{42} & . \\ . & . & 12 & . & . & . & . & . \\ . & . & . & 8 & . & . & \boxed{12} & . \\ . & . & . & . & 4 & . & \boxed{8} & . \\ . & . & . & . & . & \boxed{32} & . & . \\ . & . & . & . & . & . & 24 & . \\ . & . & . & . & . & . & . & \boxed{105} \\ . & . & . & . & . & . & . & . \end{bmatrix} [\mathrm{UL}\cdot\mathrm{m}]$$

$$\underline{\underline{W_{New}}} = \begin{bmatrix} . & 15 & . & . & . & \boxed{22} & \boxed{34} & . \\ . & . & 12 & . & . & . & . & . \\ . & . & . & 8 & . & . & \boxed{8} & . \\ . & . & . & . & 4 & . & \boxed{8} & . \\ . & . & . & . & . & 14 & . & . \\ . & . & . & . & . & . & 15 & . \\ . & . & . & . & . & . & . & \boxed{77} \\ . & . & . & . & . & . & . & . \end{bmatrix} [\mathrm{UL}\cdot\mathrm{m}]$$

The total material workflow of the assembly system can be obtained by summarizing the elements of columns and rows of the $\underline{\underline{W}}$ matrix.

$$W = \sum_{i=1}^{n}\sum_{j=1}^{n} q_{ij}\cdot l_{ij} \qquad (1)$$

Total material workflow in case of the actual layout is:

$$W_{Act} = 275\ [\mathrm{UL}\cdot\mathrm{m}]$$

Total material workflow in case of the new layout is:

$$W_{New} = 217\ [\mathrm{UL}\cdot\mathrm{m}]$$

4.3.3. Amount of cross workflow in the assembly process

The cross material flow (where material flow paths are crossing together) could be a bottleneck in the manufacturing process and cause problems in component supply and can result accidents.

In the actual layout (Figure 2) cross flows are in the following relations: between No1-No6, No1-No7, No3-No7, No4-No7, No5-No6 and No7-No8. In the new layout (Figure 3.) cross flows are in the following relations: between No1-No6, No1-No7, No3-No7, No4-No7 and No7-No8. The total cross workflow can be calculated by the sum of those elements of matrix W, where cross paths are realized (the cross workflow elements are highlighted by blue rectangle in matrix W_{Act} and W_{New}).

Total material cross workflow in case of the actual layout is:

$$W_{Act}^{Cross} = 212\ [\mathrm{UL}\cdot\mathrm{m}]$$

Total material cross workflow in case of the new layout is:

$$W_{New}^{Cross} = 149 \left[UL \cdot m\right]$$

4.3.4. Available free space for the new potential business or other value adding activities

Rearrangement of workstations results better utilization of shop floor. As it can be seen in Figure 3, that approximately 12 m^2 floor space can be free up (highlighted by blue rectangle), so totally 27 m^2 useful free floor space will be available. This free space can de used for new potential business (*e.g.* establishment of new machines) or other value adding activities.

The relocation of machines requires some extra costs including concrete foundation, reinstallation and set up of machines, etc. This investment cost was also calculated and it can be concluded that the payback time period of this re-layout cost is approximately 0,9 year. Based on this information, the management supported the implementation of the redesign suggestions. The result of layout redesign can be summarized in the Table 1 based on the 4 before mentioned indicators:

Table 1. Result of layout redesign

	Actual layout Figure 2	New layout Figure 3	Difference
1. Total travel distance of goods [m]	110	95	- 16,64 %
2. Total workflow [UL·m]	275	217	- 21.00 %
3. Cross workflow [UL·m]	212	149	- 29,72 %
4. Free floor space [m^2]	15	27	+ 12 m2

It can be concluded, that the goals of the research project were achieved. After the rearrangement of the workstations the movement of raw materials, components, equipment and workers is reduced. Total cross material flow and the total workflow in the manufacturing system is reduced to provide safe work environment and reduce material flow cost. Further advantage of the redesign is the increasing of available free floor space which can be used for future extension or change in the layout to accommodate new machine.

Conclusion

This research study is very important and actual, because the cost reduction and the improvement of productivity are very important goals of all of manufacturing companies.

The article is original and unique, because beside the description of theoretical background relating to the layout redesign, a practical method was also introduced in a case study. The effective facility planning can reduce significantly the operational costs of companies and improve the performance of production lines. The most important reasons of redesign of facility layouts are the continuously fluctuating customer demands, resulting changes in product portfolio, production volume, changes in manufacturing process and technology.

The goal of this study was to show the main objectives of the facility layout planning and the general types of facility layouts. The reasons, objectives and most general steps of a layout redesign process were introduced in a case study. In this article a design method was introduced for re-layout of a manufacturing plant, and confirmed that the layout redesign is an effective tool for process improvement.

In the article a real plant layout redesign was described, which is a part of an industrial R+D project. More alternatives were planned for the layout and were compared based on 4 indicators (total travel distance of goods, amount of total workflow in the whole assembly process, amount of cross workflow on the shop floor and available free space). It can be concluded, that the value of all of the analyzed 4 indicators was improved after the re-layout.

After the rearrangement of the workstations the movement of goods, equipment and workers was reduced. Total cross material flow and the total workflow in the manufacturing system was also reduced to provide safe work environment and reduce material flow cost. Further advantage of the redesign is the available free floor space which can be used for future extension or change in the layout to accommodate new machine.

The described case study showed how can be improved the efficiency and reduced manufacturing cost of a real life manufacturing system by layout redesign.

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Analysis of the Efficiency of Specialization Centers Formation in High-Tech Industry

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Abstract:

The article deals with the problem of effective formation of specialization centers in the process of restructuring high-tech industries. The criteria for the creation and operation efficiency of such facilities are substantiated. Economic-mathematical models are proposed for choosing the optimal variant for creating a specialization center from several alternatives and for estimating the influence of the equipment load factor, as well as the planned market share on the efficiency of creating a center of specialization. Parametric calculations were carried out based on the parameters of technologies characteristic of the modern aviation industry. The boundary coefficients of the equipment load and the share occupied by the specialization center in the global market are defined, under which its creation and operation can be effective. Based on the identified patterns, recommendations were made on the composition of the indicators that should be taken into account when analyzing projects for creating specialization centers and monitoring their operation. The rules are grounded for making managerial decisions in the selection of projects for creating specialization centers and choosing the directions for their development.

Keywords: specialization centers; capacity utilization; monitoring; economic-mathematical model; efficiency; aviation industry

JEL Classification: L60; L69; C02; O12

Introduction

Specialization centers (SC) in the Russian high-tech industry (including in the aircraft engineering) are formed within the framework of the transition from the traditional organization of production (with vertical integration and full production cycle at each enterprise) to a new, more cost-effective network industrial model. Formation of the SC system is the main task of industrial restructuring of the integrated structures of the Russian aviation industry at this stage of its development. Common problems of efficiency analysis, operation monitoring and the

substantiation for creating specialization centers in the industry include development of criteria that are appropriate to monitor for making informed decisions about the creation and development of these structures.

1. Substantiation of the problem topicality

The problem of efficiency estimation while using new equipment and technologies is relevant even without regard to its concentration in the SC, since often the introduction of new equipment reduces the utilization factor – but all other components of costs, including more significant ones, are decreased (Ruigrok and Van Tulder 2013, Batkovskiy *et al.* 2015). SC formation can be considered as a way to develop industrial potential of the hi-tech industry enterprises (Batkovskiy *et al.* 2016). Its solution is possible, specifically, on the basis of the component methodology of creating and implementing organizational innovations in enterprises (Batkovskiy, Kalachikhin *et al.* 2016).

On the one hand, the SC formation in the science-intensive and high-tech industry is intended to ensure efficient utilization of production equipment and other resources that would otherwise not be provided in case it is scattered among individual users (Patel and Thakkar 2014). On the other hand, the SC formation enables to ensure efficient utilization, including of much more productive equipment, than that provided by individual users (Winston and Weinstein 2016). And in this case, in principle, the utilization factor may even decrease relative to the original one – however, this will not mean a priori inefficiency of such solutions.

Thus, in addition to the utilization factor control, it is necessary to search for other informative indicators that could be used to monitor the SC operation or to justify their creation, first, adequately reflecting the current efficiency of the operation process, and, secondly, setting reasonable directions for the development of the SC and the industrial infrastructure of the sector as a whole.

2. Literature review

Studies of numerous researchers (Certo 2015, Hakansson 2015) are devoted to specific aspects of the problem of the formation of specialization centers in industry. Some of them consider efficiency and risk of transition from vertical integrated sectoral structures to network ones where facilities called specialization centers are created (Wu 2014). However, in these and similar studies (Ragulina *et al.* 2015, Hansen 2016) efficiency of such restructuring process is considered rather from the viewpoint of the parent enterprise, the system integrator than of the specialization centers themselves, which are suppliers of components or production services.

In some papers, the influence of market shares on labor productivity and the operation efficiency of manufacturing enterprises is studied, taking into account a variety of scale effects, including the effect of training with production (Faria and Wellington 2014, Chang and Wu 2014, Aghion *et al.* 2015). A number of works are studying the problem of efficient utilization of the production potential of enterprises, including the equipment utilization, as well as the problem of estimating the equipment efficiency and increasing the equipment productivity (Koren *et al.* 2017).

In some works, that are very close to the given problem, the interrelation between the efficiency indicators and the use of the production potential and integral indicators of the efficiency and operation of the enterprise, including profit, profitability, *etc*., is considered. Within the framework of the studies dealing with the concept of "Quick Response Manufacturing" (QRM), for example, (Suri 2010b, Suri 2013, Greiner 2015, Folmer *et al.* 2016), the issue of efficiency of using more productive equipment was studied in stochastic formulation. However, these works fail to directly investigate the situation of introducing high-performance equipment, the load of which will even decrease in comparison with the initial one; but nevertheless, the project will remain effective as a whole due to a significant reduction in other cost fractions (Klotchkov 2016). Thus, the literature does not suggest methods, economic-mathematical models and the resulting qualitative recommendations for making decisions on the establishment of a specialization center, its development with the changing levels of capacity utilization or occupied market share, the choice of alternative options for organizing specialization centers (Taha 2001), (Kremer *et al.* 2005). The unresolved nature of these problems in contemporary economic literature determines the relevance of the tasks of the study presented here.

3. Methodology

3.1. Hypotheses and prospective research plan

Efficiency of production concentration in the SC is determined by two factors: the possibility of increasing the utilization of the equipment employed, and also the possibility of ensuring the efficient use of more productive equipment (Cruz-Cázares *et al.* 2013, Xu *et al*. 2015). For quantitative analysis and identification of conditions in which the use of more productive equipment will be effective in the SC and also in which the utilization factor will decrease at the same time, in comparison with the utilization of equipment for individual users, it is possible to use deterministic models (Uusitalo *et al.* 2015) or, stochastic models of queuing systems (Tintner and Sengupta 2014, Shahin *et al.* 2015, Vahdani and Mohammadi 2015).

This research can be confined to deterministic models, focusing on the conditions under which a decrease in the productive capacity utilization in the introduction of high-performance equipment, however, will not mean inefficiency of the project.

As a rule, the creation of specialized high-tech industries is cost-effective only if these industries manage to occupy a significant market share of the relevant components or production services (Simonen *et al.* 2015). In this article, it is assumed that with an increase in production in the SC, the average labor productivity rises, and, accordingly, the opportunity to provide a competitive level of workers' wages, profit rates and capital reproduction. To assess the relationship between average labor productivity and market share occupied, it is sufficient to take advantage of simple models of the effect of training with production, for example, on the basis of a logarithmic learning curve.

3.2. Principles of choosing the best options for specialized center creation as part of integrated structures

As a rule, in the process of enterprise restructuring, alternative projects of specialization of various operating enterprises and alternative projects for the creation of certain SC on the basis of certain production sites within integrated structures compete in the integrated structures. Formally, the task of choosing the best of the alternative options can be represented as follows.

As an integral efficiency indicator of SC creation projects on the basis of certain enterprises, it is possible to estimate the costs with increasing the capacity of the *j*-th type of production at the *i*-th enterprise to a given level v_j^{plan}. Let b_j^i is the incremental capital intensity of the *j*-th type of productions at the *i*-th enterprise (strictly speaking, the capital intensity can differ at different enterprises – at least in view of the individual conditions of capital construction in different regions, as well as various technologies that are appropriate to apply depending on production volumes at a particular enterprise). The minimum amount of investment required for the planned capacity increase for the *i*-th enterprise (*i.e*., for the *i*-th alternative project for creating the SC of the *j*-th type) can be presented in the following form:

$$\Delta I^i = \sum_{j=1}^{m} b_j^i \cdot \max\left\{0; \left(v_j^{plan} - v_j^i\right)\right\}, \; i = 1, 2, \ldots n \,. \tag{1}$$

That is the case is also taken into account when the already existing capacities of the *j*-th type of productions at the *i*-th enterprise are sufficient or even redundant. Based on the criterion of minimum costs, the following option should be chosen:

$$i_j^{opt} = \arg \min_{i=1,2,\ldots n} \Delta I^i \,. \tag{2}$$

Important factors influencing the choice are the levels of the already created production capacities of the specific redistribution, as well as the incremental capital intensity of the respective types of production at various enterprises. Significant capacities (of the cutting-edge technological level) of these types of production available at this enterprise and low values of incremental capital intensity contribute to the selection of this enterprise as a specialization center specializing within an integrated structure for the production of relevant components or

production services. Though, in this case too, it is incorrect to be confined to only comparing investment costs. It is necessary to compare the integral efficiency indicators of investment projects for the development of the material and technical base of the enterprise.

Strictly speaking, in the aviation industry, the amount of investment in the development of the production potential of enterprises cannot be a generalizing criterion for decision-making, if only because, in addition to investments in fixed assets, there are more significant components in the structure of the cost of production – the payroll budget, material costs (Wright 1936). And it is quite possible that the option of development of production capacities that requires minimal investment will not be effective even by the criterion of minimizing total costs (although in science intensive industry, including the aviation sector, minimum costs are not a correct goal in decision-making, time factors are also important for launching products to the market and quality assurance). Large investment costs can be compensated for by a lower level of average variable costs at the production stage – by reducing the labor intensity and material intensity of production processes (Bodie *et al.* 2014, Kaplan and Atkinson 2015). At the same time, the required amount of investment can be a critically important indicator in the conditions of a shortage of investment resources, both monetary and material, that is, sometimes the possibilities for purchasing the necessary equipment are limited either because of the complication of the foreign policy situation or because of the complex condition of the Russian machine tool industry.

3.3. Deterministic calculation of specialization center creation efficiency

Let the equipment unit cost equals *F* monetary units, the normative service life is *T* years, the annual productivity (with maximum shifts, taking into account unavoidable downtime for maintenance and repair, etc.) totals to *V* product units per annum. Direct costs for the output of a product unit will be denominated c monetary units per unit. Then, with an annual output of $q \le V$ product units per annum, the total costs will be:

$$TC(q) = q \cdot c + \frac{F}{T} \text{ monetary units per annum,} \tag{3}$$

average unit cost:

$$AC(q) = c + \frac{F}{q \cdot T} \text{ monetary units for product unit,} \tag{4}$$

and equipment load factor:

$$k = \frac{q}{V}. \tag{5}$$

Thus, equipment load factor affects the average unit cost (which is considered here as a criterion for the economic efficiency of equipment, technologies and organizational solutions) as follows:

$$AC(q) = c + \frac{F}{k \cdot V \cdot T} = c + \frac{b}{k \cdot T}, \tag{6}$$

where: $b = \frac{F}{V}$, monetary units for product unit per annum, which is product capital intensity, characterizing equipment and technologies.

Let now, within the specialization center, the inflows of orders for *n* homogeneous productions be combined, and to comply with them substantially more efficient equipment is acquired with the capacity of $V' >> V$ product units per annum – and this equipment is obviously more expensive at the cost of $F' >> F$ the monetary units (for simplicity, assume that the normative terms of service life coincide, although their difference is easily taken into

account in the calculation). The direct costs of manufacturing a product unit using this, more productive, equipment amount to $c' < c$. Then the total production costs in the center of competence or specialization will be:

$$TC'(n \cdot q) = n \cdot q \cdot c' + \frac{F'}{T} \text{ monetary units per annum,} \quad (7)$$

average unit cost:

$$AC'(n \cdot q) = c' + \frac{F'}{n \cdot q \cdot T} \text{ monetary units per annum,} \quad (8)$$

and equipment load factor:

$$k' = \frac{n \cdot q}{V'}. \quad (9)$$

In this case can again be expressed through the load factor of the equipment and its capital intensity:

$$AC'(n \cdot q) = c' + \frac{b'}{k' \cdot T}, \quad (10)$$

where: $b' = \frac{F'}{V'}$, monetary units for product unit per annum, which is product capital intensity of more efficient equipment mounted in the center of competence or specialization.

Thus, if the average unit cost is considered a criterion of the economic efficiency of production, a specialization center formation and its equipping with new, more efficient equipment will be expedient if the following condition has been fulfilled:

$$AC'(n \cdot q) = c' + \frac{b'}{k' \cdot T} < AC(q) = c + \frac{F}{q \cdot T}, \text{ or } c - c' > \frac{b'}{k' \cdot T} - \frac{b}{k \cdot T}. \quad (11)$$

Thus, saving of direct costs per product unit should exceed the difference between the average fixed costs (which, in principle, may be in favor of new equipment installed in the competence center, but here the opposite case is considered).

To fulfill the obtained condition, it is necessary that the load factor of the competence center capacities satisfy the following inequality:

$$k' > k'_{\min} = \frac{b'}{\left[\frac{b}{k} + (c - c') \cdot T\right]}. \quad (12)$$

In the event that the capital intensity of new technology and more efficient equipment is lower than the initial capital intensity (that is $b' < b$), it can be unequivocally asserted that $k'_{\min} < k$, *i.e.* reduction in the load factor to a certain limit is entirely permissible, and does not mean inefficiency of concentrating production facilities in the center of competence or specialization. Otherwise, if the new technology is characterized by higher capital intensity, a priori conclusions should not be made (*i.e.* it is entirely possible that $k'_{\min} > k$, and reduction in the load factor, will mean inefficiency of concentrating production facilities in the center of competence or specialization). One can only make qualitative conclusions about the dependence of the threshold level of capacity utilization on the model parameters. Thus, the threshold level of the load factor $k'_{\min}$ is lower with the increase in saving of direct costs

$(c - c')$. If the production is characterized by relatively low capital intensity (which is typical for many types of aircraft manufacturing, (Other Aircraft Parts, 1999, 2004, 2009), the range of possible equipment load factors is very wide.

3.4. Accounting of production volumes and the expected market share in the evaluation of efficiency of specialization center formation in the aviation industry

Despite the fact that in the above simplified models, a linear representation of the variable production costs is considered, *i.e.* the constant level of average variable costs, in reality non-linearity of the cost function is an important factor in assessing the efficiency of creation of specialized production facilities – suppliers of high-tech components for aviation equipment or production services, and more specifically – a strong positive effect of scale resulting in a significant decrease in average variable costs with growth of output volumes. At the same time, in the Russian conditions the relatively small capacity of the domestic market of aviation equipment and components to them, and the inevitably low level of penetration of the relevant components or production services to the global market lead to the fact that Russian vendors can lose out by several times to leading world competitors in average labor productivity, profitability of production, etc.

Economic-mathematical models for assessing such nonlinear effects have been developed and their impact on the economic performance of enterprises supplying components to aviation equipment, on the economic efficiency of the organization of specialized high-tech production facilities in the aviation industry have been considered. A simplified model of the average labor productivity dependence on the market share of the relevant components α was proposed and developed in the works of Suri (2010), Klotchkov and Tsiklon (2011), taking into account the effect of training with production. Let us introduce the labor intensity of producing a product unit $l = \frac{\eta}{w}$, man-hours/units, where η is the average fund of working time per annum, in hours. In aircraft manufacturing, as in many high-tech industries, it is reduced while experience is gained owing to the so-called *effect of learning*. Suppose that the labor intensity of manufacturing a product unit varies throughout the life cycle of the product as follows. As experience accumulates, the unit labor costs for the next *q*-th product unit is reduced from the initial level l_o according to a law called the *learning curve*. In this model, the logarithmic form of the learning curve is assumed:

$$l(q) = l_0 \cdot (1 - \lambda)^{\log_2 q} \tag{13}$$

where: λ is a rate of training. This is the most common type of learning curve in simplest models, meaning that with each doubling of accumulated experience, unit labor costs per unit of output is reduced by a fraction λ.

Let us make use of the following approximate formula for the total labor input (in man-hours) for output of *Q* product units that is valid for large *Q* (of the order of hundreds of units of output) in those cases when the learning curve has the above logarithmic form:

$$\sum_{q=1}^{Q} l(q) \approx l_0 \cdot \frac{Q^a}{a}, \tag{14}$$

where: $a = 1 + \log_2 (1 - \lambda) < 1$.

Then the average labor intensity of manufacturing a product unit can be expressed as follows:

$$\overline{l}(Q) = \frac{\sum_{q=1}^{Q} l(q)}{Q} \approx l_0 \cdot \frac{Q^{a-1}}{a}, \tag{15}$$

where: Q is the total natural output volume of products completed by the components manufactured by this SC, for the entire life cycle of products of this generation (PLC). It, in turn, is defined as $Q = \alpha \cdot Q_{\Sigma}$ where Q_{Σ} is the total sales volume of this type of products in the market over the PLC, α is a share of this SC in the market of this type of purchased integrated parts and production services.

It should be emphasized that in this case we have in mind precisely the share of Russian suppliers in the markets of aviation components and production services. This share is not obliged to coincide with the share of Russian final manufacturers in the markets of finished aircraft products.

Thus, with the increase in production volumes by x times, the total labor costs will increase by a x^a factor, and the average labor costs (both natural and in value terms, with a fixed time rate of labor payment) per unit of output will change by $x^{a-1} = x^{\log_2(1-\lambda)}$ times, that is, they will decrease, because $\log_2(1-\lambda) < 0$.

Summarizing the expressions obtained earlier, it is possible to estimate the average labor productivity in the SC during the PLH of one generation of products:

$$APL = \bar{w} \cdot d = \frac{\eta}{\bar{l}(Q)} \cdot d = \frac{\eta \cdot d \cdot a}{l_0 \cdot Q^{a-1}} = \frac{\eta \cdot d \cdot a}{l_0 \cdot (\alpha \cdot Q_{\Sigma})^{\log_2(1-\lambda)}}, \quad (16)$$

that is $APL \quad \alpha^{1-a} = \alpha^{-\log_2(1-\lambda)}$.

It follows rom the obtained formula that with an increase in the share of the global market of this nomenclature of components and production services occupied by this SC, the average labor productivity increases.

The average labor productivity achieved in the world aviation industry APL_{world} can be assessed in practice using open statistical sources, for example, (Aircraft Manufacturing, 1999, 2004, 2009). In the following calculation examples, in contrast to the work by C.L. Benkard (2004), it is assumed that the average labor productivity reaches the "world" level with a 40% share of the global market, *i.e.* APL_{world} = APL (0.4). Thus, it is assumed that the advanced level of labor productivity is reached by enterprises occupying 40% of the corresponding markets, which can be considered quite realistic, since in most markets of components and high-tech production services in the aviation industry 2-4 competing suppliers operate that are close in order of magnitude of output volumes

4. Results

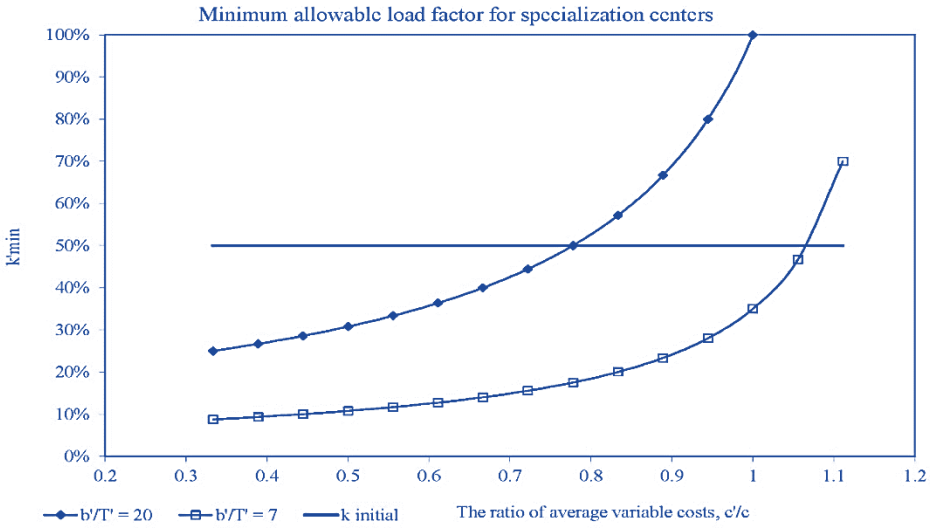
4.1. Results of parametric analysis of the load factor impact on the specialization center efficiency

Let us consider the following example of the input data for parametric calculations based on the model proposed in section 3.3. Let the average variable costs for the manufacture of a product unit by the initial technology be c = 90 monetary units for a product unit in a certain period of time (monetary unit/unit), and the average fixed costs at a 100% capacity utilization make $\frac{b}{T}$ = 10 monetary units/unit. This ratio of fixed and variable costs, in the first approximation, corresponds to the economic specifics in the aviation industry, since, according to official statistical sources (Aircraft Engine 1999, 2004, 2009); in the US aircraft industry, the share of fixed assets does not exceed 3-5% of revenue and total costs. Suppose that the initial load factor of equipment in the enterprises with a full production cycle was k = 50%.

Let now, with the SC formation, equipment be acquired and technologies be introduced that have a higher capital intensity, such that its ratio to the normative service life of fixed assets equals $\frac{b'}{T}$ = 20 monetary units/unit. Figure 1 shows a curve of the threshold utilization factor for the SC capacities, at which its formation is efficient by the criterion of lowering the average cost, $k'_{\min}$, calculated using the ratio obtained above, from the level of average

variable costs in the SC, for clarity referred to the initial level of the average variable costs, *i.e.* $\frac{c'}{c}$. It should be emphasized that in this model and in parametric calculations performed with its help, it is not so much the absolute values of the component costs that are important, as their ratios. For clarity, the initial load factor of the equipment k is represented by a thick unmarked horizontal line.

Figure 1. The dependence of the minimum required load factor of the specialization center capacities on changes in average variable costs when introducing new equipment (Case Study 1)

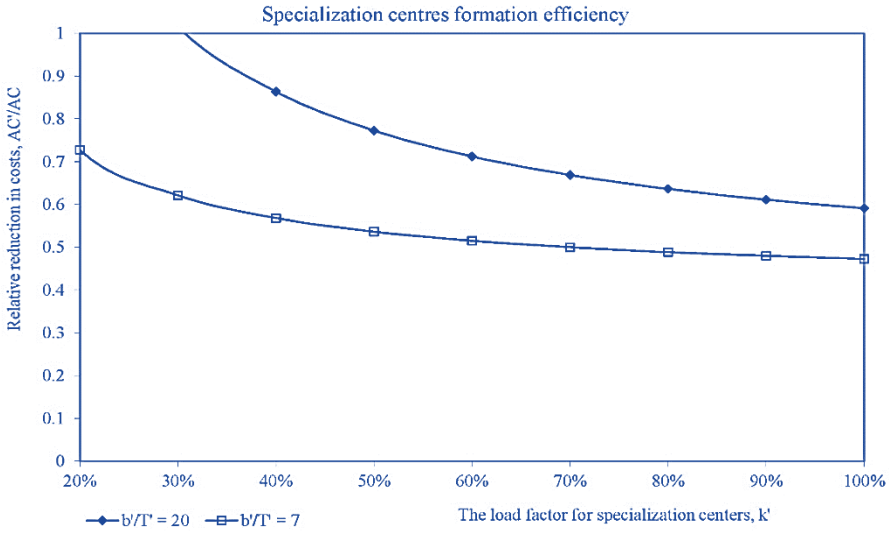


Also Figure 1 shows a curve of similar dependence for the unlikely (but possible) case where capital intensity of new and more efficient equipment is even lower than the initial one, $\frac{b'}{T}$ = 7 monetary units/unit. Analysis of the curves shows that with the reduction of the technology capital intensity the equipment load factor reduction is also admissible, compared with that at the independent enterprises of full production cycle, moreover, in a very broad range of average variable cost values – even if they are not reduced with the introduction of more efficient equipment. However, such a correlation processing coefficients for the initial situation and after the SC formation is unlikely. A significant increase in the capital intensity is more likely with possible reduction of average variable costs. In this case, as can be seen from Figure 1, the SC equipment load factor must not be lower than the initial one (k = 50%), even with a very large, approximately two-fold saving of the average variable costs ($\frac{c'}{c}$ = 0.5-0.6).

It should be borne in mind that the maintenance of the SC equipment load factor just at the threshold level $k'_{\min}$ or slightly above it means, accordingly, no effect (in the form of cost savings) or little effect of the SC formation. Therefore, to ensure a high efficiency of the SC formation and concentration of high-performance equipment in this SC for manufacture of certain components or production services it is necessary to maintain high levels of equipment utilization that are significantly higher than the initial ones.

Below in Figure 2, curves with the similar markers for $\frac{b'}{T}$ = 20 monetary units/unit and $\frac{b'}{T}$ = 7 monetary units/unit show the dependence of the relative cost reductions achieved through the SC formation, $\frac{AC'}{AC}$, on the SC equipment load factor k'. In this example, the value of average variable costs in the SC is assumed as c' = 45, *i.e.* twice less than in the initial technology.

Figure 2. The dependence of the average production costs on the load factor of the specialization center capacities (Case Study 1)



The figure shows that significant savings are achieved only when the values of SC load factor make k' = 60-70% and higher (whereas the boundary values are 11% and 35%, respectively). Moreover, at high load factor values, as should be expected, the effect achieved is weakly dependent on the capital intensity – the impact of the average fixed costs is leveled.

It should be noted that the reduction in the average cost per product unit is only the simplest criterion for efficiency of the SC formation, moreover, the "optimistic" one (Winston and Weinstein 2016), because in reality it is necessary to take into account a number of additional costs (transportation and transaction), as well as the risks inherent in the network structure of the industry, which is described in more detail by R. Ashkenas with co-authors (2015). In view of these factors which in reality often block the specialization of enterprises and the transition to more progressive sectoral structures, more stringent requirements should be imposed for the reduction of production costs that is achieved as a result of discussed organizational transformations and technological changes.

In principle, the initial values of the equipment load factors for manufacturing companies of complete production cycle could be extremely low for the following reason. A number of domestic enterprises in aviation industry, having relatively good economic state (as a rule, owing to the commercial production of internationally competitive aviation equipment designs that were delivered mainly for export), have already implemented technical re-equipment programs on their own, acquiring advanced production equipment and technologies, mainly foreign ones, due to the difficult situation of the Russian machine-tool (RF State Program 2014).

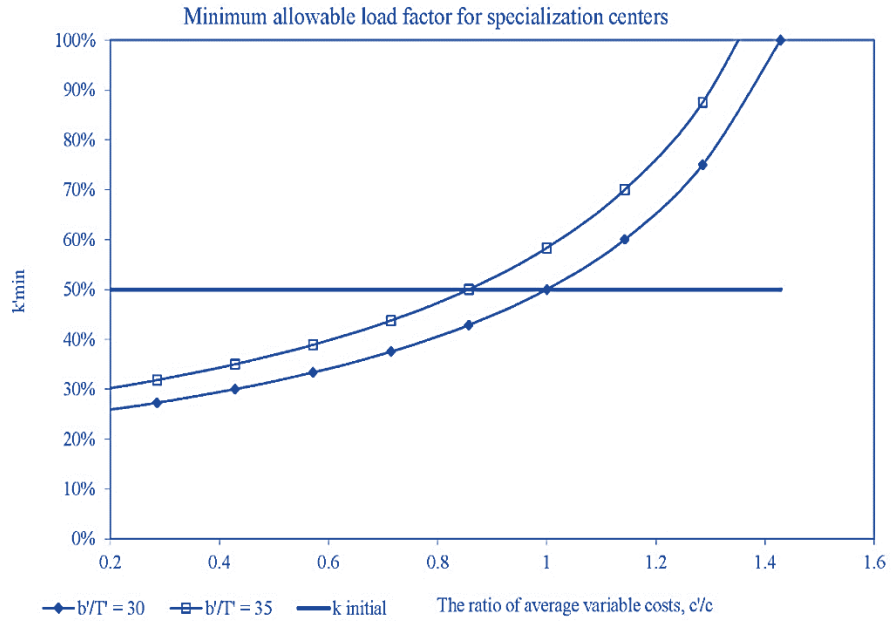
At the same time, the range of foreign machine tool enterprises is designed, primarily, to be used as a part of the high-tech specialized enterprises, since in advanced aircraft manufacturing countries the network structure has already been formed. Thus, imported equipment is usually highly automated, equipped with computerized numerical control, and has a high unit capacity, which cannot be effectively loaded in the appropriate section of the enterprise with full production cycle. In this regard, it is expedient to consider a lower value of the initial equipment load factor, for example, k = 25%. However, if concentration of modern highly automated equipment in the SC is considered, it is advisable to assume even the initial value of average fixed costs equal to $\frac{b}{T}$ = 30 monetary units/unit. In this case, the effect of SC formation is obviously achieved by increasing the equipment load factor.

Alongside, despite the low values of depreciation charges per monetary unit of marketable output in modern foreign aviation industry, strictly speaking, in the interests of this study fixed and variable costs are of interest rather

than the direct costs and the costs of fixed assets. While the load factor is reduced, not only owning costs for physical infrastructure facilities remain virtually unchanged (including, in turn, not only depreciation but also electricity, heating, guarding charges, etc.). A significant part of payroll budget can also be attributed to the semi-fixed costs since operative change in the number of employed is economically impractical (and often impossible) with short-term fluctuations in capacity utilization.

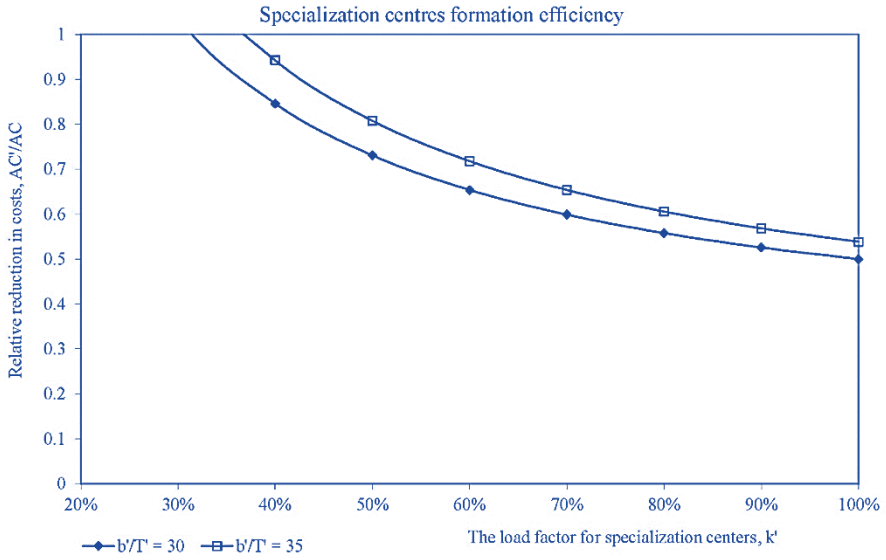
Suppose that initially the average fixed costs made up $\frac{b}{T}$ = 30 monetary units/unit with all other initial data of the case study discussed above. Accordingly, the average variable costs initially were at a level of c = 70 monetary units/unit. When forming the SC, on the one hand, the increase in capital intensity of technologies is inevitable. On the other hand, since due to automation labor intensity and the need for maintenance of highly qualified personnel decreases, including the decrease in the load factor, it can be assumed that the total average fixed costs will be established at the level of $\frac{b'}{T}$ = 35 monetary units/unit during the SC formation. If in this case a significant reduction in average variable costs is also achieved, then the SC form will remain quite effective over a wide range of values of its load factor k'. Figure 3, similar to Figure 1, shows the same curves $k'_{\min}\left(\frac{c'}{c}\right)$, but obtained at the specified ratios of variable and fixed costs, more responsive to the economic characteristics of high-tech industries.

Figure 3. The dependence of the minimum allowable load factor of the specialization center capacities on changes in average variable costs when introducing new equipment (Case Study 2)



Analysis of these curves shows that even in case of small saving in average variables costs making 20-30%, in principle, the SC formation may be effective at the level of its capacity utilization not exceeding the initial one of 50%. If more economical (for large volumes of output) production equipment is applied in the SC, which will provide significant savings in variable costs – 40 -50% – then the SC capacity utilization is admissible at the level of 30-35%. In case of higher levels of capacity utilization, more significant savings will be achieved, *i.e.* the SC operation efficiency will be even more significant. Figure 4, similar to Figure 2, shows curves of relative changes in the average production cost for a unit of output obtained within the latter case study.

Figure 4. The dependence of the average production costs on the load factor of the specialization center capacities (Case Study 2)



Thus, the actual correlation of average variable and average fixed costs in the aviation industry (and in some other high-tech industries where drastic reduction in production personnel is not practical in case of reduction in the output) strengthens the conclusion about the efficiency of the SC organization and operation even in cases when more efficient equipment will not be utilized much more intensively than the equipment at the individual enterprises with a full production cycle

4.2. The results of a parametric analysis of the market share impact on the specialization center formation efficiency

For the parametric calculations using economic-mathematical model, proposed in Section 3.4, let us assume the rate of training with production equal to λ = 15%. Then the exponent in the formula of the average productivity dependence on the global market share will be:

$$1-a=-\log_2\left(1-\lambda\right)\approx 0.23. \quad (17)$$

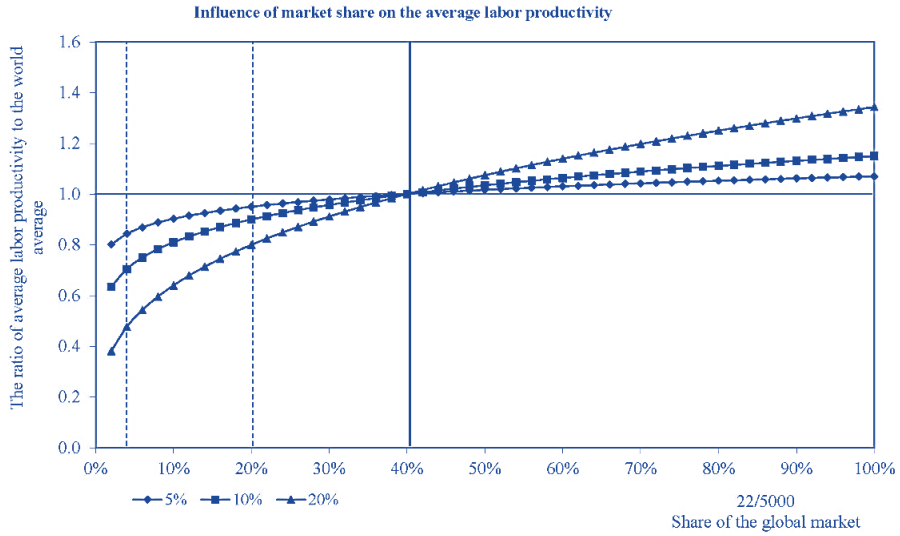
If, for example, the SC production program is designed to produce components in a volume corresponding to a share of α = 3.6% of the global market, the average labor productivity will be by $\frac{APL_{world}}{APL_{(\alpha)}}=(\frac{40\%}{3.6\%})^{0.23}\approx 1.75$ = 1.75 times lower than the world level, which will amount to $\frac{200}{1.75}\approx 114$ thousand dollars per person per annum (thousand dollars/person*year). Does this mean that such production processes will certainly be unprofitable? This is not necessary – they can be less profitable than a free market investor requires. In the long term, the SC organization for manufacturing of components for aviation equipment or high-tech production services can be cost-effective and efficient from social and budgetary standpoints, even if the final product is oriented only to the domestic market, as justified in the work by Baibakova and Klotchkov (2010).

In addition, in the current geopolitical and global economic environment, mastering the production of the necessary range of high-tech components for aviation equipment and production services can become a categorical requirement of national security and technological independence. In this case, the creation of a SC in the relevant areas of product or technology specialization is becomes inherently effective, since reproduction of the traditional industrial structure of the industry at a modern technological level provides an alternative to it, assuming that there are all major redistributions at each enterprise while maintaining a full production cycle.

The investment volumes required for this are many times higher than the investment opportunities of the sectoral enterprises and the state budget of the Russian Federation, as well as the required investment in the creation of an SC system equipped with modern high-tech equipment within the network structure.

Figure 5 shows the dependence curves of the average labor productivity in the SC versus its share in the global market of the corresponding components, for three values of the training rates – 5%, 10% and 20%. Thin solid horizontal and vertical lines reflect, respectively, the world average level of labor productivity APL_{world} and the global market share (40%), at which it is achieved.

Figure 5. Influence of the market share of components for aviation equipment on the average labor productivity (Case Study)



Dotted vertical lines are drawn at the levels of two characteristic values of the global market share – 4% and 20%. First roughly corresponds to a situation where the SC fully covers demand of the domestic aviation equipment market for the relevant product components. The curves show that at low training rates (5-10%), even in this extremely pessimistic scenario, the SC loss to the world leaders in terms of labor productivity is relatively small – about 20-30%. But with a 20% training rate the loss reaches the double level.

If in the future the SC will be globally competitive and able to take, for example, about 20% of the global market of the relevant components and production services, then even at high levels of learning the loss in labor productivity – and hence in profitability, in production costs, and so on – will be negligible. Thus, the planned volume of production or the market share of the respective components or production services provided by the SC is an important indicator that affects the efficiency of its formation and operation.

4.3. Recommendations on the composition of factors that are significant for efficiency analysis of creating and monitoring the specialization center operation

Considering that the analysis of projects for establishing and, in the future, monitoring the SC operation should provide the initial information for making rational managerial decisions, the following recommendations can be formulated.

The indicators to be taken into account when creating a SC should include:

- indicators of the SC planned performance, including breakdown by the main redistribution;
- indicators of the planned volume of output (or capacity utilization factor, which, in combination with the previous indicator, provides the necessary information);
- indicators of the expected market share (Russian and global ones) of the relevant components or production services that the SC is expected to occupy.

These indicators will allow making an economically justified decision on the feasibility of creating the SC, in terms of expected profitability, average labor productivity, as well as ensuring technological independence and economic security of the industry.

For a reasonable choice between alternate variants of the SC formation at different production sites, it is also advisable to take into account:

- the existing level of capacities of the respective production facilities, their qualitative conformity with the advanced and average global level of technology development and automated production;
- the required level of investment in the development of the SC capacities, or the incremental capital intensity of the corresponding production facilities in the given enterprise;
- the current utilization rate of this type of production facilities, including external orders.

As part of the monitoring process of the current operation of an already established SC, in addition to the above indicators, it is advisable to consider:

- the actual level of capacity utilization;
- the actual nomenclature of the manufactured products (for estimating the breadth of the assortment and the required universality of equipment and technologies);
- the actual level of prices for products in comparison with the prices of foreign analogs.

To enhance the substantiated decision-making on the SC development, and more specifically on the expediency of its extensive expansion due to the increase in the number of the park of equipment already in use, or on the advisability of its technical re-equipment by means of more efficient equipment, it can be recommended to include indicators of shares of conditionally fixed and variable costs in the total costs of the enterprise, as well as the share of their increase with increasing the output, in the list of indicators to be recorded and analyzed in the SC monitoring process. In the event when variable costs begin to prevail (and, accordingly, conditionally fixed costs are distributed over a large volume of output, and the average fixed costs become small), this is a signal that there are economic conditions for the introduction of more efficient types of technologies and manufacturing equipment.

Obviously, the collection of the listed types of data can be, firstly, labor-intensive, especially in the absence of electronic certification of production capacities, and secondly, it may be associated with institutional problems due to reluctance of management of enterprises (production sites) to disclose certain information. At the same time, the openness of enterprises-applicants for creation of the SC on their basis must necessarily provide an opportunity for a rigorous evaluation of the efficiency of the relevant investment project, especially if it claims financial support from the state budget.

Discussion

As a result of research and parametric analysis of the built economic-mathematical models, we were able to identify some of the effects that are not reflected in the foregoing and related works. Thus, it is shown that concentration of high-performance equipment in the specialization centers may be advantageous, according to the profit and cost-effectiveness criteria, even in cases when the equipment load factor will be lower than previously at the full cycle plants using old inefficient equipment, *i.e.* inappropriateness of absolute priority given to the partial factor of the equipment utilization efficiency is justified.

The criteria for selection of alternative options for specialization centers are significantly adjusted, as compared with the known works, on the basis of the existing enterprises or new production sites.

In addition, it is shown that the occupied market share is highly important to ensure the profitability of the specialization center creation and operation.

Conclusion

The analysis of the factors determining the efficiency of the establishment and operation of specialization centers in the Russian aviation industry demonstrated that efficiency can be determined by:

- the possibility of increasing the production equipment utilization rate, which otherwise would have been established at the enterprises of the full production cycle;

- the possibility of cost-effective implementation of more economical technologies and equipment of higher capacity.

Calculations show that if more efficient equipment provides a significant reduction of specific direct production costs by 30-50%, then with the cost structure typical for the modern aviation industry, low utilization rates of about 50% are also permissible for the specialization center. Thus, the load factor alone cannot be considered as a decisive criterion of efficiency of a specialization center creation and operation.

Also, when establishing specialization centers, the required amount of investment in the creation or expansion of the corresponding capacities should not be considered as a decisive criterion when choosing alternative siting options, due to the cost structure typical for the modern aviation industry, in which direct costs predominate rather than fund-creating ones.

At the same time, the expected or actual market share of the relevant components or production services can significantly determine the average labor productivity, the cost of production and the profitability of the specialization center operation. If the expected share of the global market is of the order of several percent, one can expect a reduction in the average labor productivity by 40-50%, in comparison with the world leaders' level.

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Adaptive Market Hypothesis: Evidence from the Mexican Stock Exchange Index

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Abstract:

This paper is aimed at studying the Adaptive Market Hypothesis (AMH) of the Mexican Stock Exchange Index (IPC, for its acronym in Spanish). To do this, we apply: 1) unit-root tests, 2) nonlinear tests, and 3) episodic nonlinearity tests. The main empirical finding is that the IPC goes through plenty of periods where the market behaves in an efficient way. That is, as a random walk, followed by some periods of adaptability where non-linearity in the series of the IPC returns is found.

Keywords: adaptive market hypothesis; financial markets; emerging markets

JEL Classification: D84; D53; E40; G15

Introduction

There have been many studies about the nonlinear behavior of financial markets and in particular after some classic papers: Dalle-Molle and Hinich (1995), Hinich and Patterson (2005) and (1985), Patterson and Ashley (2000). Such studies of nonlinear behavior aimed at studying the Adaptive Market Hypothesis (AMH) proposed by Lo (2005) and (2004). This theory states that markets switch between adaptive efficiency and adaptive inefficiency at different time periods and therefore are adaptable. According to this, the degree of market adaptive efficiency is related to different factors, as the magnitude of profit opportunities, the number of competing participants, and how they adapt to market signals. The AMH has some practical implications, among which are: risk-reward relationships that change over time according to the preferences of the market participants. These preferences affected by past prices and movements they experience from the point of view of natural selection contrasting to the weak-form of the Efficient Market Hypothesis (EMH) proposed by Fama (1970). Furthermore, arbitrage opportunities, being constantly created and disappearing, exist at different points in time and, therefore, the market goes from adaptive efficiency to adaptive inefficiency in different periods.

In the specialized literature there are several tests to detect nonlinearity in a time series. In this regard, Patterson and Ashley (2000) recommend a battery of such tests. Some of the most used nonlinear tests are those from Tsay (1986), Engle (1982), and Broock *et al*. (1996). In this research, we will apply these tests in order to detect the presence of nonlinear dependence in a time series and, therefore, to find out about market adaptive inefficiency. However, in order to test the AMH, it is not sufficient to show only nonlinear behavior of the whole series but also to reveal the different time periods where nonlinear phenomena occurs; see, for instance, Hinich and Patterson (1985), Hsieh (1991), Panagiotidis and Pelloni (2007), and Patterson and Ashley (2000).[1]

[1] Regarding non-linear behavior of returns in Mexico see, for instance, Venegas-Martínez and Islas-Camargo (2005), and López-Herrera *et al*. (2009).

In this paper, we use the H and T4 tests from Hinich and Patterson (1985) and Wild *et al*. (2010) to provide evidence of the AMH in the Mexican Stock Exchange Index (IPC). To do this, we consider a sample of daily returns from 1994 to 2015 for detecting the periods of nonlinear serial dependence (adaptive inefficient periods) and, therefore, to examine how adaptive efficiency evolves through time. We believe that our results are relevant given that they shed light on the AMH for an emerging market. The H and T4 tests have been applied in similar contexts in Bonilla *et al*. (2008), Coronado-Ramírez *et al*. (2015) Coronado-Ramírez and Arreola (2011), Hinich and Serletis (2007), Lim *et al*. (2008), and Romero-Meza *et al.* (2007), among others.

There has been also a growing interest in the shift from the traditional EMH (absolute and static) to the AMH that captures the degree of adaptive efficiency at different periods of time. In this regard, Noda (2016) measured the degree of market adaptive efficiency in the Japanese stock market, Hiremath and Kumari (2014) focused on India's stock market, Alvarez-Ramirez *et al.* (2012), Ito and Sugiyama (2009) and Kim *et al.* (2011) found time varying adaptive efficiency in the U.S, Charles *et al.* (2012) and Neely *et al.* (2009) found evidence of AMH in the foreign exchange market, Lim *et al.* (2008) studied Asian markets, and Urquhart and McGroarty (2016) provided evidence of AMH in four major stock markets. Furthermore, Coronado-Ramírez *et al.* (2014) studied the international coffee market, applying nonlinear statistical tests to detect periods of adaptive inefficiency in the case of Colombian Arabica beans, while Coronado-Ramírez *et al.* (2015) studied the AMH in agricultural commodity futures contracts.

The structure of the paper is as follows. Section 2 provides the methodology employed in the present study. Section 3 describes the sample data. Section 4 presents the statistical tests and the empirical results. Finally, the conclusions are reached.

1. Methods and test

In this section we present the methods and tests that we are going to apply. We will first briefly describe the unit root tests and the battery of nonlinear tests that will be used and explain in more detail the Hinich H and T4 tests. With these tests, we support the evidence of AMH for the IPC.

1.1. Unit root tests

We use three different unit root tests, as described below. First, we justify that the price time series is stationary after first differences and, subsequently, we apply the nonlinear statistical tests to the return series. We apply the classical test, namely the Augmented Dickey and Fuller (1979) (ADF) test, which belongs to the autoregressive unit root test class. In this test, the null hypothesis is $\phi = 1$ (difference stationary) against the alternative hypothesis that $\phi < 1$ (trend stationary). Such tests are called unit root tests because under the null hypothesis the autoregressive polynomial of z_t, $\phi(z) = (1 - \phi z) = 0$, has a root equal to unity, see Zivot and Wang (2006). In particular, the ADF test considers the null hypothesis that a time series is $I(1)$ against the alternative that it is $I(0)$ assuming that the dynamics in the data have an ARMA structure and that the process is normally distributed. A test that does not require normality or any functional form of the distribution of the data sample is the Residual Augmented Least Squares (RALS), developed by Im *et al.* (2014). We also use the efficient unit root test (ERS) from Elliott *et al*. (1996), which has more power against persistent alternatives.

1.2. Some nonlinear tests

Patterson and Ashley (2000) suggest a battery of tests for nonlinear dependencies. Among them are the ones suggested by Tsay (1986), the Engle's (1982) Lagrange Multiplier (LM) test and the Broock *et al*. (1996) BDS test. We next explain briefly each of these tests.

Tsay test examines the data for quadratic serial dependence using quadratic terms lagged up to k periods. Consider $K = k(k+1)/2$ column vectors v_i, $i = 1, \ldots, K$, containing all unique cross-products of the form $x_{t-i}x_{t-j}$ extracted from the sample time series. These column vectors are regressed on the k −lagged original time series in order to obtain the residuals $\widehat{v_{t,i}}$. Then, the parameters $\alpha_1, \ldots, \alpha_k$ are estimated from the following OLS regression.

$$x_t = \alpha_0 + \sum_{i=1}^{K} \alpha_i \ \widehat{v_{t,i}} + \varepsilon_t \qquad (1)$$

This test uses the *F*-statistic for the null hypothesis that $\alpha_k = 0$ for all values of K.

Engle's (1982) ARCH test, also known as Lagrange Multiplier (LM) test is used to assess the significance of ARCH effects in a time series. It is based on the autocorrelation of the squared residuals of an OLS regression. Consider a set of sample residuals $\hat{v}_t$ and regress the squared residuals on a constant with lags up to p in such way that.

$$\hat{v}_t^2 = \alpha_0 + \alpha_1 \hat{v}_{t-1}^2 + \alpha_2 \hat{v}_{t-2}^2 + \cdots + \alpha_i \hat{v}_{t-i}^2 + \varepsilon_t \quad (2)$$

The null hypothesis is $\alpha_i = 0$ for all values of i. As in the case of the Tsay test, the LM test also uses the *F*-statistic for the regression on the squared residuals. Whereas the Tsay test is a direct test for non-linearity of a specific time series, the BDS test is an indirect test. There are two main advantages of choosing the BDS test: (1) it has been shown to have more power than other linear and nonlinear tests, see Barnett *et al.* (1997) and Brock *et al*. (1991); and (2) it is nuisance-parameter-free and does not require any adjustment when applied to fitted model residuals, see Lima (1996).

The BDS test is based on the correlation integral that measures the frequency at which patterns in time are repeated in the series. For a time series x_t for $t = 1,2, \ldots, T$ and its m −history defined by $x_t^m = (x_t, x_{t-1}, \ldots, x_{t-m+1})$, the correlation integral at embedding dimension m is given by

$$C_{m,\epsilon} = \frac{2}{T_m(T_m-1)} \sum_{m \le s < t \le T} \sum I(x_t^m, x_s^m; \epsilon) \quad (3)$$

where: $T_m = T - m + 1$

$$I(x_t^m, x_s^m; \epsilon) = \begin{cases} 1, & if\ |x_{t-i} - x_{s-i}| < \epsilon \\ 0, & \text{otherwise} \end{cases}$$

The BDS statistic is defined as follows

$$V_{m,\epsilon} = \sqrt{T} \frac{C_{m,\epsilon} - C_{1,\epsilon}^m}{s_{m,\epsilon}} \quad (4)$$

where: $s_{m,\epsilon}$ is the standard deviation. It converges to a standard normal distribution, so the null hypothesis of iid is rejected at the 5% significance level whenever $|V_{m,\epsilon}| > 1.96$.

1.3. Tests of episodic nonlinearity

The windowed test procedure used in this study, the Hinich portmanteau bicorrelation test (*H test*) is explained now. This test is used to detect periods of transient dependence in a discrete-time pure white noise process and involves a procedure of dividing the full sample period into equal length non-overlapping moving time windows or frames on each of which the portmanteau bicorrelation statistic (*H statistic*) is computed to detect nonlinear serial dependence. Let the sequence $\{x(t_k)\}$ denote the sampled data process at a fixed rate, where the time unit t is discrete. The *H* test employs non-overlapped time windows Thus, if we denote by n the window length, then the k-th window is $\{x(t_k), x(t_k + 1), \ldots, x(t_k + n - 1)\}$. The next window is $\{x(t_{k+1}), x(t_{k+1} + 1), \ldots, x(t_{k+1} + n - 1)\}$ where $t_{k+1} = t_k + n$. All observations are standardized $z(t_k) = (x(t_k) - \mu_x)/\sigma_x$, where μ_x and σ_x are the expected value and the standard deviation of each process, respectively. The null hypothesis for each window is $\{z(t_k)\}$ that are realizations of a stationary pure white noise process that has zero bicorrelation defined by $C_{zzz}(r, s) = E[z(t)z(t + r)z(t + s)]$, $0 < r < s < L$, where L is the number of lags in each window. The alternative hypothesis is that the process generated in the window is random with some non-zero bicorrelations, *i.e.*, there exists third-order nonlinear dependence in the data generation process. The *H* statistic used to detect nonlinear dependence within a window, and its corresponding distribution, are:

$$H = \sum_{s=2}^{L} \sum_{r=1}^{s-1} \frac{G^2(r,s)}{T-s} \sim \chi^2_{L(L-1)/2} \quad (5)$$

where: $G(r, s) = (n - s)^{1/2} C_{zzz}(r, s)$. The number of lags L is specified as $L = n^c$ with $0 < c < 0.5$, and where c is a parameter to be chosen.

To maximize the power of the test and ensure the asymptotic properties, Hinich and Patterson (2005) and (1985) suggest, based on results from Monte Carlo simulations, to set $c = 0.4$. A window will be statistically significant if the null hypothesis is rejected at the specified threshold level set to 0.05.

A high order spectra accumulated is defined as the transformed of Fourier cumulants over random process, then the trispectrum is the Fourier transform of cumulants of fourth order of random process (Chandran *et al.* 1994 and Dalle-Molle and Hinich (1995). According to Wild *et al.* (2010), the following statistic is used to detect periods of non-linear unit (with moments of fourth order):

$$T4 = \sum_{v=3}^{L} \sum_{s=2}^{v-1} \sum_{r=1}^{s-1} [G^3(r,s,v)] \sim \chi^2 \frac{L(L-1)(L-2)}{3} \quad (6)$$

where : $G(r,s,v) = \sqrt{n-v} \times C_{zzzz}(r,s,v)$.

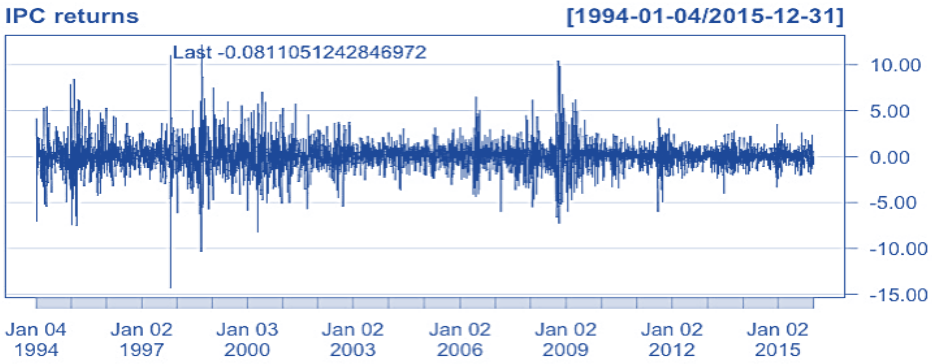
2. Data

In this study, we consider daily returns of the Mexican Stock Exchange Index (IPC) for the period from January 3, 1994 to December 31, 2015, for a total of 5526 daily observations. Data was obtained from Yahoo Finance. The dates were chosen in order to capture different important economic moments of the Mexican economy. We transformed the time series of prices into a series of compounded percentage returns by taking the difference of the logarithms of the prices and multiplying it by 100, *i.e.* $\Delta IPC = 100\ (\ln(p_t) - \ln(p_{t-1}))$, where p_t is the price of the IPC on day t. In Figure 1 we show the time series plot of the daily prices of the IPC for the period under study. In Figure 2 we present the time series plot of the daily returns.

Figure 1. Time series plot of prices of IPC from January 3, 1994 to December 31, 2015.

Source: Authors' own elaboration with data from Yahoo Finance and R Statistical Package.

Figure 2. Time series plot of compounded percentage returns of IPC from January 3, 1994 to December 31, 2015.



Source: Authors' own elaboration with data from Yahoo Finance and R Statistical Package.

Table 1 presents the summary of statistics for IPC and ΔIPC. As it can be observed, the statistics are consistent with some stylized facts of financial time series, see Cont (2001) and Rojas and Trejo-Pech (2014). Notice that the IPC series is platykurtic whereas the ΔIPC series is leptokurtic.

Table 1. Summary statistics for prices and returns

Statistics	IPC	ΔIPC
Observations	5,526	5,525.000
Mean	18,795.864	0.051
Min	1,458.700	-14.314
Max	46,357.238	12.154
Standard deviation	15,138.383	1.523
Skewness	0.445	0.043
Kurtosis	-1.412	6.522
Jarque-Bera	641.087***	9793.152***

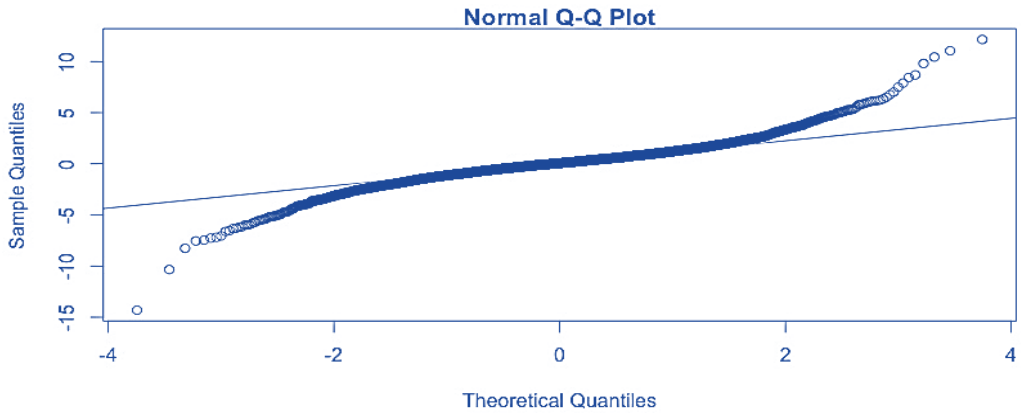
Source: Authors' own elaboration with data from Yahoo Finance and R Statistical Package.

Furthermore, the Jarque-Bera test that uses the JB statistic:

$$JB = \frac{\hat{S}^2}{6/T} + \frac{(\hat{K}-3)^2}{24/T} \tag{7}$$

which is asymptotically distributed as a χ^2 random variable with 2 degrees of freedom, where $\hat{S}$ is the sample skewness, $\hat{K}$ the sample kurtosis and T the sample size. One rejects H_0 of normality if the *p*-value of the JB statistic is less than the significance level. For both series the null hypothesis of normality is rejected at 1% (throughout the document we denote by *** a significance level of 1% for the different hypothesis tests). A quantile-quantile plot that shows the departure from normality, especially in the tails of the normal distribution for ΔIPC, is shown in Figure 3.

Figure 3. Quantile-quantile plot of ΔIPC

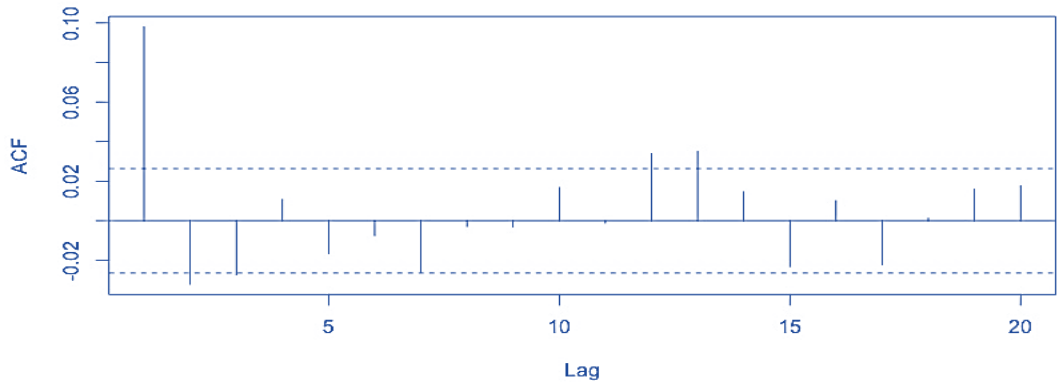


Source: Authors' own elaboration with data from Yahoo Finance and R Statistical Package.

3. Empirical results

It is a well-known fact that financial time series of returns do not exhibit any significant linear autocorrelation (Cont 2001). As it can be seen from Figure 4, in the plot the autocorrelation function of the returns of the IPC, the series decays rapidly to zero after only a few lags (days). Thus, it is of interest to study if any nonlinear dependence can be observed in the time series of returns. However, in order to do so, we first test the time series under study for unit roots, *i.e.*, for stationarity, which is a requirement of the statistical tests that we employ.

Figure 4. Autocorrelogram for the returns of IPC for lags up to 20, where the dotted lines represent the 95% confidence interval.



Source: Authors' own elaboration with data from Yahoo Finance and R Statistical Package.

We now proceed to show the results of the unit root tests we applied to the IPC price and return series under study. The results are presented in Table 2. As it can be observed, all four tests are conclusive with the fact that the price time series are non-stationary while the return time series are at a significance level of 1%. The null hypothesis is that there is a unit root. The lag was selected using the Bayesian Information Criteria (BIC). All tests fail to reject the null hypothesis that the series in levels are non-stationary and reject the null hypothesis that the series in first differences are non-stationary at the 1% critical level. Thus, the series in levels are integrated of order one, $I(1)$. The critical values at 10%, 5% and 1% for the ADF and RALS tests are - 3.12, - 3.41 and -3.96 respectively. For the ERS test, the critical values for the aforementioned significance levels are - 1.62, - 1.94 and - 2.57 respectively.

Table 2. Unit root tests results

Statistic	IPC	ΔIPC
ADF	-0.1176	-67.3584***
RALS	1.8540	-71.8923***
ERS	1.4870	-11.3200***

Source: Authors' own elaboration with data from Yahoo Finance and R Statistical Package**.**

Once we have shown that the time series of returns is stationary, we fit an Autoregressive model $AR(2)$, according to the BIC, in order to work with the residuals and remove any possible linear dependence in the series, which is usually known as pre-whitening the series. In this way, we reject the null hypothesis of the nonlinear tests, at a significance level of 5% and are confident that the pure white noise is explained solely by the nonlinearity of the historic return time series. In Table 3 we present the results of the Tsay and LM tests, which we ran for lags 5, 15 and 20. As it can be seen both tests show evidence of nonlinearity in the ΔIPC series.

Table 3. Tsay and LM nonlinear tests results

Statistic	ΔIPC
Tsay (lag=5)	4.507***
Tsay (lag=15)	3.954***
Tsay (lag=20)	3.491***
Lm test (lag=5)	570.000***
Lm test (lag=15)	690.000***
Lm test (lag=20)	710.000***

Source: Authors' own elaboration with data from Yahoo Finance and R Statistical Package

Table 4 shows the results of the BDS test applied to the ΔIPC series. The parameters m and ε denote the embedding dimension and the distance, respectively, and ε is equal to various multiples of the sample standard deviation σ. These results show the nonlinearity of the series.

Table 4. BDS nonlinearity test results

Serie	m/ε	0.5σ	σ	1.5σ	2σ
	2	9.3696***	9.3129***	9.6479***	10.8023***
ΔIPC	3	13.6343***	13.4768***	13.7245***	14.2802***
	4	16.7222***	16.4026***	16.5845***	16.6751***

Source: Authors' own elaboration with data from Yahoo Finance and R Statistical Package.

After showing that the series is nonlinear, it is now of our interest to find out whether the non-linearity can be located in different epochs of time. This is done with the objective of showing that the series under study goes from periods of adaptive efficiency to periods of adaptability after some non-linearity events occurs, explaining the adaptive efficiency of the market.

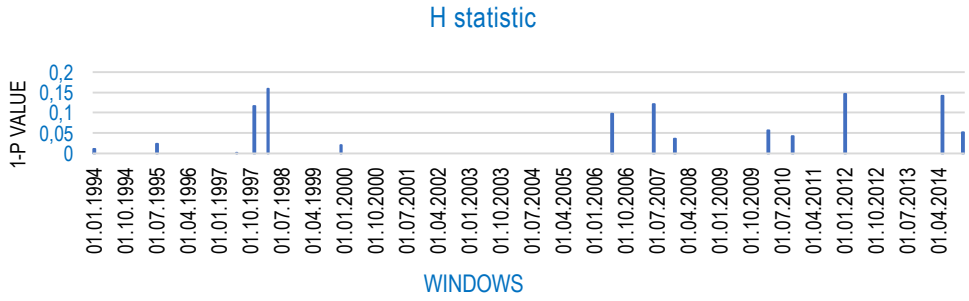
Table 5 shows the results of the H and T4 tests, applied to the residuals of an $AR(2)$ process. A total of 178 windows of length 31 were considered according to the methodology previously described. In Figure 5 we present the significative windows of non-linearity according to the *H* statistics corresponding to 7.87% of nonlinear episodes in the series. As it can be observed, there are many periods where the market behaves in an efficient way, *i.e.*, as a random walk, followed by some periods of adaptability, *i.e.*, where non-linearity in the series is found and possible arbitrage opportunities might exist.

Table 5. Significative H and T4 windows of Hinich test

Statistic	*H*	*T4*
Significant windows (%)	14 (7.87%)	19 (10.67%)
Dates	1/4/94 - 2/15/94	2/15/95 - 3/30/95
	7/3/95 - 8/14/95	8/12/96 - 9/24/96
	6/26/97 - 8/7/97	6/26/97 - 8/7/97
	11/6/97 - 12/22/97	11/6/97 - 12/22/97
	3/24/98 - 5/11/98	12/21/98 - 2/3/99
	12/15/99 - 1/27/00	1/24/02 - 3/8/02
	6/23/06 - 8/4/06	7/25/02 - 9/5/02
	6/21/07 - 8/2/07	10/22/02 - 12/4/02
	12/17/07 - 1/30/08	6/9/03 - 7/21/03
	3/9/10 - 4/23/10	8/15/05 - 9/27/05
	10/19/10 - 12/2/10	9/19/06 - 10/31/06
	1/11/12 - 2/23/12	12/17/07 - 1/30/08
	5/19/14 - 6/30/14	4/29/09 - 6/11/09
	11/10/14 - 12/31/14	10/22/09 - 12/7/09
		1/22/10 - 3/8/10
		11/25/11 - 1/10/12
		8/13/14 - 9/25/14
		11/10/14 - 12/31/14
		11/6/15 - 12/21/15

Source: Authors' own elaboration in Fortran with data from Yahoo Finance.

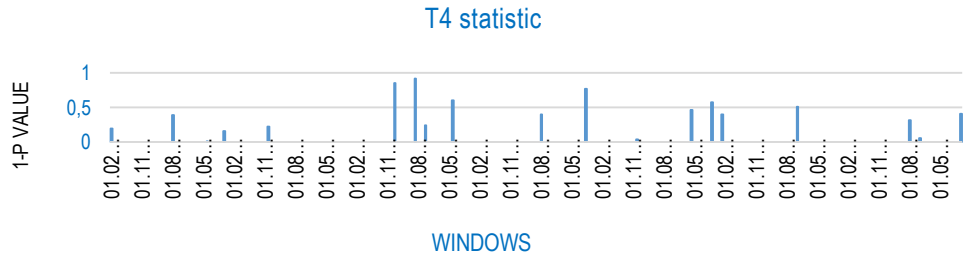
Figure 5. Significant windows derived from the H statistic



Source: Authors' own elaboration in Fortran (http://www.la.utexas.edu/hinich/files/T23/) with data from Yahoo Finance

In Figure 6 we show the results of the T4 statistic, corresponding to 10.67% of windows with non-linearity present. The results are in accordance with the *H* statistic and also show evidence on the AMH of the IPC.

Figure 6. Significant windows derived from the T4 statistic



Source: Authors' own elaboration in Fortran (http://www.la.utexas.edu/hinich/files/T23/) with data from Yahoo Finance

Conclusions

In this paper we have studied the AMH of the IPC. We applied unit-root tests in order to show that the time series of returns is stationary and, subsequently, we applied some nonlinear tests to examine the nonlinear structure of the series under study. We applied the H and T4 statistic to show how the series of returns went from plenty of periods where the market behaves in an efficient way, *i.e.*, as a random walk, followed by some periods of adaptability, *i.e.*, where non-linearity in the IPC return series was found.

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The Impact of the Global Crisis on the Stability of the Financial System

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Abstract:

We examine the impact of the recent global crisis on the stability of the global financial system. We use seven measures of stability that include Bank Z-Score, Bank non-performing loans, Bank capital, Bank credit, Regulatory capital, Liquid assets, and Provisions to non-performing loans. These data are from World Bank's Global Financial Development Database (GFDD). Our findings indicate that during the run-up to the crisis, there was no significant change in any of the stability measures. Our findings also indicate that, during the crisis period, banks' non-performing loans significantly increased while their liquid assets significantly decreased. Interestingly, Bank Z-Score, Bank capital, Bank credit, Regulatory capital, and Provisions to non-performing loans did not change significantly during the crisis period. When we look at the period after the crisis, we are seeing that banks reacted by reducing credits and increasing their regulatory capital. However, during this post-crisis period, banks suffered even more because of continuing increase in non-performing loans. We are hoping that these findings on the timing of changes in these measures will help banks and policymakers in devising strategies to deal with the problems before they occur.

Keywords financial system; stability of financial system; global crisis; financial crises

JEL Classification: G01; G10; G20; G21; G32

Introduction

In this study, we examine the impact of the recent global crisis on the stability of the global financial system. We use seven measures of stability that include Bank Z-Score, Bank non-performing loans, Bank capital, Bank credit, Regulatory capital, Liquid assets, and Provisions to non-performing loans. The data on these measures are from World Bank's Global Financial Development Database (GFDD).

We examine how these variables are affected during the pre-crisis period, the crisis period, and the post-crisis period. The results for the pre-crisis period will show us whether any of these variables can serve as indicators of an upcoming crisis. If a certain variable changes significantly during the run-up to a crisis, policymakers can use that variable as an indicator of an upcoming crisis and take precautions accordingly. The results for the crisis period will show us how the stability of the system is affected during a crisis. Our results for the post-crisis period will show us how the governments and central banks reacted to the crisis. We also expect to see some continuing effects of the crisis on some of these variables. Our argument here is that, for some of these measures, there is a longer-term effect that continues after the crisis.

There are several studies that attempt to find the possible indicators of a global financial crisis. Most of these studies focus on measures that relate to exchange rates. Edwards (1989), Frankel and Rose (1996), Bruggemann and Linne (1999), and Osband and Rijckeghem (2000) focus on nominal exchange rates mainly against the US dollar. Goldfajn and Valdes (1998) and Apoteker and Barthelemy (2000) focus on real exchange rates.

There are other studies that combine changes in interest rates, reserves and the exchange rate, and use this combination as an indicator of a crisis. Sachs, Tornell and Velasco (1996), Corsetti, *et al.* (1998), Fratzcher (1998), Kaminsky *et al.* (1998), Berg and Pattillo (1999), Tornell (1999), Bussiere and Mulder (1999, 2000), and

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Frankel and Wei (2005) combine exchange rates with changes in reserves and use this combination as an indicator. Other papers like Eichengreen, Rose and Wyplosz (1995), Herrera and Garcia (1999), and Hawkins and Klau (2000) combine changes in interest rates, reserves and the exchange rate, and use this as an indicator.

While all of these previous studies focus on many different measures, in this study, we want to focus on the stability of the financial system. We use the "stability" variables posted on World Bank's Global Financial Development Database. Therefore, our first contribution is our focus on the impact of a crisis on "stability". Also, as mentioned above, we look at three different periods: the pre-crisis period, the crisis period, and the post-crisis period. Therefore, our second contribution is to look at the issue from a wider perspective.

Our paper proceeds as follows: Section 1 summarizes the previous literature. Section 2 explains our hypotheses. Section 3 explains the data. Section 4 shows the empirical results. In the final section, we conclude.

1. Literature review

Previous research examines whether there are indicators that can help explain a financial crisis before it happens. Most of these tested indicators relate to the changes in the exchange rate. Edwards (1989), Frankel and Rose (1996), Bruggemann and Linne (1999), and Osband and Rijckeghem (2000) focus on nominal exchange rates mainly against the US dollar. Goldfajn and Valdes (1998) and Apoteker and Barthelemy (2000) focus on real exchange rates. Rose and Spiegel (2009), on the other hand, use the changes in the SDR exchange rate as a possible indicator.

Sachs, Tornell and Velasco (1996), Corsetti, *et al.* (1998), Fratzcher (1998), Kaminsky *et al.* (1998), Berg and Pattillo (1999), Tornell (1999), Bussiere and Mulder (1999, 2000), and Frankel and Wei (2005) combine exchange rates with changes in reserves and use this combination as an indicator. Some other papers like Eichengreen, Rose and Wyplosz (1995), Herrera and Garcia (1999), and Hawkins and Klau (2000) combine changes in interest rates, reserves and the exchange rate, and use this combination as a measure of central banks' defense against speculative attacks. Besides these different measures that are used as possible indicators of a crisis, there are other indicators that have been used, like the drop in GDP (Ghosh and Ghosh 2003) and equity market changes (Grier and Grier 2001).

The three reviews conducted by Kaminsky *et al.* (1998), Hawkins and Klau (2000), and Abiad (2003) examine most of the papers published on the topic and determine the most widely used variables in defining a crisis. Frankel and Saravelos (2010) integrate the findings of all three reviews, and provides a more systematic analysis of the indicators in the studies cited by Abiad (2003). They also evaluate the results of some of the newer papers published. Their review suggests that central bank reserves and past movements in the real exchange rate are the two leading indicators that have proven the most useful in explaining crisis incidence across different countries and crises in the past.

Frankel and Saravelos (2010) then investigate whether leading indicators can help explain the cross-country incidence of the 2008-09 financial crisis. For the 2008-09 crisis, they use six different variables to measure crisis incidence: drops in GDP and industrial production, currency depreciation, stock market performance, reserve losses, or participation in an IMF program.

Based on their results, "foreign exchange reserves, the real exchange rate, the growth rate of credit, GDP and the current account are the most frequent statistically significant indicators in the papers reviewed. Different measures of reserves and of the real exchange rate in particular stand out as the top two most important leading indicators being statistically significant determinants of crisis incidence in more than half of the 83 papers reviewed".

Obstfeld, Shambaugh and Taylor (2009, 2010) use the percentage depreciation of local currencies against the US dollar as a proxy of the crisis and find that the excess of reserves (as a proportion of M2) over the values predicted by their model of reserve demand was a statistically significant predictor of currency depreciation over year 2008. On the other hand, the authors do not find the simple unadjusted level of reserves/M2 to be a statistically significant predictor of crisis.

Rose and Spiegel (2009) use a model that combines the 2008 changes in real GDP, the stock market, country credit ratings and the exchange rate to predict the crisis. The authors did not find consistently statistically significant variables.

Jara, Moreno and Tovar (2009) examine the impact of the global crisis on Latin America and argue that the region was affected after the Lehman Brothers bankruptcy but the disruption to the functioning of domestic financial markets has been less severe compared to the previous crises. According to the authors, "the unprecedented (non-reserve) foreign asset accumulation by residents in some countries and the progress made in developing domestic debt markets (particularly in government securities) appear to have played important roles". Jara, Moreno and Tovar (2009) contend that policy responses across the region were significant, and in many cases pre-emptive.

According to Jara, Moreno and Tovar (2009), as they entered the global crisis, while many Latin American sovereigns had reduced or stabilised their external debt, private external borrowing in the region had either increased or remained high. The authors argue that "central banks thus sought to provide foreign currency liquidity to the private sector, to ensure both the continued operation of foreign exchange markets and the continued availability of external financing, including trade finance. Central banks also intervened to counteract tighter financial conditions in domestic funding and credit markets".

Berkmen *et al.* (2009) use the change in 2009 growth forecasts by professional economists before and after the crisis hit as a proxy for the crisis. They find that countries with more leveraged domestic financial systems and more rapid credit growth tended to suffer larger downward revisions to their growth outlooks. Berkmen *et al*. (2009) find that international reserves did not play a significant role in explaining the crisis.

Lane and Milesi-Ferretti (2011) find that the countries that suffered most in 2008-09 were those that had previously shown higher pre-crisis growth relative to trend, current account deficits, trade openness and share of manufacturing. They also find that high-income countries were hit more than low-income countries, the reverse of the usual pattern in previous global shocks. Supporting this argument, Llaudes, Salman and Chivakul (2011) and Dominguez, Hashimoto and Ito (2011) find that emerging market countries that had accumulated reserves by 2007 suffered lower output declines in the global recession.

Han and Melecky (2013) find that greater access to bank deposits can make the deposit funding base of banks more resilient in times of financial stress. According to the authors, "policy efforts to enhance financial stability should thus not only focus on macroprudential regulation, but also recognize the positive effect of broader access to bank deposits on financial stability".

2. Hypotheses

Our null hypothesis for the pre-crisis period is that there is no significant change in any stability measure before the crisis happens. Therefore, our first hypothesis is:

Hypothesis 1: None of the stability measures are affected before the crisis.

We expect the stability measures that are directly affected by the crisis to worsen significantly during the crisis period. In this study, these measures are "Bank Z-Score", "Bank non-performing loans to gross loans (%)", and "Liquid assets to deposits and short term funding (%)". These variables are explained in detail in the "Data" section. Therefore, our second hypothesis is:

Hypothesis 2: During the crisis period, all three measures (i.e. "Bank Z-Score", "Bank non-performing loans to gross loans (%)", and "Liquid assets to deposits and short term funding (%)") have deteriorated ("Bank Z-Score" and "Liquid assets to deposits and short term funding (%)" have decreased, while "Bank non-performing loans to gross loans (%)" has increased).

It is important to note that, some stability measures (*i.e*. "Bank capital", "Bank credit to bank deposits (%)", "Regulatory capital", and "Provisions to non-perf. loans") are "reaction" measures that reflect authorities' and banks' reaction to the crisis, rather than measures that are directly affected by the crisis itself. Again, these variables are explained in detail in the "Data" section. We expect these measures to significantly change after the crisis (not during the crisis). In other words, we expect banks and authorities to take actions which would affect these measures after the crisis. Due to the actions taken by the banks and the authorities, we expect "Bank credit to bank deposits (%)" to go down, and the other three measures to go up after the crisis (no change during the crisis). We

also expect banks to continue suffering with non-performing loans immediately after the crisis. Our third hypothesis is:

Hypothesis 3: After the crisis, all four "reaction" measures (i.e. "Bank capital", "Bank credit to bank deposits (%)", "Regulatory capital", and "Provisions to non-perf. loans") have improved ("Bank capital", "Regulatory capital", and "Provisions to non-perf. loans" have increased, while "Bank credit to bank deposits (%)" has decreased). Also, "Bank non-performing loans to gross loans (%)" have continued to increase.

3. Data

In this study, as "stability" measures, we use seven variables. The data are from World Bank's Global Financial Development Database (GFDD). It covers 203 countries. World Bank collected these data from different sources. Below, we show these variables, their definitions, as well as the original source of each variable. These definitions are from World Bank's Global Financial Development Database:

- Bank Z-Score. It captures the probability of default of a country's banking system. Z-score compares the buffer of a country's banking system (capitalization and returns) with the volatility of those returns. It is estimated as (ROA + (equity/assets))/sd(ROA); sd(ROA) is the standard deviation of ROA. ROA, equity, and assets are country-level aggregate figures (Calculated from underlying bank-by-bank unconsolidated data from Bankscope).
- Bank non-performing loans to gross loans (%). Ratio of defaulting loans (payments of interest and principal past due by 90 days or more) to total gross loans (total value of loan portfolio). The loan amount recorded as nonperforming includes the gross value of the loan as recorded on the balance sheet, not just the amount that is overdue. (International Monetary Fund, Global Financial Stability Report);
- Bank capital to total assets (%). Ratio of bank capital and reserves to total assets. Capital and reserves include funds contributed by owners, retained earnings, general and special reserves, provisions, and valuation adjustments. Capital includes tier 1 capital (paid-up shares and common stock), which is a common feature in all countries' banking systems, and total regulatory capital, which includes several specified types of subordinated debt instruments that need not be repaid if the funds are required to maintain minimum capital levels (these comprise tier 2 and tier 3 capital). Total assets include all nonfinancial and financial assets. (International Monetary Fund, Global Financial Stability Report);
- Bank credit to bank deposits (%). The financial resources provided to the private sector by domestic money banks as a share of total deposits. Domestic money banks comprise commercial banks and other financial institutions that accept transferable deposits, such as demand deposits. Total deposits include demand, time and saving deposits in deposit money banks. (International Monetary Fund, International Financial Statistics);
- Regulatory capital to risk-weighted assets (%). The capital adequacy of deposit takers. It is a ratio of total regulatory capital to its assets held, weighted according to risk of those assets. (International Monetary Fund, Global Financial Stability Report);
- Liquid assets to deposits and short term funding (%). The ratio of the value of liquid assets (easily converted to cash) to short-term funding plus total deposits. Liquid assets include cash and due from banks, trading securities and at fair value through income, loans and advances to banks, reverse repos and cash collaterals. Deposits and short term funding includes total customer deposits (current, savings and term) and short term borrowing (money market instruments, CDs and other deposits). (Bankscope);
- Provisions to non-performing loans (%). Provisions to non-performing loans. Non-performing loans are loans for which the contractual payments are delinquent, usually defined as and NPL ratio being overdue for more than a certain number of days (*e.g.,* usually more than 90 days). (International Monetary Fund, Global Financial Stability Report).

It is important to note that, four of these measures (*i.e*. "Bank capital", "Bank credit to bank deposits (%)", "Regulatory capital", and "Provisions to non-perf. loans") are "reaction" measures that reflect authorities' and banks' reaction to the crisis, rather than measures that are directly affected by the crisis itself. We expect these measures to significantly change after the crisis (not during the crisis). In other words, we expect banks and authorities to

improve these measures after the crisis. Due to the actions taken by the banks and the authorities, we expect "Bank credit to bank deposits (%)" to go down, and the other three measures to go up after the crisis (no change during the crisis).

The other three measures are variables that are affected due to the crisis itself. We expect these measures to change significantly during the crisis (not before and not after if precautionary actions are taken). We expect "Bank Z-Score" to go down, "Bank non-performing loans to gross loans (%)" to go up, and "Liquid assets to deposits and short term funding (%)" to go down during the crisis.

Figure 1 shows the trend in "Bank Z-Score" from 2001 to 2011. An increase in the score is a sign of decreased probability of default in a country's banking system while a decrease in the score reflects increased probability of default. As we are seeing in the figure below, there was a sharp decline in the Z-Score (*i.e*. an increased chance of default) during the crisis period (*i.e*. from 2007 to 2008). Then, just after the crisis, from 2008 to 2009, we are seeing a sharp increase in the Z-Score (*i.e*. a decreased chance of default). We are arguing that, due to the actions of authorities, the banking systems around the world has stabilized after the crisis. We are seeing a similar "stabilization" from 2001 to 2002 (*i.e*. just after the 2000-2001 recession that mostly affected developed countries).

Figure 1. Bank Z-Score

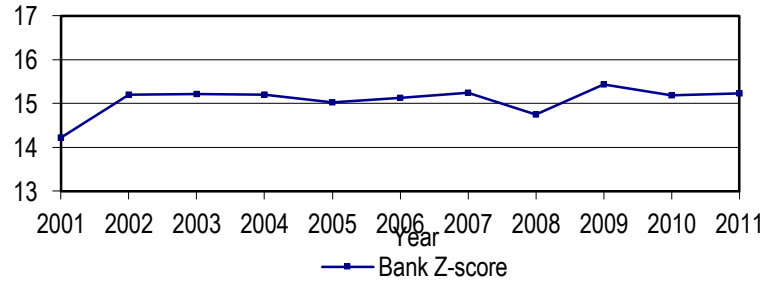

Figure 2 shows the trend in "Bank non-performing loans to gross loans (%)" over the same time period. In this figure, we are seeing that the percentage of non-performing loans gradually decreases until 2007. Then, during the crisis period (*i.e*. from 2007 to 2008), it is flat. From 2008 to 2009, there is a sharp increase in this measure, meaning that the loans are affected from 2008 to 2009 (when they are due).

Figure 2. Bank Non-Performing Loans to Gross Loans (%)

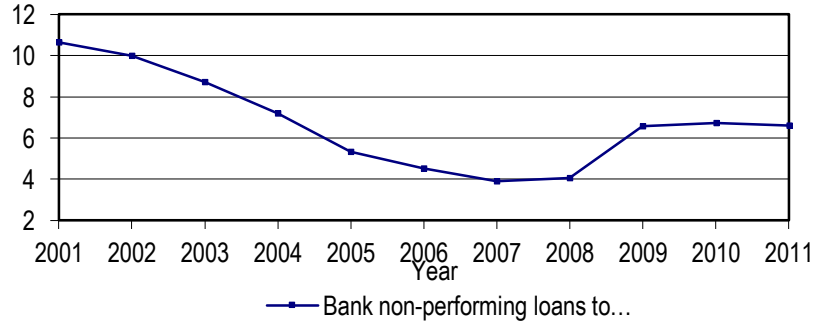

Figure 3 shows the trend in "Bank capital to total assets (%)". In this figure, we are seeing that the percentage of bank capital to total assets has gradually increased from 2003 to 2008. Then, after the crisis (*i.e*. from 2008 to 2009), there is a shaper increase in this measure. This sharper increase reflects authorities' efforts to shore up banks' capital just after the crisis.

Figure 3. Bank Capital to Total Assets (%)

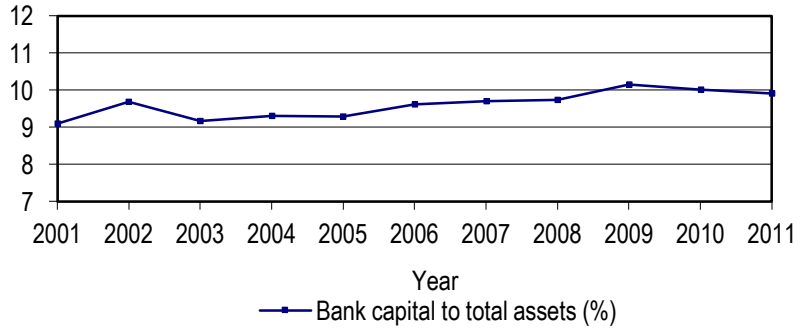

Figure 4 shows the trend in "Bank credit to bank deposits (%)". Bank credit relative to bank deposits increases from 2003 to 2008, and then it sharply drops just after the crisis. Here, it is interesting to find that banks have continued to extend credit during the crisis period which is 2007 to 2008.

Figure 4. Bank Credit to Bank Deposits (%)

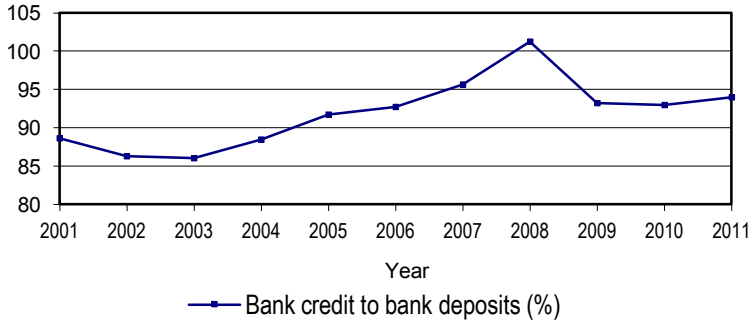

Figure 5 shows the trend in "Regulatory capital to risk-weighted assets (%)" which reflects the capital adequacy of banks. We are seeing zig zags throughout the whole period. We are seeing that, just after the crisis (*i.e*. from 2008 to 2009), banks' capital adequacy significantly improved.

Figure 5. Regulatory Capital to Risk-Weighted Assets (%)

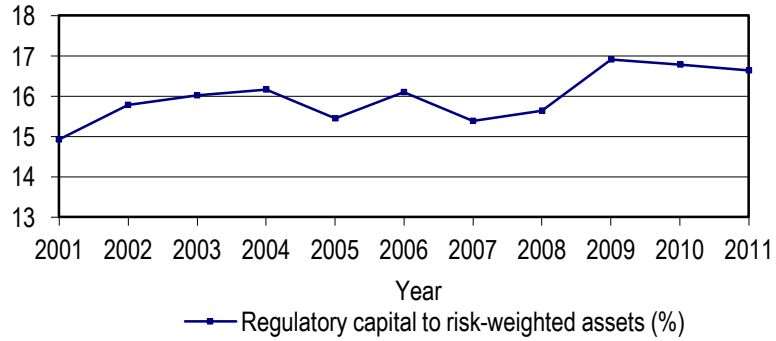

Figure 6 shows the variable "Liquid assets to deposits and short term funding (%)" over time. This measure is almost flat from 2002 to 2006. Then, it goes down. This drop in liquid assets is more pronounced during the crisis period (*i.e*. 2007 to 2008). We are seeing that banks' liquid assets depleted during the crisis.

Figure 6. Liquid Assets to Deposits and Short-Term Funding (%)

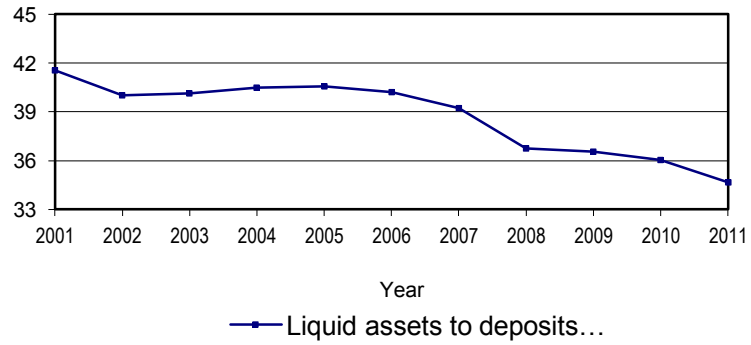

Figure 7 shows the trend in "Provisions to non-performing loans (%)". Here, we are seeing three distinct periods. From 2001 to 2004, there is sharp increase, from 2004 to 2009 there is sharp decrease, and after 2009, again there is a sharp increase. This figure indicates that banks tend to increase their provisions to non-performing loans mainly 1-3 years after a crisis hits. After the 2000 recession, they have started increasing their provisions but they have done it more from 2003 to 2004. Then, after 2004, because of improving economy, they have started reducing these provisions. Similarly, after the 2008 recession, they have started increasing their provisions after 2009. This figure shows the banks' delay in this process.

Figure 7. Provisions to Non-Performing Loans (%)

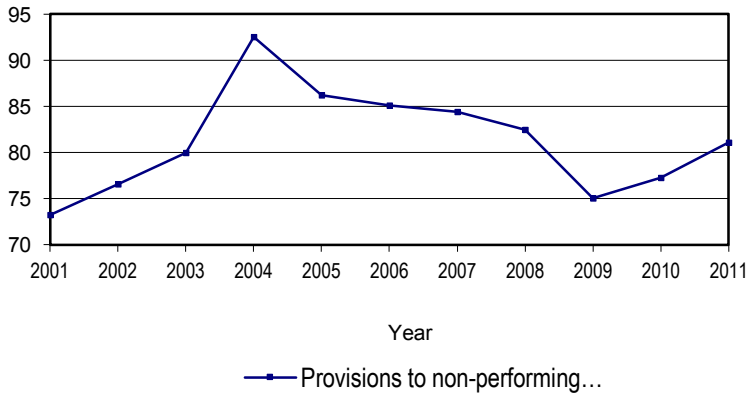

Table 1 shows the summary statistics for the stability variables. Table 2 shows the variables over time in tabular form.

Table 1. Summary Statistics

Variable	Mean	Std	Min	Max
Bank Z-score	15.23	10.40	-3.45	62.14
Bank non-perf. loans	6.60	6.50	0.40	38.80
Bank capital	9.91	3.65	3.90	21.60
Bank credit	93.96	73.30	15.20	898.01
Regulatory capital	16.65	4.09	9.30	30.40
Liquid assets	34.66	20.13	5.25	133.78
Provisions to non-perf. loans	81.11	54.88	2.50	278.10

Table 2. Stability Variables over time

Year	01	02	03	04	05	06	07	08	09	10	11
Bank Z-score	14.2	15.2	15.2	15.2	15.0	15.1	15.2	14.7	15.4	15.2	15.2
Bank non-perf. loans	10.7	10.0	8.7	7.2	5.3	4.5	3.9	4.0	6.6	6.7	6.6
Bank capital	9.1	9.7	9.2	9.3	9.3	9.6	9.7	9.7	10.2	10.0	9.9
Bank credit	88.6	86.3	86.0	88.5	91.7	92.7	95.7	101.3	93.2	92.9	94.0
Regulatory capital	14.9	15.8	16.0	16.2	15.5	16.1	15.4	15.6	16.9	16.8	16.6
Liquid assets	41.6	40.0	40.1	40.5	40.6	40.2	39.2	36.8	36.5	36.0	34.7
Provi. to non-perf. loans	73.2	76.5	80.0	92.5	86.2	85.1	84.4	82.5	75.1	77.2	81.1

4. Results

Table 3 shows the change in our stability variables before the crisis started. From year 2006 to year 2007, none of the measures change significantly. The median value of "Bank Z-score" is 13.80 in 2006. The corresponding value in 2007 is 13.17. The change is statistically insignificant (p=0.4767). The median value of "Bank non-perf. loans" is 3.10 in 2006. The corresponding value in 2007 is 2.70. The change is statistically insignificant (p=0.1365). The median value of "Bank capital" is 9.25 in 2006. The corresponding value in 2007 is 8.90. The change is statistically insignificant (p=0.4539). The median value of "Bank credit" is 82.58 in 2006. The corresponding value in 2007 is 83.62. The change is statistically insignificant (p=0.2563).

The median value of "Regulatory capital" is 14.70 in 2006. The corresponding value in 2007 is 14.00. The change is statistically insignificant (p=0.1667). The median value of "Liquid assets" is 37.79 in 2006. The corresponding value in 2007 is 36.26. The change is statistically insignificant (p=0.3182). Finally, the median value of "Provisions to non-perf. loans" is 71.20 in 2006. The corresponding value in 2007 is 67.80. The change is statistically insignificant (p=0.4770). We can say that these results confirm our first hypothesis which states that no stability measure has significantly changed before the crisis.

Table 3. The Run-Up to the Global Crisis

	2006		2007		Mann-W.	
Variable	Mean	Med.	Mean	Med.	p-value	Change
Bank Z-score	15.12	13.80	15.24	13.17	0.4767	_
Bank non-perf. loans	4.52	3.10	3.90	2.70	0.1365	_
Bank capital	9.62	9.25	9.70	8.90	0.4539	_
Bank credit	92.73	82.58	95.65	83.62	0.2563	_
Regulatory capital	16.09	14.70	15.38	14.00	0.1667	_
Liquid assets	40.20	37.79	39.22	36.26	0.3182	_
Provisions to non-perf. loans	85.14	71.20	84.38	67.80	0.4770	_

Table 4 shows the change in our stability variables during the crisis period (*i.e.* 2007 to 2008). We are seeing that, due to the crisis, banks' non-performing loans have significantly increased. While the median value of "Bank non-perf. loans" is 2.70 in 2007, it increased to 3.10 in 2008 (p=0.0618). We are also seeing that, during the crisis period, banks' liquid assets have significantly decreased. While the median value of "Liquid assets" is 36.26 in 2007, it dropped to 31.31 in 2008 (p=0.0552). While there is a significant change in non-performing loans and liquid assets during the crisis, for the other five measures, we are not seeing a significant change. We contend that these other measures are not affected significantly at the time of a crisis. As discussed in the previous section, in fact, three of these measures (*i.e.* "Bank capital", "Regulatory capital", and "Provisions to non-perf. loans") are "reaction" measures that reflect authorities' and banks' reaction to the crisis, rather than measures that are directly affected by the crisis itself.

Table 4. The impact of the global crisis on stability of the financial system

	2007		2008		Mann-W.	
Variable	Mean	Med.	Mean	Med.	p-value	Change
Bank Z-score	15.24	13.17	14.74	13.35	0.3292	_
Bank non-perf. loans	3.90	2.70	4.04	3.10	0.0618	UP
Bank capital	9.70	8.90	9.74	9.05	0.4505	_
Bank credit	95.65	83.62	101.25	89.25	0.1643	_
Regulatory capital	15.38	14.00	15.64	14.30	0.3638	_
Liquid assets	39.22	36.26	36.76	31.31	0.0552	DOWN
Provisions to non-perf. loans	84.38	67.80	82.45	70.75	0.4701	_

These results confirm our second hypothesis (with the exception of Z-Score). There is evidence of a significant deterioration in non-performing loans and liquid assets. However, we do not find a significant change in "Bank Z-Score").

Table 5 shows the change in our stability variables just after the crisis (*i.e.* 2008 to 2009). We are seeing that, two of the four "reaction" variables (*i.e.* "Bank credit" and "Regulatory capital") have improved after the crisis. While the median value of "Bank credit" is 89.25 in 2008, it decreased to 84.76 in 2009 (p=0.0846). After the crisis, banks have reduced their credits relative to their deposits. When we look at "Regulatory capital", while the median value is 14.30 in 2008, it increased to 16.10 in 2009 (p=0.0006). This finding indicates that, after the crisis, banks have increased their regulatory capital.

Table 5. The reaction after the crisis

	2008		2009		Mann-W.	
Variable	Mean	Med.	Mean	Med.	p-value	Change
Bank Z-score	14.74	13.35	15.44	13.89	0.3319	
Bank non-perf. loans	4.04	3.10	6.57	4.25	0.0004	UP
Bank capital	9.74	9.05	10.16	9.60	0.1494	
Bank credit	101.25	89.25	93.24	84.76	0.0846	DOWN
Regulatory capital	15.64	14.30	16.91	16.10	0.0006	UP
Liquid assets	36.76	31.31	36.54	31.33	0.3898	
Provisions to non-perf. loans	82.45	70.75	75.06	62.75	0.1371	

Interestingly, we are seeing that, banks' non-performing loans have continued to increase after the crisis. The median value is 3.10 in 2008, while it is 4.25 in 2009 (p=0.0004). This result indicates that banks have continued struggling with non-performing loans.

The table shows that there is no significant change after the crisis in the other measures. "Bank Z-Score", "Bank capital", "Liquid assets", and "Provisions to non-perf. loans" have not changed significantly after the crisis.

These results partially confirm our third hypothesis. There is evidence of a significant change in "Bank credit" and "Regulatory capital". Banks have reduced their credits and improved their capital adequacy. As expected, non-performing loans continue to deteriorate after the crisis. However, we do not find a significant increase in bank capital or in provisions to non-perf. loans.

Conclusion

In this study, we examine the impact of the recent global crisis on the stability of the global financial system. We use World Bank's Global Financial Development Database to access the data. This database has data on 203 countries around the world. The database has seven measures of stability that include Bank Z-Score, Bank non-performing loans, Bank capital, Bank credit, Regulatory capital, Liquid assets, and Provisions to non-performing loans.

As our first hypothesis states, we expect none of the stability measures to have been affected before the crisis started. Our findings confirm that. During the run-up to the crisis, there was no significant change in any of the seven stability measures.

Our second hypothesis deals with the crisis period. For the crisis period, our hypothesis is that the three stability measures that are directly affected by the crisis (*i.e*. "Bank Z-Score", "Bank non-performing loans to gross loans (%)", and "Liquid assets to deposits and short term funding (%)") to have worsened significantly. Our findings indicate that, during the crisis period, banks' non-performing loans significantly increased while their liquid assets significantly decreased. Interestingly, Bank Z-Score, Bank capital, Bank credit, Regulatory capital, and Provisions to non-performing loans did not change significantly during the crisis period.

Our third hypothesis deals with the post-crisis period. It states that, during the post-crisis period, all four "reaction" measures (*i.e.* "Bank capital", "Bank credit to bank deposits (%)", "Regulatory capital", and "Provisions to non-perf. loans") have improved while "Bank non-performing loans to gross loans (%)" have continued to deteriorate (*i.e*. some of the loans were due next year). For the post-crisis period, we find that banks reacted by reducing credits and increasing their regulatory capital. We also find that, during this post-crisis period, as expected, banks suffered even more because of continuing increase in non-performing loans. The other four variables did not change significantly in this post-crisis period.

We are hoping that these findings on the timing of changes in these measures will help banks and policymakers in devising strategies to deal with the problems before they occur. Not all measures deteriorate at the same time. Knowing the timing of these changes would allow banks and policymakers to take precautions beforehand. Future studies may focus on the regional impacts of the crisis.

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Russian Experience of Practical Application of Banking Supervision Tools and Techniques

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Abstract:

Until recently, most economists have analyzed banking system from the standpoint of the stability of some of its elements: commercial banks. Last macroeconomic crisis has given new impetus to the study of banking supervision and the formation of understanding of this type of state regulation as an activity not only aimed to overcoming the crisis, but also operating as a constant system of measures to prevent and minimize negative impacts. In this context, the problem of efficient state regulation of banking activities through the use of supervision tools and techniques that contribute to the achievement by commercial banks of the necessary degree of public trust, becomes today particularly acute and deserves a detailed and comprehensive study and consideration. The article presents the results of a study of the Russian experience in the practical application of the main techniques of state regulation of banking activities, consisting in licensing, setting and analysis of norms of compliance with prudential supervision, regulating the bankruptcy of commercial banks, as well as tools facilitating their implementation. The authors seek to identify the advantages and disadvantages of the modern state regulation of the banking system on the Russian Federation scale.

Keywords: banking regulation; banking supervision; commercial bank

JEL Classification: E52 ; E58 ; G18 ; G28; H12

Introduction

An important condition for a successful and stable functioning of the modern banking system of market type is an effective state regulation of commercial banks' activities through the use of supervisory tools and techniques. During the last decade, the statement formulated by us has been confirmed by the changing positions of regulatory authorities in the economies of various countries: priorities, methodology and tools get transformed, in order to increase the efficiency and strengthen the importance of these bodies.

According to the results of a special study of 60 countries with developed market economies, it has been found that only in 19 countries the involvement of the Central Bank is considered poor, while in 41 countries its involvement is recognized as a evident and significant (Murychev 2007). At the same time, the main external factors

that enhance the regulatory power of the state, are usually the following: the state of the external macroeconomic environment, growing number of commercial banks, possibility to replenish the resource base of commercial banks by depositing public financial resources in them, globalization and internationalization of financial markets, intensification of state investment policy, formation and building effective "bank-client" relationship, bank capital concentration and centralization, need for continuous monitoring of the level of liquidity and optimization of the bank capital cost, scientific and technological progress, increase of scientific, research and experimental development expenditures in banking sphere, development of the financial market infrastructure and perfect substitutes, state participation in the capital of leading commercial banks, presence of group relationships of commercial banks conducting coordinated market policy, presence of the dominant commercial banks and abusive exercise of their economic power.

1. Background of the research

1.1. Importance of the Problem

Justifying the relevance of the research topic, it is appropriate to mention the opinion of Alan Greenspan, the former Chairman of the US Federal Reserve: "There are compelling reasons why the central bank of the United States - the Federal Reserve - should continue to be involved in the supervision of banks.

The supervisory activities of the Federal Reserve, for example, have benefited from its economic stabilization responsibilities and its recognition that safety and soundness goals for banks must be evaluated jointly with its responsibilities for the stability and growth of the economy. The Board believes that these joint responsibilities make for better supervisory and monetary policies than would result from either a supervisor divorced from economic responsibilities or a macroeconomic policymaker with no practical experience in the review of individual bank operations" (Yermakov and Galkina 2011). It should be also emphasized that since the beginning of the 1970s, according to various estimates, about 130-140 countries, or about ¾ of the IMF member states have experienced local or systemic banking crises which are systematized in Table 1.

Table 1. Systemic banking crises over the 1990-2015 period

Banking crisis period	Country that experienced a banking crisis	Banking crisis period	Country that experienced a banking crisis
1990-1992	Algeria	1988-1991	Nepal
1995, 2001-2002	Argentina	1991-1995	Nigeria
1994-1997, 2001-2002	Bolivia	1987-1993	Norway
1994-1999	Brazil	1989-1992	Papua New Guinea
1994-1997	Burundi	1995-1999	Paraguay
1988-1994	Burkina Faso	1998, 2008-2009, 2014-till present time	Russia
1993-1997	Venezuela	1995	Swaziland
1997-2002	Ghana	1990-1993	Sierra Leone
1993-1995	Guyana	1980-1992, 2008-2009	USA
1991-1994	India	1997-1998	Taiwan
1992-1995, 1997-2002	Indonesia	1988-1991	Tanzania
1990-1995, 2008	Italy	1997-2002	Thailand
1987-1993, 1995-1998	Cameroon	1991-1995	Tunisia
1997-2002	Korea	1991, 1994, 2000-2002	Turkey
1993-1995	Kenya	1994-1997	Uganda
1994-2002	Congo	2002	Uruguay
1999-2000	Colombia	1991-1994, 2008	Finland
1994-1997	Costa Rica	1998-2002	Philippines
1988-1991	Côte d'Ivoire	1989-1993	Sri Lanka
1991-1995	Liberia	1990-1993	Sweden
1988-1991	Madagascar	1992	Chad

Banking crisis period	Country that experienced a banking crisis	Banking crisis period	Country that experienced a banking crisis
1984-1993	Mauritania	1995-2002	Ecuador
1997-2001	Malaysia	1988-1999	South Africa
1994-1997	Mexico	1996-2000	Jamaica
		1992-2002, 2007-2008	Japan

The main cause of increasing instability of the banking systems of many countries is associated with the effect of the previously mentioned factors, among which are:

- *firstly*, the "snowballing growth" of innovations in banking activity related to the emergence of innovative financial instruments and banking services;
- *secondly*, the intense pace of development of new banking technologies and online forms of payments;
- *thirdly*, the active liberalization of capital movement.

Theoretical and practical understanding of the frequency and the factors of increasing instability of modern banking market-type system has determined the priority direction of our scientific research, consisting in the study of the efficiency of the market mechanism-related system of techniques and tools of state regulation of banking activities.

1.2. Purpose and objectives of the study

The purpose of the article is to study the efficiency of the Russian experience of using a market mechanism-related system of techniques and tools of state regulation of banking activities.

The determined purpose has identified the objectives of our study:

- to examine the main areas of the modern market-type banking system regulation by means of banking supervision, as well as the existing system of tools and techniques of state influence on the activities of commercial banks;
- to analyze how actively and productively the Central Bank of the Russian Federation applies a system of techniques and tools of regulation of commercial banks by banking supervision at the national level;
- to identify the strengths and weaknesses of the national system of state regulation of banking activities.

1.3. Degree of Development of the issue

The problem of state regulation of banking activities is characterized by the variety of aspects and is studied by many scientists and experts:

- fundamental theoretical concepts of state regulation of banking activity can be found in scientific works by Chortareas, Girardone, and Ventouri (2012), Kazakbieva (2004), Sargsyan (2006), Semkin (2011), and others;
- methodological framework used for evaluating the efficiency of state regulation of activity of commercial banks, has been offered by Vidyakin (2010), Becht, Bolton and Röell (2011), Dubova (2013), Laeven, Levine (2009), Peresetsky (2009), Summer (2003) and others.

During the analysis of the degree of development of the issue, it has been determined that today theoretical and methodological aspects of the study of state regulation of banking activities are underdeveloped:

- *firstly*, the publications are devoted mainly to micro-prudential regulation and monetary policy, when crisis management has been poorly studied;
- *secondly*, the stability of the banking system is often regarded in the context of the stability of its individual elements rather than the entire system.

Thus, while appreciating the results obtained in the works of these authors, we consider it necessary to note that there are still many aspects that require in-depth analysis, revisions and improvements.

2. Research methodology

Study of the efficiency of the set of techniques and tools applied by the Central Bank of the Russian Federation to regulate commercial banks by means of banking supervision across the country determines the need for:

- systematization of techniques and tools for regulation of commercial banks' activity by means of banking supervision as represented in Table 2;
- consistent application of general economic analytical methods: grouping of indicators, comparison, graphical representation of the analyzed information, as well as statistical analysis techniques: calculation of relative and average values, time series analysis.

Of course, we should note that when attempting to evaluate complex systems, there is a risk of missing some economic indicators, reflecting the laws and tendencies of their development.

Table 2. System of techniques and tools for regulation of commercial banks activity through the banking supervision

Techniques	Objective of regulation	Tools
General	▪ Ensuring the stability and reliability of a commercial bank. ▪ Protection of deposits of natural and legal persons, and the prevention of excessive panic of depositors in crisis situations.	▪ Improving the legal and regulatory framework for commercial bank activity in accordance with the internationally recognized techniques; ▪ Standards for the commercial bank capital adequacy; ▪ Reserve requirements; ▪ Maximum risk per borrower or group of related borrowers; ▪ Maximum large credit risks; ▪ Commercial banks liquidity ratios; ▪ Foreign exchange, interest and other types of banking risks; ▪ Bank deposit insurance.
Banking licensing	▪ Protection of commercial bank clients from an unprofessional management, and strengthening of confidence for economic agents in banking system.	▪ Minimum size of the commercial bank authorized capital; ▪ Requirements for commercial bank senior managers.
Management of the bankruptcy of organizations	▪ Enforcement of rights of depositors and creditors in case of bankruptcy of commercial banks.	▪ Special requirements to the procedures of bankruptcy of organizations.

3. Results and discussion

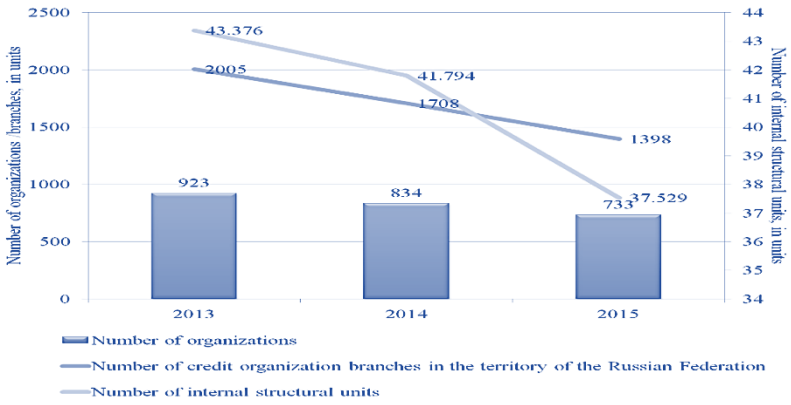
The authors of the article have tried to analyze how actively and efficiently the Central Bank of the Russian Federation applies techniques of regulating the activities of the commercial banks registered and operating in the territory of the country, by means of the banking supervision in the following sequence: licensing of banking activities, general technique and management of the bankruptcy of credit organizations.

The use of banking licensing as a technique of state regulation is determined by its purpose consisting in a restricting access to the market of financially unstable and fragile commercial banks, and the commercial banks the managers of which have a doubtful reputation.

As can be seen in Figure 1, in 2015, the number of credit organizations in the Russian Federation reduced: over the analyzed period, the total number of operating credit organizations having license to conduct banking operations decreased due to withdrawal of licenses and reorganization of credit institutions from 923 in 2013 to 733 in 2015, or by 20.59%, and "... in the coming years we may not expect significant changes in this sector of economy" (Rakhlis *et al.* 2014). Large multi-branch banks in 2013-2015 continued optimization of their regional offices. The total number of credit organization structural units decreased by 5847 units: from 43,376 units in 2013 to 37,529 units in 2015. The number of additional offices decreased from 24,486 to 21,836, lending and cash services offices:

from 2463 to 1853, stand-alone cash desks: from 7845 to 5696, operational offices: from 8436 to 7609. As a result of these structural changes, the number of internal structural units per 100,000 population decreased from 43.4 at the end of 2013 to 37.5 at the end of 2015. It is worth noting that many experts believe that "... the revealed tendencies have a generally negative influence on the social and economic development of our country, which is supposed to be socially-oriented according to our constitution" (Tarasova *et al.* 2009).

Figure1. Number of credit organizations and their branches in 2013-2015.



An important tool of banking licensing is the requirement for the minimum authorized capital of newly registered credit organizations. According to the Federal Law of 02.12.1990 N 395-1 "On banks and banking activity", the minimum authorized capital of a newly registered credit organization on the day of submission of the application for state registration and issuance of license for banking operations is set in the amount of 300 mln RUB.

The grouping of the operating commercial banks in terms of authorized capital for 2013-2015 is presented in Table 3.

Table 3. Credit organizations operating in the territory of the Russian Federation, grouped by size of authorized capital, for 2013-2015.

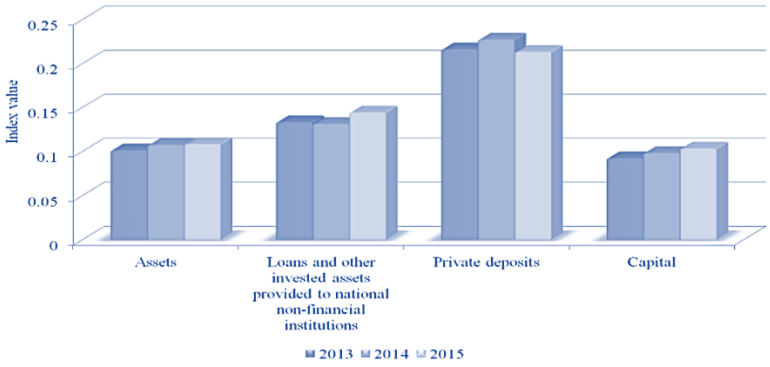
Authorized capital size	2013		2014		2015	
	Number, units	Specific weight, %	Number, units	Specific weight, %	Number, units	Specific weight, %
less than 3 mln RUB	15	1.6	10	1.2	12	1.6
3-10 mln RUB	15	1.6	13	1.6	12	1.6
10-30 mln RUB	45	4.9	38	4.6	40	5.5
30-60 mln RUB	36	3.9	30	3.6	28	3.8
60-150 mln RUB	143	15.5	112	13.4	86	11.8
150-300 mln RUB	251	27.2	212	25.4	168	23.1
300-500 mln RUB	116	12.6	118	14.1	103	14.1
from 500 mln RUB to 1 bln RUB	116	12.6	111	13.3	98	13.5
1-10 bln RUB	161	17.4	163	19.5	152	20.9
from 10 bln RUB and more	25	2.7	27	3.2	29	4.0
Total	923	-	894	-	733	-

According to Table 3, the number of commercial banks with the authorized capital corresponding to the requirements of the Central Bank of Russia decreased by 36 units during the period under review, but such dynamics was due to a decrease in the total number of commercial banks operating in the country. In turn, the specific weight of credit organizations with the authorized capital corresponding to the requirements of the Central Bank of Russian Federation for the analyzed period increased from 45.29% in 2013 to 52.11% in 2015. This

indicates an increased reliability of national commercial banks and, accordingly, the efficiency of the considered tool of state regulation of banking activities.

Moreover, during the analyzed period, the indicators characterizing the concentration of banking activities tend to increase, which is shown in Figure 2. Indicators of concentration widely used in international practice, in particular, the Herfindahl-Hirschman Index, show that the concentration in 2013-2015 in terms of the main groups of assets and liabilities was average in the presence of the upward trend, with the exception of deposit market.

Figure 2. Indicators of the Russian banking sector concentration in 2013-2015

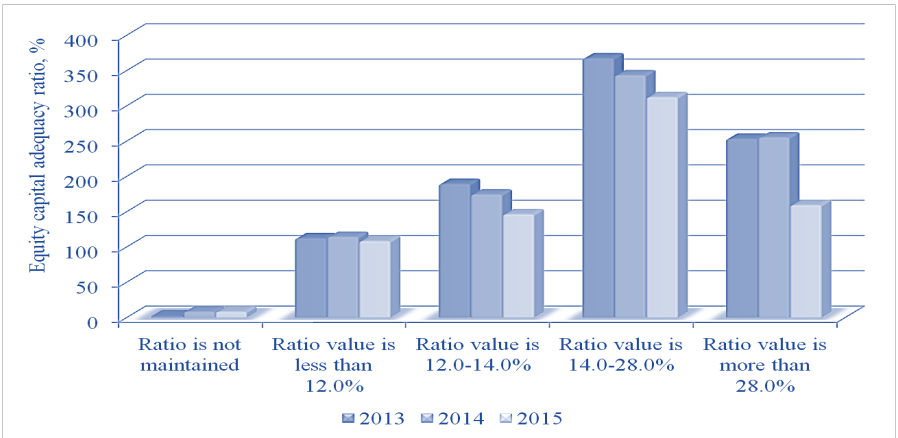


The general technique of commercial bank activity regulation through banking supervision is based primarily on the determination and analysis of compliance of the commercial banks with prudential regulations, in particular: bank capital adequacy; maximum risk dimension per borrower or group of related borrowers; maximum large credit risk dimension; commercial banks liquidity ratios. Similarly, experts point out that "... in most studies, specific variables of banks such as bank size, credit risk, capital bank ratio and equity are used as internal determinants of bank performance" (Faten 2013). We emphasize that in a broad sense, the prudential supervision means a remote, documentary control, based on the inspection of report forms submitted by a credit organization to the Central Bank of Russian Federation, and making it possible to pre-identify problems which may cause the risk of insolvency of commercial banks and their bankruptcy (Ageeva and Vasilieva 2016).

Distribution of credit organizations operating in the territory of the Russian Federation, based on the value of the capital adequacy ratio is presented in Figure 3, according to which the following can be noted. During the period under study, there were minor changes in the distribution of credit organizations based on the value of the capital adequacy ratio:

- *firstly*, during the years 2013-2015, the banks with the capital adequacy ratio from 14.0 to 28.0% had the largest specific weight amounting in 2013 to 39.8%, in 2014 to 38.4%, and in 2015 to 42.6%;
- *secondly*, the number of banks with the capital adequacy ratio below 12.0% decreased from 112 commercial banks in 2013 to 108 in 2015, while their share in the general banking sector structure increased from 12.1% in 2013 to 14.7% in 2015;
- *thirdly*, the number of banks with the capital adequacy ratio from 12.0 to 14.0% decreased from 189 commercial banks in 2013 to 146 in 2015, while their share in the general banking sector structure decreased from 20.5% in 2013 to 19.9% in 2015;
- *fourthly*, the capital adequacy ratio was not maintained by 2 credit organizations in 2013 and 8 credit organizations in 2014 and 2015, and the increase in the number of such credit organizations was accompanied by an increase in their specific weight from 0.2% in 2013 to 1.1% in 2015. It should be noted that in 2015, license was revoked from 6 credit organizations, and one credit institution was reorganized.

Figure 3. Distribution of credit organizations operating in the territory of the Russian Federation based on the value of capital adequacy ratio in 2013-2015

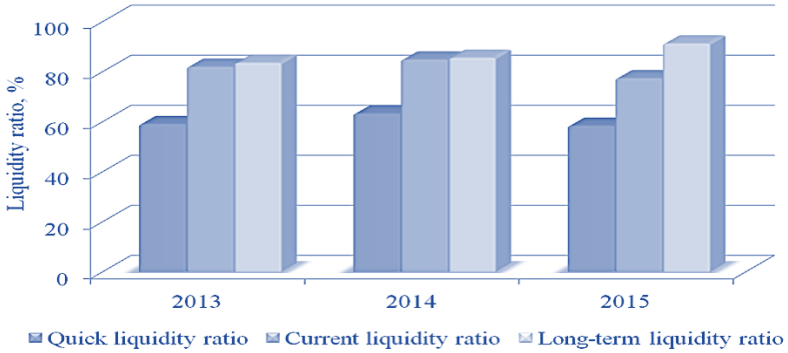


The level of credit risks of commercial banks operating in the territory of the Russian Federation is characterized, as a rule, by means of the maximum risk dimension per borrower or group of related borrowers and maximum large credit risk size. During the analyzed period, the value of large credit risks in the banking sector increased by 34.9%, to 19.5 billion rubles. The specific weight of large loans in the banking sector assets for the years 2013-2015 remained practically unchanged and amounted to almost 25.0%. During the period under study, the norm of dimension of maximum risk per borrower or group of related borrowers was violated by 69 commercial banks in 2013, while in 2015 the norm was not observed already by 122 credit organizations, and the norm of the maximum dimension of large credit risks was violated by 6 commercial banks in 2013, while in 2015 it was violated already by 14 credit organizations. In addition, at the end of the analyzed period, the norm of the maximum amount of loans, bank guarantees and sureties given by a credit organization (banking group) to its members (shareholders) was determined by 306 credit organizations, the norm was violated by 6 credit organizations. The total number of violations of credit risk norms was 144 in 2013 against 84 violations in 2015. Thus, "... such a high threshold together with the above stated tendencies are a powerful stimulus to intensify the work" (Balynskaya and Koptyakova 2015).

Compliance with the norms regulating the maximum risk per borrower or group of related borrowers, the maximum dimension of large credit risks, the aggregate value of risk by commercial bank insiders are ensured by commercial banks by selecting credit projects, depending on the lending objectives, the actual loan repayment sources, the financial situation of the borrower, his credit history, the state of the economy sector and the region, all relations with the credit institution and related persons, the availability of sufficient security, the level of payment for the loan.

The level of liquidity risk of commercial banks registered and operating in the territory of the Russian Federation is characterized by norms of quick, current and long-term liquidity, the dynamics of which is reflected in Figure 4.

Figure 4. Liquidity of the banking sector of the Russian Federation in 2013-2015



Due to the faster growth of short-term liabilities with respect to highly liquid assets of credit organizations, the average value of the quick liquidity ratio in the banking sector decreased from 59.0% in 2013 to 58.3% in 2015, at the normative level of 15.0%. The annual average actual value of the current liquidity in the studied time period decreased from 81.9% in 2013 to 77.3% in 2015, which is also significantly higher than the minimum standard value amounting to 50.0%. The long-term liquidity ratio in 2015 increased from 83.5 to 91.2%, compared to 2013. At an average, in a year, the volume of long-term lending (granted for a term of over 1 year) in 2015 increased by 27.2% compared to 2013; the average value of the banking sector liabilities with a maturity of over 1 year increased by 21.6%, and the rate of increase of the average value of own funds (capital) was 14.0%. The current dynamics allows credit institutions to maintain a quite balanced structure of long-term assets and liabilities, and taking into account the maximum value of long-term liquidity indicator of 120.0%, credit institutions have an opportunity to increase a long-term credit to the economy.

We should note that in 2015, there were several isolated cases of non-compliance by individual credit organizations with required liquidity ratios. Of the total number of credit institutions operating in 2015, the quick liquidity ratio was violated by 10 of them, current liquidity ratio was not maintained by 14 credit organizations, the long-term liquidity ratio was not maintained by 7 credit institutions.

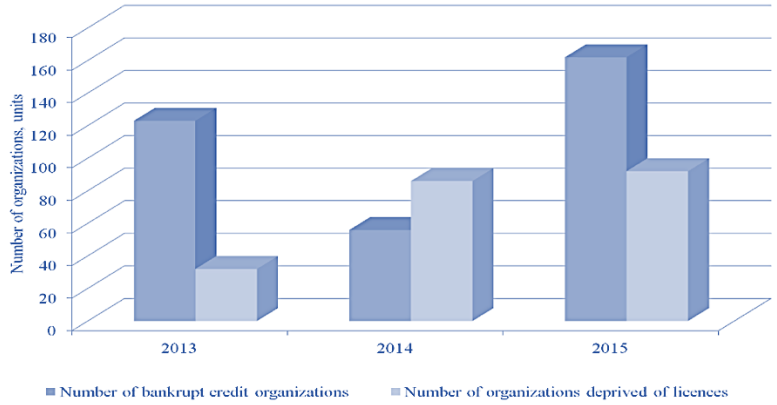
Correspondence of indicators of quick, current and long-term liquidities to the established norms is ensured by liquidity risk management by banks through the following: assessment and analysis of payment position; establishment and monitoring of structural limits; analysis of the actual values and the dynamics of liquidity ratios (both external, set by the Central Bank of Russian Federation, and internal, determined by commercial bank) and dimensions of the risks born by commercial banks when attracting and investing funds; analysis of maturity gaps concerning claims and liabilities of banks.

The above analyzed values suggest that for the years 2013-2015, commercial banks registered and operating in the country, followed the mandatory economic standards, and were able to work in the real current economic conditions within the acceptable risk zone, observing the requirements of banking supervision and regulation bodies. Moreover, national commercial banks are entitled to count in case of need on financial support from the Central Bank of Russian Federation, which will help them to overcome financial difficulties and be competitive monetary institutions in the country.

And at last, it is interesting to consider the practical implementation of such a technique of regulation of banking activities through banking supervision as the regulation of the commercial bank bankruptcy.

During the analyzed period, the Central Bank of the Russian Federation in conjunction with the “Deposit Insurance Agency” state corporation carried out work in the field of prevention of insolvency (bankruptcy) of credit organizations within the framework of the Federal Law of 25.02.1999 N 40-FZ “On Insolvency (bankruptcy) of credit organizations”. The number of credit organizations recognized as insolvent (bankrupt) for the period under review increased by 31.7%, while the rate of increase in the number of credit institutions deprived of licenses for 2013-2015 amounted to 187.5%, which is shown in Figure 5.

Figure 5. Dynamics of the number of credit organizations recognized as insolvent and credit institutions deprived of licenses in 2013-2015



The grounds for the revocation of banking licenses during the analyzed period were, as a rule, the following: the failure to comply with the federal laws regulating banking activities and the regulations of the Central Bank of Russian Federation, upon repeated taking of measures provided for by the Federal Law of 10.07.2002 N 86-FZ "On the Central bank of Russian Federation (Bank of Russia)" in relation to a credit organization within one year, discovering essential unreliability of the reported data; decrease of the size of own funds (capital) of a credit institution below the minimum authorized capital value established at the date of its state registration; capital adequacy ratio below 2.0%; inability to satisfy the claims of creditors on monetary obligations within 14 days from the due date. Moreover, within the analyzed period, the Central Bank of the Russian Federation revoked licenses of credit institutions due to the adoption by their members (shareholders) of a decision on voluntary liquidation.

Thus, during the analyzed period, there was a continued implementation of measures to freeing the national market-type banking system from the financially unstable credit institutions unable to ensure the safety of depositors' funds, as well as from those conducting dubious operations.

Conclusions

Summary of results of the study provides an opportunity to point out the following.

Firstly, in modern conditions, the Central Bank of the Russian Federation is a subject regulating the banking activities through banking supervision in the fields of maintaining the financial stability of the banking system, provision conditions for an effective regulation of banking activity by regulating the major aspects of banking activities and protecting the interests of creditors and depositors.

Secondly, the Central Bank of the Russian Federation has significantly expanded a set of banking supervision tools, giving priority, first of all, to economic tools of state regulation. At the moment, taking into account the current situation in the economy, the Central Bank of the Russian Federation introduces into practice the tools of state regulation as per international recommendations, for example, already in 2014 it has started applying new approaches to assess capital adequacy of commercial banks: Basel III.

Thirdly, the analysis of the efficiency of the use of modern system of techniques and tools of commercial bank regulation by the Central Bank of Russia across the country has revealed the ability of the vast majority of banks to adequately respond to new regulatory standards even in less favorable external environment of the banking business.

The results of the study can be used in the work of regulatory authorities, in particular, when choosing the priority directions of development of banking regulation, in determining the productive, non-standard techniques and tools to manage the crisis in banking activities.

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The Impact of Exchange Rate Movements and Wage Levels on Foreign Direct Investment from South Korea into Bangladesh: Cost-Oriented Versus Market-Oriented Industry

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Abstract:

This paper examines the impact of exchange rate movements on foreign direct investment (FDI) from South Korea into Bangladesh for two different industries: cost-oriented industry versus market-oriented industry. Using the unique Bangladesh FDI panel data over 1990-2015, we find that a depreciation in Bangladesh currency against Korean currency significantly increases FDI from Korea into the Bangladesh cost-oriented industry. In addition, lower wage level in Bangladesh against Korea promotes greater FDI from Korea into Bangladesh. Our results are consistent with the prediction of the conventional theory and show Bangladesh is an attractive market for Korean investors for its relatively lower production cost advantages.

Keywords: exchange rate movements; wage levels; FDI, South Korea; Bangladesh; cost-oriented industry

JEL Classification: F21; F31

Introduction

For Bangladesh, South Korea has been one of the major sources of FDI. Bangladesh has started attracting Korean FDI, it being BDTK 20.1 million in 1990, which increased to BDTK 6084.2 million in 2015, *i.e*. more than a 300-fold increase. Further, of the nearly 60 countries providing FDI inflows in Bangladesh, South Korea ranks 3rd in 2015 (Bangladesh Bank). Yet, there is a dearth of empirical research focusing of impact of exchange rate movements on FDI inflows in Bangladesh from South Korea.

No empirical research has been undertaken in this area; this paper attempts to fill this gap by investigating the effects of changes in the exchange rate on FDI in market-oriented versus cost-oriented industry during the period 1990-2015. Following the methodology of Chen, Rau, and Lin (2006), our panel data analyses show that depreciation in Bangladesh currency against Korea and increase FDI from Korea for the cost-oriented industry. Also, relatively higher wage level in Korea against Bangladesh plays a significant role in boosting outward FDI from Korea to Bangladesh for the cost-oriented industry.

1. Literature review

There have been only few studies that empirically examined the impacts of exchange rate volatility on FDI compared with the studies analysing the effects of exchange rate and other variables. Although the effects of the exchange rate on FDI are generally robust in that the appreciation of host currency promotes FDI outflow to home country, the impacts of exchange rate volatility on FDI have been shown to be ambiguous.

Markusen (1995) argued that firms will engage in FDI to avoid the costs of international trade which include currency risk as exchange rate becomes more volatile, more firms will choose to serve foreign markets through export substitution FDI. Numerous empirical studies have supported this view. Cushman (1988) and Stokman and

Vlar (1996) founded a significantly positive relationship between exchange rate volatility and FDI flows into and out of the US and the Netherlands. De Menil (1999) examined the issue across the EU and founded that a sustained 10% increase in exchange rate volatility (as measured by the standard deviation of real exchange rate) will eventually increase the level of FDI by 15%. Pain and Van Welsum (2003) documented evidence supporting this result for industrialized countries. They founded a positive effect for inflows of FDI into the UK, Germany, Canada, the USA, Italy and France.

Unlike the studies reviewed above, the negative impact of exchange rate volatility on FDI was confirmed by Benassy-Quere, Fontagne and Lahreche-Revil (2001) and Urata and Kawai (2000). Benassy-Quere, Fontagne and Lahreche- Revil (2001) investigated the impacts of exchange rate volatility, which was measured by the coefficient of variation of quarterly nominal exchange rate over the past three years, on FDI from developed to developing countries for the 1984–96 periods by using annual data. They found that high exchange rate volatility discouraged FDI while the depreciation of local currency promoted FDI from developed countries. Urata and Kawai (2000) included exchange rates and their volatility, which was measured by the coefficient of variation of exchange rate over a five-year period, in their study of Japanese firms' decision on the location of their FDI. By analysing a firm-level panel data covering 1980–94 for 117 countries from four manufacturing industries in Japan, they found that high exchange rate volatility discouraged FDI while the depreciation of host country currency increased Japanese FDI to the depreciating country. Lee and Min (2011) provide supportive evidence using a Korean dataset for both the volatility and the level of exchange rates that the change in FDI in response to exchange rate volatility is robust, persistent, and nonlinearity while that response to the level of exchange rates is quite mixed in Korea.

Studies on the impact of expected exchange rate level are limited since expected exchange rates are not observable. Campa (1993) suggested that there may be a trade-off between the impact of the level and the volatility of the exchange rate. In his model, investors concerned about expected future profits are shown to be more likely to invest in a host market with an appreciating currency. This is because high exchange rate and the expectation of further increases raise the expected profits to be earned from locating (and selling) in the host market. Takagi and Shi (2011), based on his review of survey data studies, concluded that depreciation tends to be followed by expectations of further depreciation in the short run but by expectations of moderate reversal (or appreciation) in the long run, and that the tendency for mean reversion increases during periods of sharp volatility. Chakrabarti and Scholnick (2002) documented that FDI data to find indirect evidence on the formation of exchange rate expectations by foreign direct investors. Using panel data techniques on exchange rate movements and FDI flows from the USA to 20 OECD countries they find that skewness of devaluations has a robust positive impact on FDI flows.

2. Data description and methodology

Before undertaking a statistical analysis of the impacts of exchange rate movements on South Korean's FDI in Bangladesh, this section briefly examines the patterns of South Korean's FDI from 1990 to 2015. The FDI data employed in this paper are taken from Bangladesh Investment Development Authority (BIDA), Prime Minister's Office, Government of the People's Republic of Bangladesh. These data are quite unique since it has not been ever used in previous researches.

Table 1 presents FDI by industry that is classified by BIDA in 8 industries. An examination of the sectoral patterns of South Korean FDI in Table 1 shows that the share of manufacturing is major part of FDI, while the share of non-manufacturing is small part of FDI. Among manufacturing subsectors, textile and engineering had large shares throughout the period. The level of the nominal exchange rate, *Rt,* is the average bilateral real exchange rate, expressed in units of TK per Korean Won. It is calculated with a nominal exchange rate of BDTK to US$, and that of Korean Won to US$. GDP and exchange rate data are compiled from Bangladesh Bank, central bank of Bangladesh. The nominal relative wage index, $Wage_{i,t}$, defined as the ratio of the nominal annual average wage index of Bangladesh over the nominal annual average wage index of south Korea, The nominal relative wage index is collected from Bangladesh Economic Review-2014, finance division, ministry of finance of Bangladesh and Bangladesh Bank. The nominal annual average wage index of South Korea is compiled from OECD. Following Tsay (2002, 229), we first use a modified average and a modified standard deviation of the monthly change in the logarithm of the nominal exchange rate to stand for the trend and volatility of the nominal exchange rates. We then

use a GARCH process to estimate the conditional mean and variance of the nominal exchange rate as the other measures of its trend and volatility, since some studies such as Pozo (1992) note that exchange rates often exhibit persistent behaviour. We compute the basic statistics and the correlations of the variables used in the analysis, which are summarised in Tables 2 and 3.

We employ the methodological concepts from Chen, Rau and Lin (2006) to construct following quantitative variables. The cost-oriented industry dummy, $cost_i$, is defined as follows: If the reverse imports of an industry from Bangladesh in its total revenue sales and export to another country most of sales revenue. Some of firms which produce the product for export oriented firms as raw materials are nontradeable for local consumers, then the industry are referred to as cost-oriented and the value of $Cost_i$ is 1. Otherwise, the value of $Cost_i$ is 0. Cost-oriented industries in our sample include agro based, textile, engineering, Printing Publishing and Packaging, Tannery and Rubber products. The market-oriented industry dummy, $Market_i$, is defined as follows: If the firms' sales their product in Bangladesh and most of the product sale in local market. Some of the firms produce their product for local firms as raw materials are tradeable for local consumers, then the industry is referred to as market-oriented and the value of $Market_i$ is 1. Otherwise, the value of $Market_i$ is 0. Market-oriented industries in our sample include Chemicals product and services. The sunk investment costs dummy ($Sunk_i$) value is 1 for an industry that is with high R&D departments and with high marketing departments in Bangladesh during 1990–2015. Otherwise, the value of $Sunk_i$ is 0. According to these criteria, the industries with high sunk investment costs in our sample include agro based, chemicals, and services.

Table 1. Trend of South Korean's Foreign Direct Investment in Bangladesh

BDTK in Million	1990-1992	1993-1995	1996-1998	1999-2001	2002-2004	2005-2007	2008-2010	2011-2013	2014-2015
All Industries	99.021	987.192	1703.554	557.481	5166.917	4922.374	5231.181	14028.4	14733.07
Manufacturing Total	84.028	987.192	1684.554	524.117	5020.017	3073.783	2223.778	8813.6	8915.87
Agro Based	11.996	0	0	0	608.354	74.690	13.130	770.4	513.48
Chemicals product	0	592	61.900	19.840	161.25	156.350	585.724	895.3	392.99
Engineering	0	0	6.600	278.225	21.000	584.257	731.316	1590.5	1405.0
Textile	64.178	288.600	1507.054	226.052	4146.234	2090.806	810.126	5197.2	5844.7
Printing Publishing & Packaging	0	0	84	0	83.179	18.500	83.482	290	70.3
Tannery and Rubber products	7.854	106.592	25	0	0	149.180	0	70.2	689.4
Non-Manufacturing Total	0	0	19	33.364	64.600	1834.091	3007.403	5091.6	5719.3
Services	0	0	19	33.364	64.600	1834.091	3007.403	5091.6	5719.3
Miscellaneous	14.993	0	0	0	82.300	14.500	0	123.2	97.9

Table 2. Summary statistics

	Mean	Standard Deviation	Minimum	Maximum
FDI_{cost}/GDP	190.12	219.4	2.9	892.4
FDI_{MKT}/GDP	123.15	180.37	0	534.82
Ex-Rate	0.056	0.0114	0.0337	0.0734
$Trend_{Tsay}$	0.0075	0.066	-0.21	0.12
$Trend_{GARCH}$	-0.0021	0.0041	-0.0125	0.015
$Volatility_{Tsay}$	0.037	0.032	0.003	0.156
$Volatility_{GARCH}$	0.014	0.0102	0.0056	0.058
Wage Rate Ratio	0.00875	0.0017	0.0069	0.013

Note: GDP is for the host country, Bangladesh

Table 3. Correlation matrix

	FDI_{MKT}/GDP	FDIcost/GDP	Exchange Rate	$Trend_{GARCH}$	$Trend_{Tsay}$	$Volatility_{GARCH}$	$Volatility_{Tsay}$	Wage Rate Ratio
FDI_{MKT}/GDP	1							
FDIcost/GDP	0.657347	1						
ExchangeRate	0.654578	0.603244	1					
$Trend_{GARCH}$	-0.04876	-0.06801	-0.22538	1				
$Trend_{Tsay}$	0.074263	-0.0568	-0.11916	0.635976	1			
$Volatility_{GARCH}$	-0.06215	-0.22027	-0.32053	0.699684	0.364108	1		
$Volatility_{Tsay}$	-0.09456	-0.15369	-0.23436	-0.12479	-0.3954	0.537044	1	
Wage Rate Ratio	0.778833	0.564769	0.468616	0.101677	0.082544	-0.03444	-0.20389	1

Therefore, the empirical model based also on Chen, Rau, Lin (2006) for our analyses is established as follows:

$$\frac{FDI_{it}}{GDP} = \alpha_i + \beta_1 EX_{t-1} + \beta_2 Trend_t + \beta_3 Volatility_t + \beta_4 Wage_{it-1} + \beta_5 Sunk_i Volatility_t + \beta_6 Market_i EX_{t-1} + \beta_7 Cost_i EX_{t-1} + \beta_8 Market_i Volatility_t + \beta_9 Cost_i Volatility_t + \beta_{10} Time_t + \varepsilon_{it} \quad (1)$$

Where subscript *i* refers to industries, subscript *t* refers to time periods. *EX* is the exchange rate, *Time* is simply the time trend to control for other time-related variables, and other variables are the same as explained above. The signs of the parameters, β s, for crucial variables in the empirical model are as the followings:

Table 4. Expected Sign of the Variables

Industry Type	Exchange Rate (*EX*)	Exchange Rate Trend (*Trend*)	Exchange Rate Volatility (*Volatility*)	Sunk Cost (*Sunk*)	Host Country Relative Wage(*Wage*)
Market-oriented	+	+	-	-	-
Cost-oriented	-	-	-	-	-

3. Estimation results

Table 4 reports the results from the panel estimation of our empirical model. Four regression equations are estimated. In the first two equations in column 1 and 2, Tsay's measures of the trend and volatility of real exchange rates are used for fixed effects and random effects, respectively, while the measure estimated from a GARCH model are adopted in other equations reported in column 3 and 4 for each effects model.

For all the estimation equations, Hausman test is undertaken and provides results that random effects model is statistically accepted. Nevertheless, we report provide all the results since the estimated parameters are robust across the models. The results show that three parameters, $\beta_4, \beta_7, \beta_{10}$, are significantly estimated. The negative sign of β_4 means that FDI from Korea into Bangladesh increases as Bangladesh relative wage to Korean wage is lower. The positive sign of β_7 means that FDI into Bangladesh increases as exchange rate is higher when the industry is cost-oriented. This finding implies that depreciated Bangladesh currency (=appreciated Korean currency) encourages more FDI from Korea into Bangladesh cost-oriented industry. Finally, the positive sign of β_{10} means that FDI from Korea into Bangladesh continuously increases as time passes.

These empirical results are consistent with theoretical prediction. First, lower wage level in host country attracts FDI from advanced countries with higher wage levels. Second, advanced countries increase FDI as the domestic currency of those countries appreciated since their purchasing power parity is relatively greater in the host country.

Table 5. Regression results

Parameters	Tsay (2002)		GARCH(1,1)	
	Random Effects by Generalized Least Squares (GLS)	Fixed Effects by GLS	Random Effect by GLS	Fixed Effects
α	-1774.06*** (552.12)	-1774.16*** (504.54)	-243.99** (96.29)	-243.99** (87.63)
β_1	5534.59 (9017.22)	-734.16 (1407.55)	313.06 (1572.49)	2728.29* (1404.10)
β_2	-292.89 (1385.86)	-295.33 (1356.77)	-94.32 (241.67)	-182.63 (244.47)
β_3	-98.23 (2828.35)	716.90 (2861.28)	-48.54 (493.22)	114.59 (496.97)
β_4	-142282.7*** (45037.7)	-142282.7*** (44731.4)	-21026.01*** (7853.63)	-21026.01*** (7769.32)
β_5	-315.65 (3584.02)	-1945.92 (3722.04)	-85.63 (624.99)	-411.90 (646.48)
β_6	6513.82 (6409.92)	6422.28 (5691.37)	1213.04 (1118.08)	1277.35 (1280.25)
β_7	4234.35 (5329.02)	-18527.97* (10234.01)	-17757.99* (9987.54)	-3617.43** (1777.53)
β_8	836.11 (1776.95)	1718.63 (1860.45)	174.44 (309.87)	351.06 (323.13)
β_9	3889.45 (9812.33)	3792.58 (9331.29)	3699.96 (9103.26)	3750.03 (8903.71)
β_{10}	35.09*** (12.82)	35.09** (12.72)	6.21*** (2.23)	6.21*** (2.21)

Parameters	Tsay (2002)		GARCH(1,1)	
	Random Effects by Generalized Least Squares (GLS)	Fixed Effects by GLS	Random Effect by GLS	Fixed Effects
R^2	0.460	0.469	0.408	0.420
Obs.	208	208	208	208

Note: Numbers in parentheses are standard errors. Asterisks mean significance level (*: 90% significance level, **: 95% significance level; ***: 99% significance level)

Concluding remark

This paper investigates the impact of exchange rate movements on FDI from Korea into Bangladesh with consideration of industry type: market-oriented versus cost-oriented. Using the unique dataset from Bangladesh Investment Development Authority (BIDA), Prime Minister's Office, Government of the People's Republic of Bangladesh, we find that appreciation in Korean currency against Bangladesh currency promotes greater FDI from Korea into Bangladesh especially for the cost-oriented industry. In addition, lower wage level in Bangladesh is important to determine more FDI from Korea into Bangladesh. These findings provide meaningful implications that Bangladesh is an attractive market for Korea in that it gives production cost advantages to Korean investors.

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Improvement of Russian Pension Fund Scheme: Financial Priorities in Using Population's Incomes and Savings

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Abstract:

At the present stage of socioeconomic development of Russia, the problems of citizens' pension security become more and more critical. In modern conditions there is no possibility to allow any social dependency, so, the new financial relationships contributing to integrate State and population's financial resources constitute a special science attraction. The primary aim of our study was to assess the real potential of the pension fund of Russia and analyze the expectations and behavior of Russians regarding their expenditures and savings. A special attention was paid to assessing the dynamics of population's income and attitude to the main financial institutions. The obtained results can be used to develop the tools which would help to increase citizens' activity in the sphere of co-financing of their retirement benefits. The final image of the forthcoming pension reform should be formed following a sufficient raise of the financial literacy of citizens and development of an effective informational-analytic mechanism able to guide the participants of pension co-financing system.

Keywords: pension system; sufficiency of pensions; population's savings; financial institutions; financial services for the citizens.

JEL Classification: G23; D91

Introduction

In recent times the fierce discussion about raising the retirement age has a well-defined tendency to increase, as the arguments in favor of social justice as well as economic possibilities and expediency seem quite convincing. Of

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course, Russian authorities recognize that one of the central socio-economic problems is the formation of prospects for pension system development (Medvedev 2016).

Nowadays a lot of attention is paid to this problem. Commonly, researchers consider general approaches (Galimova 2015), analyze the actual practical contradictions (Lyumarskaya 2014, Silchuk 2016); make special proposals to improve the national pension system (Mironova 2011) and even suggest quite innovative approaches (Borisov 2014).

In our opinion, the modern pension system, as well as some other elements of the Russian social security system has several serious problems, one of them is that the pension security system is no longer the system of protection against social risks (an inability to continue labor activity on reaching the age higher than the working age) but an institution generating social dependency, the pension being considered by the society as a kind of reward for working during the active period of life. Moseyko and Frolova (2014) have studied this problem from the position of its interconnection with development of a welfare state. Siebert (2005) has been observing it partly in the flow of cause-and-effect relations and purposes, after that it has got a figurative name of a “cobra effect”. And, moreover, Blyahman (2012, 2013) introduced it as the subject of a new economic science.

1. Methods

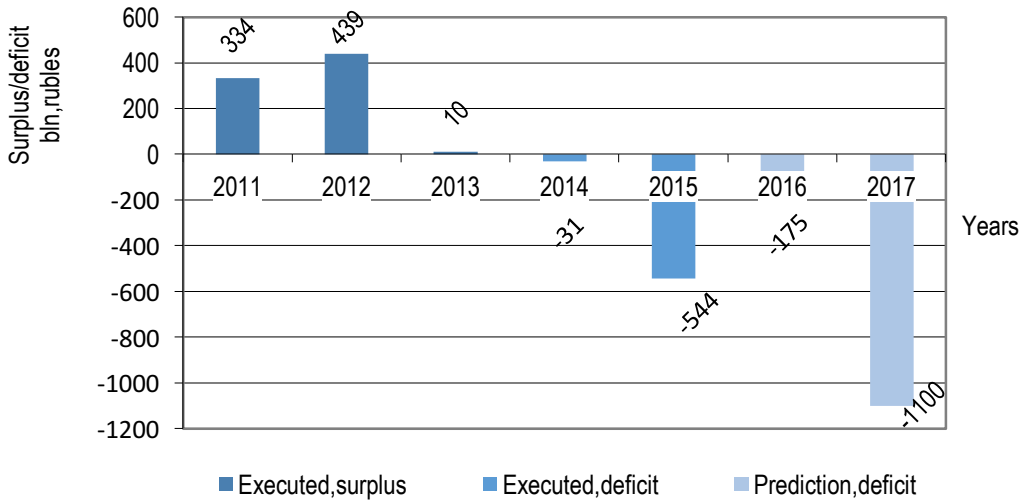
The methodology was built on the systematic approach, complemented with theoretical and empirical generalizations, statistical method, calculation method, functional and structured analysis, expert method, graphical visualization method. With the help of economic, statistical and analytical methods the analysis of modern key problems of the pension system from the point of view of citizens’ attitude to its results and possibility to take part in its development was conducted.

2. Results

2.1 Analysis of the Pension Fund of Russia activities

In the conditions of deepening deficit of the pension system the problem of pension for citizens having reached the retirement age, is becoming more and more topical Thus, if in 2013 the budget of the Russian Pension Fund had been still executed with surplus (Figure 1), in 2014 the budget deficit of 31 bln. rubles would have appeared. Although the size of deficit was not very large with regard to the joint volume of Fund expenses in 2014 – only 0.5% - however, in 2015 it increased significantly – up to 544 bln. rubles, or 7.1%. At the same time, analysts predict the further grow of load on the budget fund and the increase of its deficiency.

Figure 1. Surplus/deficit of the Pension Fund of Russia, billion rubles (the diagram is built up by the author on the base of data: Fill-in about budget executions of state off-budget)



The existing situation was the first step to the aggravation of the discussions about functioning and reformation of the national pension system. The key problems, noted by experts and scientists as Petrushina (2015), Kookueva (2015), Prohorenko and Russkih (2016), Dadayan (2016), *etc*., include the deeply increased volume of pension obligations at the expense of their accelerated indexation in recent years; the low level and of salaries and the low rate of their growth; the surpassing ratio of persons of the pensionable age to the working-age population; the increase of life expectancy; a large amount of the people getting early pensions. These problems in all their complexity endanger pensions for Russian citizens within the existing distribution system.

Table 1. Population expectations in 2016 concerning sources of income by reaching on retirement age, in % out of total amount of the respondents*

Any state pension	78
Own earnings	49
Own savings	39
Help of children and relatives	24
Salary of spouse	18
Foodstuffs produced themselves at personal part-time farms	14
Renting out property	12
Pension from a Non-state Pension Fund	11
Heritage	8
Extra pension from an enterprise, an employer	5
Income from selling property	4
Something else	1
Haven't thought about it	8

Sourse: * The table is built up by the author on the base of data: Who must provide life of dignity during pension?

Meanwhile, most of population still put hopes on the state pension system, despite the problems in its operation. The National Agency for Financial Investigations (NAFI) conducted a public opinion poll in 2016 having showed (Table 1) that the overwhelming majority (78% of the respondents) of future pensioners relied on the support of the State. Nearly a half of them (49%) planned to continue working activity after retirement with the aim to get a salary as an extra income. Also, more than a third (39%) relied on savings. Least number of respondents (from 10% to 20%) relied on children and relatives; spouse salary; renting out property, a personal part-time farm; pension from a Non-State Pension Fund. The future pensioners rarely (4-8% of respondents) hope for heritage; extra pension from an employer; income from selling property.

Table 2. Evaluation of pension sufficiency at the retirement by population in 2016, in % of total amount of the respondents*

Yes, my pension would be sufficient	8
I hope my pension would be sufficient, but I am not sure	39
Most likely, I would not be able to make ends meet, if I didn't have another source of income	28
I, undoubtedly, would not be able to make ends meet, if I didn't have another source of income	15
Difficult to answer	10

Sourse: * the table is built up by the author on the base of data: Who must provide life of dignity during pension?

At that, only 8% of the respondents suppose that the level of their future pension would be sufficient to provide normal life activity (Table 2). The vast majority of respondents – more than a third (39%) - only hopes that the level of their pension would be sufficient, but still preserve uncertainty in it. A little less than a third (28%) of the respondents incline to the opinion than their future pension would not be sufficient as a livelihood, and 15% are certain in it.

Thus, it becomes clear that most of Russian citizens rely on the State when it comes to the provision of a sustainable livelihood in case of reaching retirement age. However, the overwhelming majority of citizens are not sure that the state pension would be enough to live on. Such citizens' attitude to the source of income upon attaining retirement age, along with the sharply raised deficit of the State distributive pension scheme, intensifies socio-

economic contradictions in the society. But, at the same time, the present situation could act as a catalyst to the creation of new income generation mechanisms for population of retirement age.

The government of the Russian Federation has been handling with this problem actively in recent years. Since 2015, the score system of pension charging has been introduced. It puts the size of future pension in a position of direct dependence on active working years and the amount of insurance premiums paid during working activities. Introduction of this system is aiming to a certain number of purposes. Two of them seem to be the most important. First is the economic stimulation of citizens for later retirement, as every year of working after reaching the retirement age provides accelerated pension points. The second one is to increase the level of work legalization, as only officially recognized employment length is taken into account for pension purposes (Guryeva 2016, Ignatyeva 2016). Active discussions are under way on the issue of possible raise of the retirement age, which is 55 for women and 60 for men nowadays. At that, the authorities consider different options including gradual raise of retirement age up to 63 years for both men and women, or up to 65 for men and 60 for women (Bartsits 2015, Solovyov 2015). Moreover, different variants of reformation of early retirement pensions, including the abolishment of some of them and the development of the private co-financement, are discussed, as well as the possibile cancellation of the cumulative component of pension, which actually resulted in suspended insurance contributions transfers to the non-state pension funds (NPF). The first decision about freeze of transfers in 2014 was made in the end of 2013 (Solovyov 2015, Kudlayeva 2016).

All the actions taken were aimed to decrease the deficit of the Russian State Pension fund by reduction of the post-retirement benefits with the slowdown of their indexation (connecting with inflation rate) The increase of the rate of working people paying insurance premiums to the pension distribution system will also contribute to the decrease of this deficit. Many experts believe that the responsibility for formation of pension provision will increasingly shift on future pensioners (Yarullin and Musabirova 2016, Ageeva 2015, Asekova 2016). In other words, everybody will have to care personally about his/her future pension, as the state distribution system will be able to provide only with its minimal insurance level.

Table 3. Amount of income, being saved by population for the future, 2016, in % out of total amount of the respondents*

I don' t save for the future, though there is such opportunity	8
I don' t save for the future, as there is no such opportunity	52
No more than 10%	19
From 10% to 20%	9
More than 20%	5
Difficult to answer	7

Source: * the table is made by the author on the base of data: Russians about long-term investments

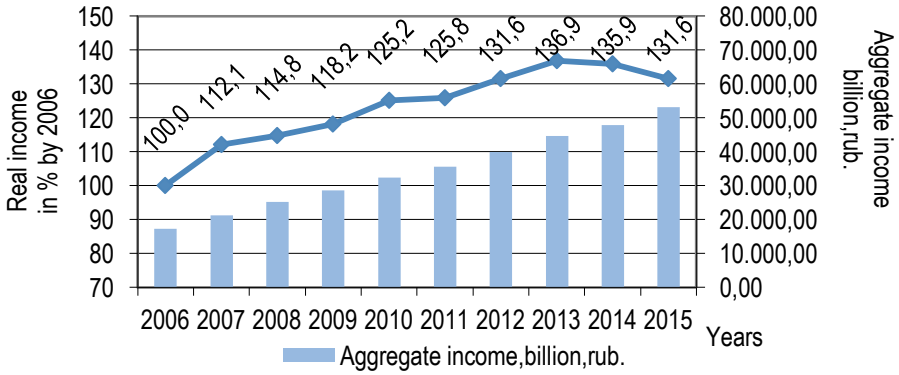
Only a third (33%) of the Russians try independently to supply their future financially (Table 3). At that, every fifth (19% out of total amount of the respondents) saves monthly no more than 10% of the income. Every tenth (9%) saves 10-20% of the income. And only every twentieth (5%) saves more than 20%. At the same time, every tenth (8%) has noticed that he/she doesn't save for the future, though there is such opportunity. Every second (52%) has noted that he doesn't save for the future, as there is no such opportunity.

As a result, advancing the idea of personal responsibility for pension size in practice faces a deep-rooted paternalistic mentality in consciousness of citizens. (Blinova 2015). But the potential of its realization still remains, since the positive dynamics of the real population's income encourages it mostly (Figure 2). Thus, during the last decade (in the period from 2006 to 2015) the aggregate volume of the annual population's income increased from 17,3 to 53,1 trillion rubles, mainly in market prices. In real expression, population's disposable income increased by a third (31.6%) during these years. So, taking into account the corrections for the inflation rate during the investigating period of time, the real population's disposable income has increased by 3.1% a year in average. At that, in the period till 2013 the dynamics was higher, as in 2014 population's income reduced a little against the background of the devaluation of national current and the slowdown of the rates of economic growth. However, on the whole the tendency still preserves its positive character that let us observe population's income as the basis for the development of personal responsibility for retirement income.

2.2. Analysis of the structure of population's expenditures

Let us analyze the structure of using personal incomes (Figure 3). Earlier this issue was reviewed by Tatuev and Bahtuzarova (2013). That study showed that Russians spent the largest share of their income on purchasing goods and services (71.2% in 2015). 11.3% of money went to the obligatory payments and different contributions. The remained part of income was spent on increasing assets (currency, cash and savings, including estate property).

Figure 2. Dynamics of the real disposable income of population in prices of the basic period (in % by 2006) and dynamics of the aggregate income of population in basic market prices (billion rubles)

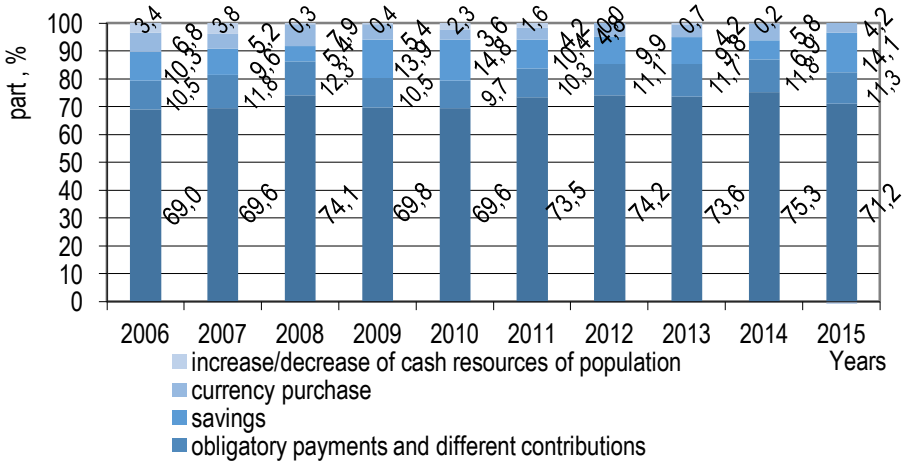


Note: This diagram was calculated and built up by the author on the base of data: Standard of life: incomes, expenses and savings of the population.

14.1% were used for savings, including the purchase of estate property. 4.2% were spent on of foreign currency purchase. Meanwhile, the amount of cash kept in Russian homes fell by 0.8% of the total amount of income during the period under review.

Analysis of the structure of using personal incomes in Russians shows that 15-20% of total income were directed at increasing earning asserts. During the crisis years (2008 and 2014) the devaluation of national currency and the slowdown of the economic growth rates resulted in a drastic reduction of the part of income directed at savings, but at the same time the purchase of currency, goods and services increased.

Figure 3. The structure of money income usage by population, in % out of total volume of money income)



Note: This diagram was calculated and built up by the author on the base of data: Standard of life: incomes, expenses and savings of the population

After the crisis years the situation changed to the opposite: the share of savings rapidly increased, while the share of incomes used for consumption (purchase of goods and services) and currency purchase decreased.

In general, the persistence of high proportion of population's income used for asserts growth, allowed to accumulate considerable funds of money savings. On 1st of January 2016 the total amount of population's savings (balances, reminders of cash and securities without taking into account deposits on the currency accounts and cash foreign currency) reached 23.9 trillion rubles. Meanwhile, most of these savings were made in the form of balances in commercial banks – 68.3% (16.3 trillion rubles), 17.0% (4.1 trillion rubles) were saved in cash, and 14.7% (3.5 trillion rubles) were capitalized in securities.

Table 4. Population's trust to key finance institutions in 2012-2015, in % out of total amount of the respondents *

	2012	2013	2014	2015
Level of confidence in banks	64	78	74	61
Level of confidence in insurance companies	35	41	38	36
Level of confidence in non-governmental pension funds	19	19	19	22
Level of confidence in investment companies	17	19	19	17
Level of confidence in microfinance institutions	14	13	11	9

Source: * The table is made by the author on the base of data: Banks are leaders of trust among finance institutions

The bias in favor of commercial banks is the result of the low level of population's trust to the key finance institutions, except bank sphere (Table 4). As the NAFI opinion poll shows, good reputation of certain entities, absence of risks to lose money, and fair attitude to the client are at the heart of trust to financial institutions. Some external factors are also of great importance, for example, regulator's activities, information background, etc. That is why nearly two thirds (61%) of the Russians trust banks (15% - completely and 52% more likely to trust). This indicator is consistently high during the recent years. The level of trust to the credit organizations in 2013 - 2014 was even higher. The level of trust to other financial institutions is much lower. Thus, only a third (36%) of the respondents trusts insurance companies. And only every 9 to 22% of respondents trust such institutions as non-state pension funds, investment companies and micro-financial organizations.

Table 5. Main financial institutions used by population for savings and investments in 2016, in % out of total amount of respondents *

Bank deposit	19
Pension fund	9
Estate property	8
Life insurance	3
Securities	2
Don't use any	63
Something else	2
Difficult to answer	5

Source: * the table is made by the author on the base of data: Russians about long-term investments

As a result, every fifth (19%) respondent notes that he/she uses a bank deposit for savings and investments (Table 5). Only every tenth invests savings in a pension fund or purchases estate property (9% and 8%, respectively). And just 2-3% of the respondents' mention life insurance, securities purchase or some other ways to save money. At that, nearly two thirds (63%) of the respondents say that they don't use any financial institution for savings.

Table 6. Key criteria of population's choice of instrument for saving in 2016, in % out of total amount of the respondents *

Profitability of contributions must be higher than the inflation rate	58
Safety and guarantee of investments in the future	43
Possibility to take money back when it's necessary	31
Possibility for inheriting savings by a spouse or close relatives	12
Something else	2

Source: * the table is made by the author on the base of data: Russians about long-term investments

Making choice of saving instruments, nearly two-thirds (58%) of the respondents were guided by profitability of savings which should surpass the inflation rate (Table 6). A little less than a half (43%) of the interviewed chose safety of investments in the future as a priority-driven factor. For a third (31%) the possibility to take savings back at any moment was crucial.

So it becomes clear, that in practice only every third citizen saves money, but most of Russian citizens are interested in the level of profitability and guaranteed safety of savings. As a result, most volume of savings is formed within the boundaries of bank sphere, which is nowadays the real alternative to the state distribution system in the matter of retirement income.

2.3. Evaluation of financial knowledge and behavior in foreign countries

It should be noted that the main reason for the mistrust of different financial institutions is the low level of financial literacy of Russians. In particular, the study of financial knowledge and behavior conducted in 30 countries by the Organization for Economic Cooperation and Development (OECD) in 2014-2015, proved this point (Table 7).

Table 7. Evaluation of financial knowledge and behavior in, conducted in 30 countries by the Organization for Economic Cooperation and Development (OECD) in 2014-2015, average indices in scores

No.	Countries	General evaluation	Evaluation of knowledge	Evaluation of behavior	Evaluation of purposes
1	France	14,9	4,9	6,7	3,2
2	Finland	14,8	5,2	6,3	3,3
3	Norway	14,6	5,2	5,8	3,6
4	Canada	14,6	4,9	6,2	3,5
5	Hong Kong, China	14,4	5,8	6,0	2,7
6	New Zealand	14,4	5,0	5,7	3,7
7	Korea	14,4	5,4	5,7	3,2
8	Belgium	14,3	4,9	6,2	3,2
9	Austria	14,2	4,9	6,0	3,3
10	Portugal	14,0	4,8	5,9	3,4
…	…	…	…	…	…
23	Georgia	12,4	4,6	5,0	2,8
24	Malaysia	12,3	3,6	5,7	3,0
25	Russia	12,2	4,1	5,1	2,9
26	Brazil	12,1	4,3	4,6	2,9
27	Croatia	12,0	4,3	4,8	3,0

Source: * the table is made by the author on the base of data: Russia takes 25th place by the level of financial literacy

Evaluation of the level of financial knowledge was being conducted on the base of a test, having financial arithmetic tasks and checking understanding of the key financial terms (inflation, financial risks, diversification, *etc*.). In average, 56% of the adults reached the minimal necessary level. Meanwhile, in countries of OECD there were

62% of the adults who reached it. Less than 50% of the respondents in the South Africa, Malaysia, the British Virgin Islands, Belarus, Thailand, Albania, Croatia, Jordanian, Great Britain and Brazil were able to prove their minimal financial literacy. In Russia there were only 45% of the respondents who demonstrated the minimal financial awareness. In China and Hong Kong there were 84%. Evaluation of financial behavior was being conducted on the base of four parameters: personal or family budget planning, ability for informed purchasing decisions, timely payment of bills and maintaining positive balance of payments. In average, 51% of the respondents reached the minimally necessary level. In Russia 44% of the respondents reached the minimally necessary level. Most of the respondents in France (85%) reached the minimal level. The lowest level of financial literacy is in Hungary (24%). Evaluation of financial attitudes was carried out on the basis three criteria: tendency to live today only; balance of expenses and savings; understanding of money function in private life. In average, 50% of the respondents reached the minimal level. In OECD countries 55% of the respondents demonstrated their financial awareness against 40% in Russia.

On the whole, according to the results of the investigation, the average financial literacy amounts to 13.2 points out of maximal 21. In the countries of OECD the average point is 13.7, 12.2 (25th place) in Russia, which is comparable to Eastern-European countries as Hungary, Belarus and Poland. However, 25th place doesn't mean a bad result, as the level of awareness was not very high in all investigated countries.

Table 8. Evaluation of financial services complexity by population in 2016, in % out of total amount of the respondents *

There are a lot of financial services difficult to understand for an ordinary person	33
There are some financial products which are difficult for understanding, but you can understand most of the services without assistance	38
Most financial services are quite clear	23
Difficult to answer	6

Source: * the table is made by the author on the base of data: Noval finances.

In the conditions of the low financial literacy most Russians find it difficult to understand the features of various modern financial instruments (Table 8). In particular, a third (33%) of the respondents think that it is difficult for an ordinary person to understand most of modern financial services. A little more than a third (38%) of the respondents adheres to the opinion that modern financial services are difficult to understand, but an ordinary person still can understand some of them. And only a fourth (23%) of the respondents understands most modern services. The higher level of education of a respondent and the younger he/she is, the better he/she understands modern financial services.

Table 9. Evaluation of difficulty of financial services proposed by individual financial institutions by population in 2016, in % out of total amount of the respondents *

Investment products	41
Credits	18
Microloans	10
Insurance	8
Deposits, savings	7
Bank cards	4
Difficult to answer	12

Source: * the table is made by the author on the base of data: Noval finances

41% of the interviewed suppose that investment services are most hard to understand. Credits come second: they are challengeable for a fifth (18%) of the respondents. Only every tenth can understand services of micro-financial and insurance organizations (10% and 8%, respectively). Bank cards and bank deposits are the least troublesome (7% and 4%, respectively).

3. Discussion of the results

The introduced characteristics permit to specify the way of solving the problem of creating new mechanisms for retirement income provision within the framework of increasing personal responsibility for his/her pension amount. This implies the development of motivation and ability of Russians to choose a viable financial instruments for saving money to ensure their pensions.

In short, an effective informational-analytical mechanism should be created to guide the activities of pension co-financing system. It will become an important precondition for the formation of the final image of the forthcoming pension reform aiming at raising financial literacy of population. Virtually, the potential possibilities to form citizens' individual pension assets portfolio due to the system of information-analytical services of professional participants of the financial market are, in fact, a starting premise for a new system of integrated pension provision.

Conclusion

Analytical and theoretical results of the conducted research showed that nowadays the State postemployment benefits obligations have sharply increased due to the accelerated indexation of pensions, low level of salaies, higher share of retired people, increased life expectancy and the increased number of early retirements. All these problems can endanger the population's retirement benefits within the existing distribution system. At the same time, Russian citizens do not accept the idea of personal responsibility for their own pensions.

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Premises for Business Activities: Economical Growth in an Uncertain World

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Abstract:

Interviews of 1409 corporate executive officers (CEO) made at the end of 2015 in 83 countries including Romania, managers of any company can become a theoretical support as inspirational material during the development of strategies and trade policies. A data analysis of these interviews, from a point of view, is made in our paper (2016 being a forecast year). The six appendixes accompanying our analysis give a touch of clarity and information to our paper.

Keywords: economic, growth, uncertain, company

JEL Classification: F43, O47.

Introduction

Business premises for activities can be created in an empirical or theoretical base. Studying the performance of activities of newly created companies with inexperienced managers, with potential economic theory is equivalent to develop recommendations destructive. For commercial strategies analysts, practitioners of the brown and most experienced companies in the world, based on economic theory, the study of critical update managerial methods shall develop policies and strategies of the organization, production and marketing. Managers' intentions in companies (hereinafter managers formally responsible fort the executive of corporation or company are rated in abbreviation CEO), for example the CEO in relation to some issues, activities are different.

It is important to know the intentions of these "deans" of companies on the economic situation globally and in Romania at different times of the years 2012-2016 and in the future periods in which conducted the survey 19 CEO, (The Staff of the Corporate Executive Board. 2010) in order to examine whether changes in terms of improvement or deterioration, growth prospects even if they were made in the event of threats own business, to the outlook for company growth (Appendix 4), (TI. 1-TI.8). Policies and business strategies of the company should be a kind of "rules" of economic behavior, productive, commercial – of the company in the different favorable and less favorable situation in which to find company. Such rules can be developed separately for each company. In this analytical product experience of successful companies can serve a theoretical scientific basis.

On the basis of scientific research survey data are released annually CEO, opinions of 1409 leading corporations from 83 countries (1409 people are interviewed, 82 are Romanians). Programming economic activities of the company by managers for periods lasting considers the environment in which the company will operate, *i.e*. trading possibilities, device resources, including a high level of professional work. All these factors matter in strategic decision-making processes, but the tax rate to be determined. A percentage of CEOs consider as CEO of the most important corporations in the world, believes that the level of taxation in countries where potential may conduct its activities, the level of taxation is the first serious factor. The prospects Directors General on fiscal strategy, 87% globally and 93% in Romania, believes that taxes are a cost to be managed effectively; fiscal and transparent approach in taxes affect corporate reputation (Annex 5). In this context, many countries interested in attracting foreign investments, it was "in line" tax system to the wishes of companies. The "conformity" of countries is limited. The state budget deficit and state debt reduce the possibilities of many states to attract companies from outside through tax reductions and as a result many companies are likely to change their business strategy under the impact of tax increases. Evolution factors, which generate major risks (globally 53% of children in Romania 67%), environmental impact (39% globally, 41% in Romania), *etc*. (Annex 2) can be predicted by the CEO. In these

cases, the potential losses of the company can be bypassed. CEO functions are included in bonds to minimize potential losses and risks in cases difficult to predict. Some firms are developing their strategies and trade policies, starting from risk analysis of the past, others in analyzing potential risks in the future. Both treatments are questionable. Developing strategies and trade policies should be made taking into account the set of all risks in the past, the future, the lack of consistency in the development policies of the governments of some countries. Governments and regulatory bodies and are the second most important category of stakeholders to ask you a decisive mark on company strategy (another category: customers, competitors, employees), (Annex 3). As regards the government's response to fiscal deficit and debt burden in view of the Growth of the economy and expressed an opinion, 71% globally and 78% in Romania (Annex 6). Of particular importance for the effective operation of the company, for successful strategies and trade policies, a company has staff trained in solving daily problems of the company.

Calling upon the employee is equivalent to remuneration a spiritual work is a way to quantify the “price” of the employee. In such drives, they have won both parties: the company, because “exploit” intellect employee and take advantage of some of its ideas; employee, for the active participation of its employee management processes is a form to express themselves, to emphasize personal priorities, intellectual priorities (Ungureanu and Matei 2007). According to research, the employees involved in company management issues work harder in the interests of the company and the likelihood that they will leave the company is reduced by 87% (Rădescu 2010). Staff shortages (availability of personnel with special empowerment in global 72%, in Romania 85%) with adequate skills the company needs is and will remain an eternal problem, because: companies develops economic activities relatively unique, without precedent in time and space. They are unique and forms of activities; may be unique production technologies (technological exchange rates globally 61% in Romania 85%). The staff, in turn, came from the outside, has a different training, a different experience. Only after a certain period of employment, the employee initiates, manages to show work. The company, which is looking for specialists may incur losses; the company that “grows” specialists - is gain. Directors CEO believes that reducing innovation activities is generated by the low number of professionals with adequate professional training. Indisputable is the fact that the state must strive for intellectual preparation of society through educational institutions, including through university academic. Of particular importance in the intellectual growth of the company has intellectual labor price. Some countries (India, China) creates prerequisites for the intellectual development of society, and ensures access to further studies in higher education, vocational; Singapore and Malaysia focus on inviting foreign specialists; United Kingdom creates tax favors for vocational education institutions, university.

Traditionally, companies established their strategies and trade policies, studying "past" under which determines its “trend”. Such an approach to management of company activities (Ștefănescu *et al.* 2009) can not be accepted under the conditions when the global economy, including the economies are performed systematically by armed conflict, political, social, scientific and technical progress when changes not only technology but also the consumer. In these conditions CEO became other specialists, other managers, performers. The external market volatility, suggests CEO limited to local markets, where potential risks to a greater extent predictable. CEO consequently changes company strategy and trade policy priority in the new strategy have no markets outside the country, but national. Some of CEO Directors predict its implementation of innovations in local (national), others prefer increase (volume) of the services; most are of the opinion that companies must “grow” innovation potential. 88% of CEOs of companies from Romania, says that in our century business success will mean more than getting a financial share, higher than the global rate. 89% implement changes regarding how to measure success. Innovation, major risks, non-financial indicators, business strategy, environmental impact are five areas where companies should do more to avoid the impact and value added of stakeholders (Annex 2).

In our century, the century of velocity, the business success means more than getting financial profit and companies are increasingly aware that both customers and how they assess public opinion in terms of its impact on society as a whole (Ștefănescu 2010)

These are two of the conclusions of the 19th annual survey of CEO for 2015/2016 and in the future. Currently, executives decisively influence the company's business strategy; implementing many changes to risk assessment, marketing management, and use of technologies is the main catalyst for interactions between companies and

stakeholders. A very important role which should not escape the attention of the managers of companies, it is the availability of talent and especially those employees who will become increasingly interested in working for social values firm that coincide with his.

Perception of general managers from Romania in 2016, and not Romania at least 2017, is to redefine business success in a changing world, located in the top threats to economic growth in an uncertain world. 72% of them believe that there are many growth opportunities for companies than three years ago. As for the changes and challenges: 90% say that business strategy is influenced decisively by customers (Annex 3); 35% think that they had always a organizational purpose which take into account the wider impact they have on society doings; another 22% have changed order company in the last three years according to the expectations of powdered concerned; 77% anticipated technology programs is a key global mega-trends that will significantly transform stakeholder expectations over the next five years; 55% will focus on identifying and developing future leaders as a matter of management talent; 94% implements changes in the way they define and manage the resources in response to ever-changing expectations of stakeholders; 83% believe that the management of customer relationships as one of the most effective technologies for increasing the involvement of stakeholders; 82% have a crisis response capacity in Romania and 74% globally.

The top threats to growth prospects: 85% availability of talent; 83% geopolitical instability (Annex 6). The process is one of the highest compared with other countries surveyed, significantly higher than was registered as globally (61%) and Central and Eastern Europe (61%) and Europe (51%). Most CEOs are preoccupied by the availability of talent and a crisis reaction capability as specific factors that may endanger business growth (Annex 4).

Geopolitical instability remains in first place among the factors of economic, practical, social and environmental issues that can threaten growth prospects, ranking second among the concerns and 3rd place occupied by exchange rate volatility, both risk factors were mentioned by 74 % globally and 83% in Romania (Annex 6). In terms of new ways of measuring success might say 88% expresses the view that in the XXI century, the success in business will mean more than getting financial profit: 83% believe that an educated workforce, qualified and flexible is one of the most important for society, and 73% mentions that one of the priorities collaboration of business with environment authorities; 67% believe that companies must do more for a better assessment of major risks; 60% think it is necessary to improve communication in the purpose and values of the company.

Economic growth in an uncertain world in 2016, the Directors General of Romania optimism about global economic circumstances is a slight increase compared to 2015. Thus, 40% believe that the global economic situation will improve in the next year, according to the survey, the percentage rising to 35% according to the survey by the end of 2015. On the other hand, 24% believe that the situation will deteriorate.

The answer of the companies' managers highlights uncertain prospects of economic conjuncture in 2017. About 47% forecast that the global economic situation remains unchanged. In Romania from this point of view there is a kind of "optimism", 33% forecast that the economic situation will not change. Then 27% of CEOs believe that in the next 12 months will be an improvement in the global economy (down from 2015 when 37% of the CEOs of the companies relied on this). In Romania, statistically speaking, things seem slightly better in this regard, 40% felt for economic improvement in this year 2016.

Table 1. Do you consider that the global economic situation in Romania: a) will improve?; b) remains unchanged?; c) will worsen over the next 12 months?

Year	Global					Romania				
	2012	2013	2014	2015	2016	2012	2013	2014	2015	2016
It will improve?	15	18	44	37	27	18	13	45	35	40
It remains unchanged?	34	52	49	44	49	43	47	47	38	33
It will be worse?	48	28	17	17	23	32	38	18	27	24

Source: Realised the author based on annual survey data CEO

From this table, for a more detailed study, we investigate what happened only in 2015, in 2016 both globally and in Romania. In the following, as an aside, we recall some notions which we operate. Then consider three-

dimensional vector space vectors x, y define the components x (a, b, c), y (A; B: C) has a real numbers. We define the length or time denoted by the vector x | .x | number given by:

$$|x| = \sqrt{a^2 + b^2 + c^2} \quad (1)$$

and the dot product of the vectors x, y as the number denoted by (x, y) given by relation:

$$(x, y) = aA+bB+cC \quad (2)$$

and finally cos t= $\frac{(x, y)}{|x|.|y|}$ (3)

where: t is the angle between the vectors *x* and *y*.

Table 2. Do you consider that the global economic situation for the period 2015-2016: a) will improve?; b) remains unchanged ?; c) will worsen next 12 months ?

Global	The share of CEO % on the global economic situation change		Evolutiom of the share %
Year	2015	2016	-
It will improve? %	37	27	-22,02
It will be the same? %	44	49	11,36
It will be worse? %	17	23	35,29

Sourse: Developed by the author based on data from the annual survey CEO

Appropriate share is:

P^1_{2015} =(37,44,17) from which it follows that $\left|P^1_{2015}\right| = \sqrt{37^2 + 44^2 + 17^2} = 59,9$ (4)

P^1_{2016} = (27,49,23) from which it follows that $\left|P^1_{2016}\right| = \sqrt{27^2 + 49^2 + 23^2} = 60,4$ (5)

Table 3. Do you consider that the Romanian economic situation for the period 2015-2016: a) will improve?; b) remains unchanged?; c) will worsen over the next 12 months?

Romania	The share of CEO % on the global economic situation changes. Romania		Evolution of the share %
Year	2015	2016	-
It will improve?%	35	40	14,28
It will bethe same?%	38	33	-13,15
It will be worse?%	27	24	-11,11

Source: Realised the author based on annual survey data CEO

Corresponding share are:

P^2_{2015} = (35, 38, 27) from which it follows that $\left|P^2_{2015}\right| = \sqrt{35^2 + 38^2 + 27^2} = 58,3$ (6)

P^2_{2016} = (40, 33, 24) from which it follows that $\left|P^2_{2016}\right| = \sqrt{40^2 + 33^2 + 24^2} = 57,8$ (7)

Table 4. Do you consider that the global economic situation for the period 2014-2016: a) will improve? b) remains unchanged? c) will worsen over the next 12 months?

Global	The share of CEO % on the global economic situation changes		Evolution of the share %
Year	2014	2016	-
It will improve? %	44	27	-38,63
It will be the same? %	49	49	0
It will be worse? %	17	*23*	26,08

Source: Realised the author based on annual survey date CEO

Corresponding share are:

P_{2014}^{3} = (44, 49, 17) from which it follows that $\left|P_{2014}^{3}\right|$ = 68,1 (8)

P_{2016}^{3} = (27, 49, 23) from which it follows that $\left|P_{2016}^{3}\right|$ = 60,4 (9)

Table 5. Do you consider that the Romanian economic situation for the period 2014-2016: a) it will improve? b) it remains unchanged ? c) it will worsen over the next 12 months ?

Romania	The share of CEO % on the economic situation changes, Romania		Evolution of the share %
Year	2014	2016	-
It will improver? %	45	40	11,11
It will be the same? %	47	*33*	29,78
It will be worse? %	18	*24*	*-25*

Source: Realised the author based on annual survey data CEO

Corresponding share are:

P_{2014}^{4} = (45,47,18) from which it follows that $\left|P_{2014}^{4}\right|$ = 67,5 (10)

P_{2016}^{4} = (40,33,24) from which it follows that $\left|P_{2016}^{4}\right|$ = 57,1 (11)

If we look at the growth prospects of the companies in the limbo, optimism CEOs of Romania on overall progress, it mentioned when it comes to prospects of their companies, an increasing trend towards the years 2014, 2015, en a result of the survey in 2016, 50% of CEOs in Romania were very confident in the prospects of their companies in increase revenues during 2017 with 13% more registered globally, 40% to 27% felt when the survey was made that the economic situation will improve.

Table 6. a) Do you consider that the economic situation had improved, unchanged or worsen over the next 12 months?

b) How confident are the prospects for your company to increase revenues over the next 12 months?

Year	Global					Romania				
	2012	2013	2014	2015	2016	2012	2013	2014	2015	2016
It will improve?	15	18	44	37	27	18	13	45	35	40
Very confident in the growth prospects of the company	40	36	39	39	35	34	42	39	44	50

Source: Realised the author based on annual survey data CEO

If we consider opportunities Di threats for companies, 52% (percentage increase insipid 43% in 2015) of CEOs in Romania perceived and perceive more threats to growth prospects compared with three years ago. For example, 66% of CEOs in the countries surveyed are convinced that the number of threats is growing to 59% in the previous edition.

Most of general managers in Romania believe that in recent years has increased both the number of opportunities and threats. From the survey that 72% of them in Romania, says that during this period there are many growth opportunities for their companies than the next three years.

Table 7. a) in previous year there was more growth opportunities for companies than the next years? b) the previous year there has been many threats to growth prospects of the company than three years ago?

Year	Global		Romania	
	2015	2016	2015	2016
Opportunities %	61	60	59	72
Threats %	59	66	43	52

Source: On annual survey data CEO

Table 8. a) Do you consider that the economic situation in Romania was improved following 12 months? b) How confident were you in prospects for your company to increase revenues in subsequent 12 months? c) The previous year there was more threats to growth prospects of the company, than three years ago?

Romania	The share of CEO changing economic the next 12 months		Evolution of the share %
Year	2015	2016	-
Economic situation had improved in the next months? %	35	40	14,28
Very confident in the growth prospects of the company? %	44	50	-13,15
Threats to the growth trend of the company three years ago	43	52	23,25

Source: Realised the author based on annual survey data OMC

Corresponding share are:

P^5_{2015} = (35,44,43) from which it follows that $\left|P^5_{2015}\right|$ = 67,2 (12)

P^5_{2016} =(40.50,52) from which it follows that $\left|P^5_{2016}\right|$ = 82,1 (13)

Let it be X_1 the development of global economic in 2015, 2016 and (i = 1, T1.2), X_2 the development of global economic in 2015, 2016 and (i = 2, T1.3), X_3 consideration the economic situation globally 2014, 2016 (i = 3, T1, 4), X_4 being the economic considerations in Romania 2014, 2015, and (i = 4,T1,5), X_5 being the economic considerations involved in Romania the threats 2015, 2016 (s = 5, T1,8) and these cases (i = I, 2,3,4,5) can be quantified by the similarity coefficient called also the cosine coefficient.

Changes in the assessment of the economic situation to improve if it remained the same overall plan or damage either in Romania or in pairs of years (2015.2016), (2014.2016) are given as follows: i = I, vectors P^1_{2015} = (37,44,17), P^1_{2016} = (27,49,23), and we denote by a_1 of the angle between these vectors; 1 = 2, vectors P^2_{2015} = (35,38,27), P^2_{2016} = (40,33,24) and a_2 the angle between these vectors; i = 3, the vectors P^3_{2014} = (44,49,17), P^3_{2016} = (27,49,23) and a_3 the angle between these vectots; i = 4 vectors P^4_{2014} = (45,47,18), P^4_{2018} = (40,33,24), a_4 the angle between these vectors ; i = 5, the intervening and threats, we vectors P^5_{2015} = (35 44 43), P^5_{2016} - (40, 50, 52) and a_5 thr angle between these vectors.

So similarity coefficients cos. is:

$$\cos a_1 = \frac{(P^1_{2015}, P^1_{2016})}{\left|P^1_{2015}\right| \cdot \left|P^1_{2016}\right|} = \frac{(37.27 + 44.49 + 17.23)}{59{,}9.60{,}4} = 0{,}980 \quad (14)$$

$$\cos a_2 = \frac{(P^2_{3015}, P^2_{2016})}{\left|P^2_{2015}\right|\cdot\left|P^2_{20016}\right|} = 0{,}72; \quad \cos a_3 = \frac{(P^3_{2014}, P^3_{2016})}{\left|P^3_{2014}\right|\cdot\left|P^3_{2016}\right|} = 0{,}95: \tag{15}$$

$$\cos a_4 = \frac{(P^4_{2014}, P^4_{2016})}{\left|P^4_{2014}\right|\cdot\left|P^4_{2016}\right|} = 0{,}981; \quad \cos a_5 = \frac{(P^5_{2015}, P^5_{2016})}{\left|P^5_{2015}\right|\cdot\left|P^5_{2016}\right|} = 0{,}95 \tag{16}$$

It can readily be seen that when cos a = 1 (for a = 0), then the vectors are identical: and when cos a = 0 (for a = 90), the vectors have minimal changes.

Or cosine similarity coefficients transcribe them in function cos a:

cos a = (1 (0.980), 2 (0.72), 3 (0.95), 4 (0.981), 5 (0.95)), that we transcribe in descending order of similarity coefficients: cos a = (4(0,981), 1(0,980), 3(0,95), 5(0,95), 2(0,72))

In 2015 the economic situation compared with 2016, according to the survey CEO minimal changes occurs in Romania; and maximum changes according to the same survey, economic changes in 2014 compared to 2016, taking place also in Romania (we think it can not be wrong if we say that the maximum changes are taking place globally in 2015 compared with 2016).

In the process of developing strategies and trade policies, company managers must take into account global trends (Ștefănescu and Ungureanu 2006). The global economic situation during 2015, 2016 remained at just 11% and 35% reported a deterioration, but 22% said that it had improved. Regarding Romania found an improvement in a 14% but remained as 13% and 11% considered damage; the global economic situation in 2014, in 2016 only 26% felt deterioration and 39% did not notice any improvement.

In Romania a total negativism in the same time period: 12% do not consider any improvement, 30% remained even so, 25% we saw a deterioration and 33% of respondents have not taken any decision. In economic period 2015, 2016, in Romania, 21% of the interviewed considered threats to growth prospects. In 2017, we still might ask: where are we going and what are the political and business trends? (Appendix 1)

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Appendix 1. Where are we going? Political and business trends

-	Global	Romania
A single global market %	22	29
Regional trading blocs %	75	56
Economic union and unified economic models %	35	48
Multiple business models %	59	44
Political union %	39	50
A unique system of rules and freedoms globally%	14	24
Multiple systems of beliefs and values %	83	68
A global bank %	15	15
Investment banks and regional %	79	74
General and free access to the Internet %	72	76
Differential access to the internet%	25	18

Source: Realised the author based on annual survey data CEO

Appendix 2. Top 5 areas that companies should do more to avoid the impact and value generated for interchangeable parts

-	Global	Romania
Innovation %	59	56
Major risks %	53	67
Non-financial factors %	44	46
Business strategy %	39	51
Environmental impact%	39	41

Source: Realised the author based on annual survey CEO

Appendix 3. Business strategy influenced predominantly by customers and competitors

-	Global	Romania
Customers %	90	90
Governments and regulatory institution %	69	68
Competitors %	67	79
Employees (including trade unions) %	51	70
Supply chain partners %	48	61
Financiers %	41	44
Public opinon %	30	45
Mass-media %	25	27

Source: Realised the author based on annual survey CEO

Appendix 4. To what extent are concerned about the following potential: threats own business, *etc.* to the growth prospects of the company?

-	Global	Romania
Availability of staff with key skills %	72	85
Technological exchange rates %	65*	60
Cyber threats %	61	52
The reaction capability in a crisis %	62	82
Changes in consumer behavior %	60	83
New competitors %	57	67
Lack of trust in business %	55	51
High costs or unstable energy %	61	40**
Stock market instability %	44	27

Note: *) 60% in 2015; **)57% in 2015
Source: Realised the author based on annual survey C

Appendix 5. Perspectives of general managers on fiscal strategy

-	Global	Romania
Tax is a cost to be managed efficiently %	87	85
Reducing burdens and tax is as beneficial as reducing tax rates %	67	93
Fiscal approach and transparency of charges affect the company`s reputation %	76	73
A stable tax system in more important than low tax rates %	48	85
Board is actively involved in shaping fiscal strategy of the company %	72	71

Source: Realised the author based on annual survey CEO

Appendix 6. Potential threats of economic, political, social level, etc., elated to the perspective of economical growth

-	Global	Romania
Excessive regulation %	79	74
Geopolitical uncertainty %	74	83
Exchange rate volatility 5	73	68
Government response to fiscal deficit and debit burden %	71	78
The tax burden in most %	68	74
Social instability %	65	57
Inadequate basic infrastructure %	56	73
Climate change and environmental issues %	50	40
The debt crisis in the Eurozone %	51	55
Access to funding %	42	50

Source: Realised the author based on annual survey CEO

Appendix 7. Business strategy influenced predominantly by customers and competitors

-	Global	Romania
Innovation %	59	56
Major risks %	53	67
Non-financial factors %	44	46
Business strategy %	39	51
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Customers %	90	90
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-	Global	Romania
Employees (including trade unions) %	51	70
Supply chain partners %	48	61
Financiers %	41	44
Public opinion %	30	45
Mass-media %	25	27

Source: Realised the author based on annual survey data CTO

Appendix 8. To what extent are concerned about the following potential: threats own business, etc. to the growth prospects of the company?

-	Global	Romania
Availability of staff with key skills %	72	85
Technological exchange rates %	60	65*
Cyber threats %	61	52
The reaction capability in a crisis %	62	82
Changes in consumer behavior %	60	63
New competitors %	57	67
Lack of trust in business %	55	51
High costs or unstable energy %	61	40**
Stock market instability %	44	27

Note: *) 60% in 2015; **) 57% in 2015
Source: Realised the author based on annual survey data CEO

Appendix 9. Perspectives of general managers on fiscal strategy

-	Global	Romania
Tax is a cost to be managed efficiently %	87	85
Reducing burdens and tax is as beneficial as reducing tax rates %	93	67
Fiscal approach and transparency of charges affect the company's reputation %	73	76
A stable tax system is more important than low tax rates %	85	48
Board is actively involved in shaping fiscal strategy of the company %	71	72

Source: Realized the author based on annual survey data CEO

Appendix 10. Potential threats of economic, political, social level, etc., related to the perspective of economical growth

-	Global	Romania
Excessive regulation %	79	74
Geopolitical uncertainty %	74	83
Exchange rate volatility %	73	68
Government response to fiscal deficit and debt burden %	71	78
The tax burden in most %	68	74
Social instability %	65	57
Inadequate basic infrastructure %	56	73
Climate change and environmental issues %	50	40
The debt crisis in the Eurozone %	51	55
Access to funding %	42	50

Source: Realised the author based on annual survey data CEO

A Multi-Level Agent-Based Model of Reinsurance

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Abstract:

Advances in agent-based modeling continue to offer new tools and concepts to model and study phenomena involving more complexity. In particular, economic and social issues with different levels of interactions and representations can benefit from frameworks of multi-level agent-based modeling that have successfully simulated other problems sharing similar properties. We show through our work how reinsurance fits into this category of complex multi-level problems, how we adapted recent concepts with recent tools to go through the modeling obstacles of this issue to come up with a model that confirms the results of other renowned works and surpasses them in terms of analysis depth and assumptions flexibility.

Keywords: reinsurance; agent-based modeling; power and shubik law; multi-level; computational economics

JEL Classification: C63; C92; G2

Introduction

Agent-based modeling is an approach where computer experiments are conducted by defining basic behavior of agents to understand the dynamics of a resulting complex phenomena where computational mathematical decomposition shows its limitations or can't explain empirical reality. Multi-level modeling addresses the issue when interactions of agents occur in different levels that influence each other but also where entities have interactions zones that make each level look as a separate model, such as cells versus tissues in biology or producers/consumers versus economic sectors (Camus, Bourjot, Chevrier 2013, 15–22).

Research in multi-level agent-based modeling solves the technical and theoretical difficulties arising when trying to include all those interactions in one model, but also offers abstraction layers and domain-specific frameworks for the particular difficulties in some phenomena where either the number of agents are too big or have complex aggregated interactions.

Indeed, we can consider reinsurance one of such problems. The insuring relationship between customer and insurer reappears repetitively between insurer and reinsurer then reinsurer of reinsurer thus defining a hierarchy which where elements play different simultaneous roles that makes a direct definition of agents actions too complex. This kind of complexity with the adaptive nature of the agents makes reinsurance an appropriate application case calling for both agent-based modeling and multi-level concepts.

While there are many models in the literature that study different insurance problems from optimal prices to market cycles and stability (Hjorth, Brady, Head, Wilensky 2016, 282-289) no similar experimental approach has been undertaken to explore the dynamics of reinsurance, which is also a starting point of our study.

In section 2, we review the theoretical background and literature related to our subject, then in section 3 we describe our model and approach in detail to finally analyze and discuss the findings in section 4.

1. Research background

1.1. Reinsurance

Most research in reinsurance tries to address questions about whether the existence of different levels in a reinsurance market is necessary (Huraux, Sabouret, Haradji 2014) and optimization problems related to which configurations of the market in terms of reinsurance levels and number of reinsurers offer the most benefit and sustainability. Due to the amount of variables involved big simplifications and hypotheses must be made in order to establish a mathematical theory of reinsurance, which is the case in Power and Shubik's work (Quijano, Louail, Hutzler 2012, 620–635). The insurance market is regarded as game between insurers and customers having classical utility functions and each retrocession *i.e* reinsurance level is viewed as a sub-game. Even though important results have been reached such as the optimal number of reinsurers for a profitable market being equal the square root of insurers' number (Plantin 2006, 153-168) the computations remained huge in comparison with the simplicity of the model as shown in the formula giving an expression of the optimal number of reinsurers.

$$n_\lambda^* = Max\left\{n_\lambda : \pi \le P_0^{(C)} < P_0^{(D)} \le 1\right\}$$

$$= Max\left\{n_\lambda : \left(\frac{n_\lambda}{n_\lambda - 1}\right)\left(\frac{n_{\lambda-1}}{n_{\lambda-1}-1}\right)\left(\frac{n_{\lambda-1}}{n_{\lambda-1}-n_\lambda}\right)\left(\frac{n_{\lambda-2}}{n_{\lambda-2}-n_{\lambda-1}}\right)\right.$$
$$\left. < \left(\frac{n_\lambda - 1}{n_\lambda - 2}\right)\left(\frac{n_{\lambda-1}+1}{n_{\lambda-1}}\right)\left(\frac{n_{\lambda-1}+1}{n_{\lambda-1}+2-n_\lambda}\right)\left(\frac{n_{\lambda-2}}{n_{\lambda-2}-n_{\lambda-1}-1}\right)\right\}' \quad (1)$$

We can note that similar classes of problems related to direct insurance has been successfully studied using agent-based modeling, mainly to understand the complex underwriting cycles (Hjorth, Brady, Head, Wilensky 2016, 282-289) where insurers tighten their standards resulting in an increase in profits and accumulation of capital which is followed by an increase in competition due to higher underwriting capacity to finally drive the premium prices thereby causing losses. However, in a computational the assessing of evolution in time is often strongly tied to predetermined laws such as Bernoulli in Power and Shubik and formulas for target monitors can only be obtained in specific stages of the model.

Recent research has viewed multi-level models in different ways to be implemented. The most common is a society of interacting models where different levels are modeled separately then synchronized (Powers, Shubik 2001, 271-290). Others ways focus on aggregations of agents which is more common in traffic flow frameworks because of the computational power required to simulate each element separately (Camus, Bourjot, Chevrier 2013, 15–22).

The category of our problem belongs more to the first case where each reinsurance level can be modeled separately according the appropriate dynamics of the level then the levels can influence each other. An analogy of reference to this situation by Wilensky is a model of climate change influencing grass growth in another model of wolf/sheep predation (Powers and Shubik 2005, 101-107).

Most of the multi-level frameworks are developed as new tools to simulate a specific problem which creates an additional technical difficulty to be used in a different context. However, some common agent-based modeling tools have recently included multi-level modeling extensions such as LevelSpace in Netlogo (Powers and Shubik 2005, 101-107) which offers both a user interface and directives for inter-model communication.

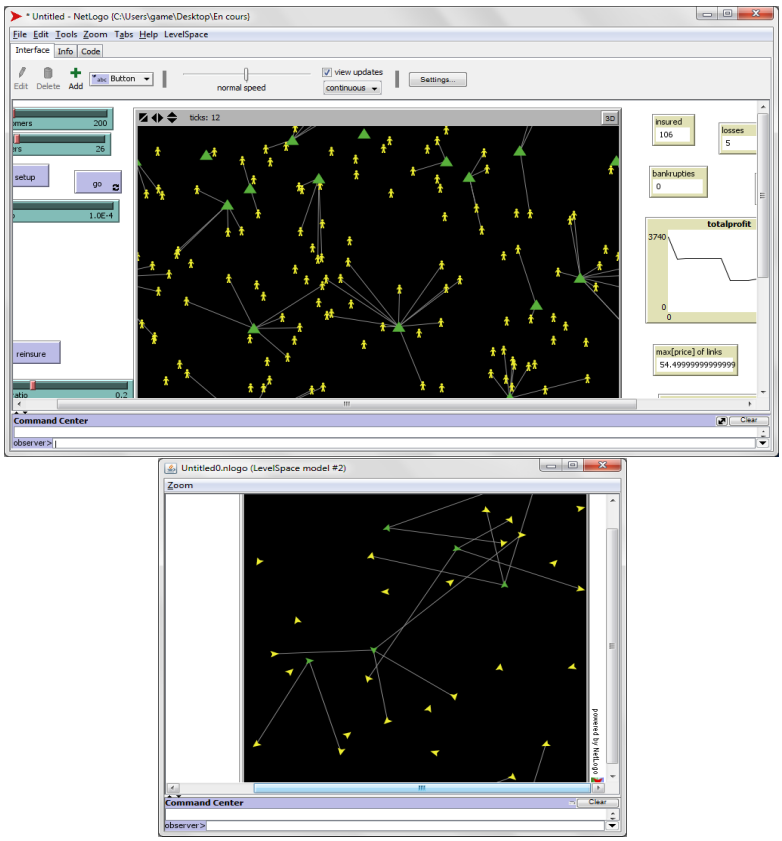
2. The model

2.1. Concepts

To avoid complications due to introducing multiple levels where an insurer has to become a customer for the reinsurer, changing his variables and redefining the same operations for all levels, we opted for a recursive definition of the model using the notion of a modeling axis (Zhou 2013). In our model we view both customers and insurers as the same agent with common goals and constraints (insuring assets, undergoing losses, being either insured or

not insured, having some risk aversion). Instead of two different agents we defined a role for each agent (either customer or insurer), and the transmission to a different level changes only roles rather than all properties and actions. Reinsurance is defined as a recursive call that creates a new instance of the model where insurers of level n-1 become customers in level n and reinsurers (insurers in level n) are automatically created according to a chosen configuration in the first level.

Figure 1. Simultaneous execution of 2 insurance levels



2.2. Model specification

Each agent representing a physical or moral entity in the model has the following properties:

- *Role*: whether the agent is an insurer or customer in the current model;
- *Asset*: either the value of the good to insure or the capital of the insurer;
- *Bid*: amount that the agent is ready to pay for insurance;
- *Insured*: Boolean variable memorizing whether the agent is insured or not;
- *Insurer*: the insurer of the turtle;
- *Risk*: indicator of bankruptcy probability;
- *Risk tolerance*: indicator of aversion to risk when dealing with another agent.

Some properties such as the price of the insurance offer cannot be considered common properties of insurer and customer, we solved this problem by considering them association properties. Each time a customer is assigned to an insurer, a **link** between the two with the following properties is created:

- *Price*: the periodic price the customer accepted to pay to the insurer;
- *Datepaid*: last date the customer paid the duty to his insurer.

The main procedures in the model are:

- *To assign*: procedure to assign the non-insured agents to insurers according to their risk tolerance;
- *To pay*: each insured customers pays to the insurer the price in their mutual link;
- *To loss*: according to a probability each customer undergoes a loss;
- *To refund*: the insurers refund their customers for the value of their assets;
- *To Insolvency Test*: test to find the insurers who can't refund their customers;
- *To update prices*: each insurer regularly updates his

2.3. Execution

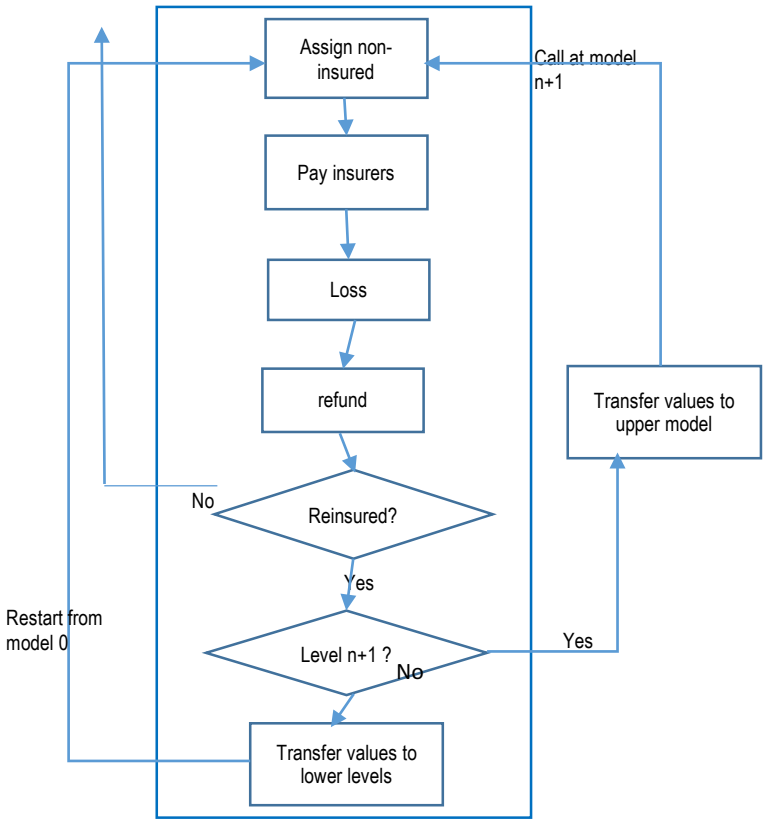
During the setup of the model, the assets of the insurers are defined proportionally to those of the customers to take into consideration the state constraints of minimal asset per insurer, the same applies for reinsurers in the superior levels.

During each step, the non-insured customers look for the closest insurer that satisfy their bid and risk tolerance constraints, some will remain non-insured since no insurer satisfies the constraints. Some customers may undergo losses if a randomly generated variable happen to give 0 as a result, the insured among them are refunded, and the others change their location and undergo an increase in their bid and risk aversion.

During the insolvency test the insurers who can't refund lose all their customers and are penalized by an increase in their risk. Some actions occur periodically, such as the monthly pay of insurance and an increase in insurers' prices proportional to their market share. The customers who can't afford the new price of their insurers break their links.

If the model is reinsured, the insurers are transferred to the upper level to re-execute the same steps with their reinsurers then come back to their original model for the next cycle.

Figure 3. Flow chart of the reinsurance model



3. Discussion

3.1. Calibration and methodology

The calibration depends on specific insurance markets, where state constraints on the minimal capital are often determined according to catastrophic incidents probabilities. The calibration can be reduced to a global capital value according to the asset value and risk probability value. Our pre-experiments showed that the increase in capital is not a determinant factor but only delays the first insolvencies and reproduces similar results of a lower capital satisfying the pre-conditions. Consequently, we focused our analysis mainly on which configurations of levels and numbers of reinsurers generate the most profits.

We set the default proportions between assets of customers and insurers to those in Power and Shubik computational model but we allowed a variation of risk probability so that any configuration of any sector can be set within the model on a lower scale. The main simplifications remain related to the evolution of risk aversion and bid and also the rational choice in choosing the insurer but the model still takes into the consideration the adaptive and interdependent nature of agents and can be considered representative of real markets and a ground for observing emergent phenomena if similar results appear in different experiments (Zhou 2013)

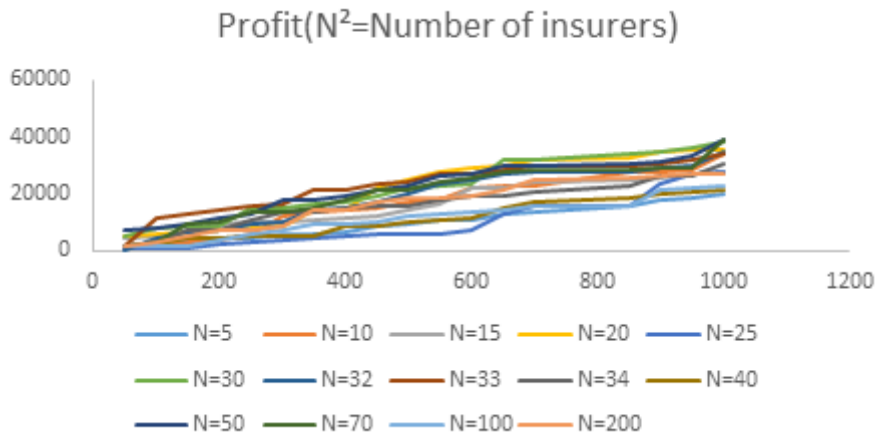
3.2. Findings

3.2.1. Life cycle of the model

Each run undergoes a slow profit or loss phase till insurers attract enough customers, then follows a phase of significant gains then a stabilization phase. After enough steps all the insurers undergo losses and customers becomes too risk averse to deal with any of them. The following analysis stages are based on executions of the model by variations of numbers of reinsurers on fixed loss probabilities:

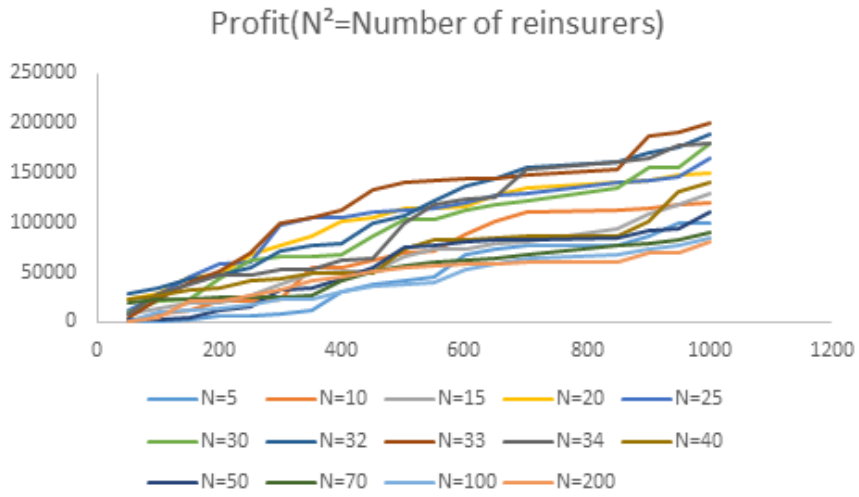
With low loss probabilities < ?: We obtain limited irregular profit curves which doesn't correlate with numbers of reinsurers.

Figure 4. Profits with one level of reinsurance and low loss probabilities



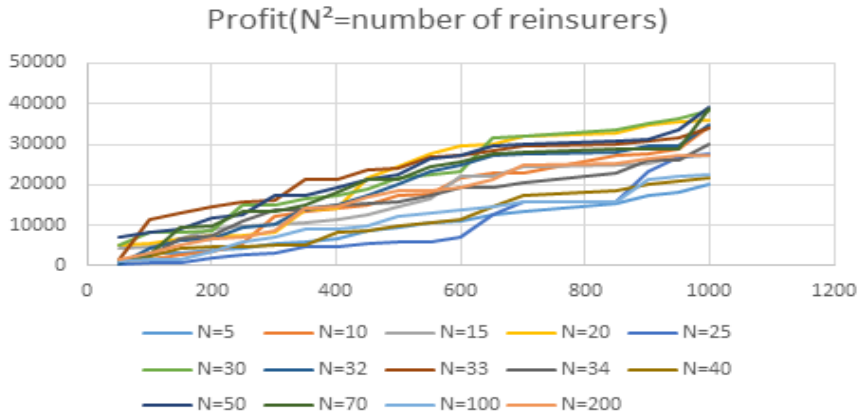
After a first loss probability threshold: For different numbers of reinsurers, we notice that the most profitable runs that reach maximal gains in the second phase are in interval centered around the square root of insurers as stated in Power and Shubik law, some runs with arbitrary numbers of reinsurers produce more gains but it occurred late in the third phase of the cycle.

Figure 5. Profits with one level of reinsurance and moderate loss probabilities



After a second probability threshold: the profits become very low and the behavior of the profit curve becomes chaotic, this can be explained by the facts the model stays a long time in the first phase and can't transit to the second because of high reinsurer expenses that can't be recovered

Figure 6. Profits with one level of reinsurance and high loss probabilities



Repeating the same experiments with two levels of reinsurance gives the following results:

- negative profits when the loss probability is low;
- negative profits with a slow linear increase in the second range;
- curves of significant profits for the third range for different numbers of reinsurers with optimal gains reach when the number of insurers in level n+1 equal the number of insurers in level n.

Our experiments were able to confirm these pattern up to 2 levels due to limitations related to computational power and model design. We are however able to confirm that there exists an optimal number of levels for each loss probability value where the number of insurers in level n+1 equals the square root of the number of insurers in level n, out of this range additional reinsurance levels lower profit and lead to the same consequences in case of catastrophic events where many customers undergo simultaneous losses. Consequently, the stability of the market depends on both on numbers of levels and number proportions between insurers and customers.

Conclusion

We consider our model to be an important application of multi-level agent-based modeling and a new framework for the study of reinsurance. We demonstrated how a recursive definition and a synchronization using multi-level frameworks makes the experimental study of complex reinsurance configurations possible, and allows more flexibility in hypotheses to filter the unnecessary ones from the computational model of reference. The model is also an experimental proof of Power and Shubik law and we showed new dynamics of the law is our analysis. Further work can calibrate the model on an existing reinsurance market specially to have more realistic price adjusting procedures. Other laws between probability loss and optimal number of levels can be explored using data science techniques. For this purpose, the model must benefit from research in large scale modeling to be able to execute with higher numbers of levels.

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Mathematical Models of Uncertainty in Economics

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Abstract:

The article reviews various types of mathematical models for uncertainty in economics. For each model, applications and application features are given. Causes for uncertainty appearance in business processes have been made specific. In the summary of theorizes, uncertainty models are analysed. In the research, an attempt is made to find out possible logical and structural regularities able to improve an approach to construction of mathematical models for uncertainty. Comparative characteristics of managerial decision-making criteria have been made specific in case of total or partial uncertainty.

Keywords: uncertainty; mathematical models; decision-making criteria.

JEL Classification: D80; D81

Introduction

Uncertainty as a condition of an open stochastic system is a principle to develop ideas about risks and their impact on business objects. Universality of this phenomenon gives rise to a variety of scientific problems related to a search for a nature of structural changes and cause-and-effect relationships within the generation cascade of risks. That is why the most important issue is a review of management methods in terms of uncertainty.

In all economic sectors, there is a need in more accurate mathematical models of decision-making. Known approaches suggest several available parameters or probabilistic characteristics of events, phenomena or processes. Implementing models, we consider probability parameters close to the indicators which have been already known, which is actually false. Blyth (2012), Borch (1968), Traub *et al.* (1988), and Jaeger *et al.* (2001) mentioned complexity in a search for alternative solutions and criteria for uncertainty assessment.

Obviously, systems operate in terms of uncertainty caused by factors of a different nature. An approximate consideration for these factors is possible by making mathematical models. Recent scientific papers have given an insufficiently detailed description and a review of mathematical models of uncertainty. This fact points out to a need in more research.

1. Literature review

Many scientists and professionals have been involved in research on the nature of uncertainty, its typing, and problems in management decision-making. American economist Knight (1921, 222) deserves the main credit for development of the uncertainty theory. He opposed 'objective indeterminacy' of equiprobable elementary alternative outcomes with his opinion that decisions were made in terms of uncertainty and associated with it.

In uncertainty studies, the next important milestone was the transition to consideration of the internal environment and the definition of uncertainty based on sources that generate it. Miles and Snow (1978, 195) definitely identify uncertainty with the internal environment reviewing 'uncertainties as predictability of conditions in the corporate environment'. Priem *et al.* (2002) gave a wider idea of uncertainty sources. In papers based on the organizational theory, attention is paid to variability of certain elements in the environment, as well as they review predisposition to uncertainty. Later, these points made it possible to extend classical abstract concepts.

As the most common definition, uncertainty refers to a lack of information or incomplete information of an object. Kuzmin considers uncertainty in economics based on the following. First, uncertainty should be considered a measure (unit) of information. Secondly, uncertainty reflects a condition of a system towards so called perfect conditions when knowledge about a phenomenon or an object is completely deterministic. Third, uncertainty is perceived as an opportunity to choose between alternatives from different options and multiple choices. Fourth, uncertainty describes a quality of data (accuracy, completeness, integrity, and actuality). Fifth, uncertainty assumes ambiguity in implementation of certain events (Kuzmin 2012, Kuzmin 2016).

Thus, uncertainty is described with different characteristics. Following basic reasons for its occurrence, we can distinguish:

- business processes as a result of interactions between a large number of different elements;
- processes as a result of a subjective decision;
- uncertainty in economics, related to more and more complicated social communications, a way of decision-making and a 'rules of the game.'

2. Material and methods

The system of mathematical uncertainty built taking into account stochastic probabilities has both positive and negative criteria (Nadezhdin and Bushuyev 2011). A positive criterion is a possibility within the model to describe the probabilistic (random) approach that does not only help to take into account parametric statistics, but also stochastic processes. A negative criterion for usage of stochastic probabilities is a compilation of coefficients that use discrete random variables. As a result, the statistical description in the example is actually a special case within the stochastic description (Hovanov and Fedotov 2006).

This form is used when it is necessary to apply sample estimates to characteristics of a random variable or a set of values that form a dynamic decision-making system. As the basis for such models, the factor of equal possibility is common when a favour measure for events is not the same. Applications of such conclusions might only respond to the real life when a number of tests and, accordingly, measurements of parameters is finite. Only in this case, stochastic probability is expressed with mathematical statistical values of mathematical parameters that predefine fuzzy sets.

The assessment framework in decision-making in terms of uncertainty can be set with an agreed mathematical model. Shannon (1948) uses probability as a basic indicator describing uncertainty and dependant on peculiar distribution of entropy:

$$H = -\sum_{i=1}^{n} p_i \times \log_b p_i, \quad H_i = -p_i \times \log_b p_i, \text{ where } p_i \neq 0, \sum_{i=1}^{n} p_i = 1 \rightarrow H > 0, \tag{1}$$

where: H – entropy (uncertainty) of the *j-th* condition; H_i - entropy (uncertainty) of the i-th event or phenomenon in the *j-th* condition; p_i – probability (frequency); b – signal size (volume of information single-unit), b>1; n – quantity of options.

Following Shannon, entropy estimation assumes that its minimum value is limited with an eventual bound when probability (frequency) of occurrence for any alternative will be close to zero. At the same time, an upper limit of uncertainty will depend on a signal size and a number of possible options, probability of which is not zero and is approaching an equally likely outcome:

$$\lim_{p\to 0+} p\times \log_b p = 0. \quad (2)$$

Discussions of uncertainty estimation using entropy index are extremely important to understand a logic of research.

3. Results

In the management theory, there are several main types of uncertainties according to which it is possible to typify mathematical models. The analytical review allows identifying models of parametric (structural) uncertainty, models of non-stationery uncertainty, model of non-parametric uncertainty, and models of nonlinear uncertainty. There are also other kinds of models. They describe areas of uncertainty: environment, decision-making, and work with consequences of decisions (Avdiysky and Bezdenezhnykh 2011).

3.1. Model of parametric (structural) uncertainty

The structure of the most modern management objects is such that an exact mathematical description of objects is either missing or widely varies (Dyda 2006). In such circumstances, incomplete information of a mathematical model imposes a significant limitation on used methods of synthesis for controls. Management systems are designed to solve problems of management in terms of uncertainty based on robust and adaptive approaches (Ksenofontova 2012). Objects with structural and parametric uncertainty belong to compound ones. Their essential feature is an uncertainty of characteristics regarding an object of management and external influences, *i.e.* insufficiency of a priori and current information of their options (Andrievskiy and Fradkov 2000).

The type of parametric uncertainty is the most common and well-examined. There is a number of papers where a successful attempt was made to systematize management principles and approaches to parametric uncertainty, including using adaptive tuning algorithms (Zyipkin and Polyak 1990). The model of system 'input – output' might be presented as follows:

$$\begin{pmatrix} x_1(t) \\ x_2(t) \\ \dots \\ x_N(t) \end{pmatrix} = \begin{pmatrix} a_{11}(q) \dots a_{1M}(q) \\ a_{21}(q) \dots a_{2M}(q) \\ \dots \quad \dots \quad \dots \\ a_{N1}(q) \dots a_{NM}(q) \end{pmatrix} \cdot \begin{pmatrix} x_1(t) \\ x_2(t) \\ \dots \\ x_N(t) \end{pmatrix} + \begin{pmatrix} b_{11}(q) \dots b_{1M}(q) \\ b_{21}(q) \dots b_{2M}(q) \\ \dots \quad \dots \quad \dots \\ b_{N1}(q) \dots b_{NM}(q) \end{pmatrix} \cdot \begin{pmatrix} u_1(t) \\ u_2(t) \\ \dots \\ u_N(t) \end{pmatrix}, \quad (3)$$

or vector-based:

$$x(t) = \mathrm{A(q)} \cdot \mathrm{x(t)} + B(q) \cdot U(t), \quad (4)$$

where: vector q is a vector of uncertain parameters; A(q) and B(q) – matrices of uncertain and time-independent factors.

3.2. Models of non-parametric uncertainty

In the most cases, structural uncertainty is caused by incomplete awareness of equations' analytic structure for a management object model. Non-parametric uncertainty sets a tolerable error in the frequency domain, that is, the error in frequency characteristics. In case of an incomplete certain transmission matrix of the object, uncertainty might be additive, fractionally rational or multiplicative.

3.2.1. Additive uncertainty

In case of additive uncertainty, the system 'input-output' model might be represented with the correlation as follows:

$$\begin{pmatrix} y_1(\mathrm{s}) \\ y_2(\mathrm{s}) \\ \dots \\ y_N(\mathrm{s}) \end{pmatrix} = \left(\begin{pmatrix} q_{11}(\mathrm{s}) \dots q_{1M}(\mathrm{s}) \\ q_{21}(\mathrm{s}) \dots q_{2M}(s) \\ \dots \quad \dots \quad \dots \\ q_{N1}(\mathrm{s}) \dots q_{NM}(\mathrm{s}) \end{pmatrix} + \begin{pmatrix} \delta g_{11}(\mathrm{q}) \dots \delta g_{1M}(\mathrm{q}) \\ \delta g_{21}(\mathrm{q}) \dots \delta g_{2M}(\mathrm{q}) \\ \dots \quad \dots \quad \dots \\ \delta g_{N1}(\mathrm{q}) \dots \delta g_{NM}(\mathrm{q}) \end{pmatrix} \right) \cdot \begin{pmatrix} x_1(\mathrm{s}) \\ x_2(\mathrm{s}) \\ \dots \\ x_M(\mathrm{s}) \end{pmatrix}, \quad (5)$$

or matrix-based:

$$y(s) = \left(G(s) + \delta G(s,q)\right) \cdot x(\mathrm{s}), \quad (6)$$

where: y(s), x(s) – input and output messages, respectively; G(s) – transmission matrix of a nominal device; $\delta G(s)$ – transmission matrix with no dynamic simulation.

3.2.2. Fractionally rational uncertainty

With fractionally rational uncertainty, the model of system 'input and output' might be represented with the following equation:

$$\begin{pmatrix} y_1(\mathrm{s}) \\ y_2(\mathrm{s}) \\ \dots \\ y_N(\mathrm{s}) \end{pmatrix} = \frac{\left(\begin{pmatrix} a_{11}(\mathrm{s}) \dots a_{1M}(\mathrm{s}) \\ a_{21}(\mathrm{s}) \dots a_{2M}(s) \\ \dots \quad \dots \quad \dots \\ a_{N1}(\mathrm{s}) \dots a_{NM}(\mathrm{s}) \end{pmatrix} + \begin{pmatrix} \delta a_{11}(\mathrm{q,s}) \dots \delta a_{1M}(\mathrm{q,s}) \\ \delta a_{21}(\mathrm{q,s}) \dots \delta a_{2M}(\mathrm{q,s}) \\ \dots \quad \dots \quad \dots \\ \delta a_{N1}(\mathrm{q,s}) \dots \delta a_{NM}(\mathrm{q,s}) \end{pmatrix} \right)}{\left(\begin{pmatrix} b_{11}(\mathrm{s}) \dots b_{1M}(\mathrm{s}) \\ b_{21}(\mathrm{s}) \dots b_{2M}(s) \\ \dots \quad \dots \quad \dots \\ b_{N1}(\mathrm{s}) \dots b_{NM}(\mathrm{s}) \end{pmatrix} + \begin{pmatrix} \delta b_{11}(\mathrm{q,s}) \dots \delta b_{1M}(\mathrm{q,s}) \\ \delta b_{21}(\mathrm{q,s}) \dots \delta b_{2M}(\mathrm{q,s}) \\ \dots \quad \dots \quad \dots \\ \delta b_{N1}(\mathrm{q,s}) \dots \delta b_{NM}(\mathrm{q,s}) \end{pmatrix} \right)} \cdot \begin{pmatrix} x_1(\mathrm{s}) \\ x_2(\mathrm{s}) \\ \dots \\ x_M(\mathrm{s}) \end{pmatrix}, \quad (7)$$

or for the model of 'input – output':

$$G(s,q) = \frac{A(s) + \delta A(s,\mathrm{q})}{\mathrm{B}(s) + \delta B(s,\mathrm{q})}, \quad (8)$$

where: y(s), x(s) – input and output message, respectively; $A(s)B^{-1}(s)$ – transmission matrix of nominal device; $\delta A(s,\mathrm{q})$ and $\delta B(s,\mathrm{q})$ – numerator and denominator of perturbation, respectively.

3.2.3. Multiplicative uncertainty

With multiplicative uncertainty, the model of system 'input – output' might be represented as follows:

$$\begin{pmatrix} y_1(\mathrm{s}) \\ y_2(\mathrm{s}) \\ \dots \\ y_N(\mathrm{s}) \end{pmatrix} = \begin{pmatrix} q_{11}(\mathrm{s}) \dots q_{1M}(\mathrm{s}) \\ q_{21}(\mathrm{s}) \dots q_{2M}(s) \\ \dots \quad \dots \quad \dots \\ q_{N1}(\mathrm{s}) \dots q_{NM}(\mathrm{s}) \end{pmatrix} \cdot \left(\begin{pmatrix} 1 & 0 & \dots & 0 \\ 0 & 1 & \dots & 0 \\ \dots & \dots & \dots & \dots \\ 0 & 0 & \dots & 1 \end{pmatrix} + \begin{pmatrix} \delta g_{11}(\mathrm{q}) \dots \delta g_{1M}(\mathrm{q}) \\ \delta g_{21}(\mathrm{q}) \dots \delta g_{2M}(\mathrm{q}) \\ \dots \quad \dots \quad \dots \\ \delta g_{N1}(\mathrm{q}) \dots \delta g_{NM}(\mathrm{q}) \end{pmatrix} \right) \cdot \begin{pmatrix} x_1(\mathrm{s}) \\ x_2(\mathrm{s}) \\ \dots \\ x_M(\mathrm{s}) \end{pmatrix}, \quad (9)$$

or for the model of 'input – output'

$$y(s) = G(s)(E + \delta G(s,q)) \cdot x(s), \tag{10}$$

where: y(s), x(s) – input and output messages, respectively; G(s) – nominal device transmission matrix;
$\delta G(s,q)$ – transmission matrix with no dynamic simulation; E – identity matrix of appropriate dimension.

3.3. Model of non-stationary uncertainty

The model of 'input-output' for a non-stationary management system can be represented as follows (Zyipkin 1992):

$$\begin{pmatrix} x_1(t) \\ x_2(t) \\ \dots \\ x_N(t) \end{pmatrix} = \left(\begin{pmatrix} a_{11}(\mathrm{t}) \dots a_{1M}(\mathrm{t}) \\ a_{21}(\mathrm{t}) \dots a_{2M}(\mathrm{t}) \\ \dots \quad \dots \quad \dots \\ a_{N1}(\mathrm{t}) \dots a_{NM}(\mathrm{t}) \end{pmatrix} + \begin{pmatrix} \delta a_{11}(\mathrm{t}) \dots \delta a_{1M}(\mathrm{t}) \\ \delta a_{21}(\mathrm{t}) \dots \delta a_{2M}(\mathrm{t}) \\ \dots \quad \dots \quad \dots \\ \delta a_{N1}(\mathrm{t}) \dots \delta a_{NM}(\mathrm{t}) \end{pmatrix} \right) \cdot \begin{pmatrix} x_1(t) \\ x_2(t) \\ \dots \\ x_N(t) \end{pmatrix} +$$

$$+ \left(\begin{pmatrix} b_{11}(\mathrm{t}) \dots b_{1M}(\mathrm{t}) \\ b_{21}(\mathrm{t}) \dots b_{2M}(\mathrm{t}) \\ \dots \quad \dots \quad \dots \\ b_{N1}(\mathrm{t}) \dots b_{NM}(\mathrm{t}) \end{pmatrix} + \begin{pmatrix} \delta b_{11}(\mathrm{t}) \dots \delta b_{1M}(\mathrm{t}) \\ \delta b_{21}(\mathrm{t}) \dots \delta b_{2M}(\mathrm{t}) \\ \dots \quad \dots \quad \dots \\ \delta b_{N1}(\mathrm{t}) \dots \delta b_{NM}(\mathrm{t}) \end{pmatrix} \right) \cdot \begin{pmatrix} u_1(t) \\ u_2(t) \\ \dots \\ u_N(t) \end{pmatrix}, \tag{11}$$

where: coefficients of perturbation matrices $\delta A(\mathrm{t})$ and $\delta B(\mathrm{t})$ are limited to some closed sets and time-dependent.

It should be mentioned that a relationship between an input and an output and stages in solving analysis and synthesis problems for correcting devices in relation to transmission matrices in the theory of stationary and non-stationary systems coincide.

3.4. Models of nonlinear uncertainty

The unconditional stability theory describes this uncertainty as a characteristic of a non-linear element belonging to sector $(\underline{\mathrm{k}}, \overline{\mathrm{k}})$ that meets the following equations (Gelig 1996):

$$\begin{aligned} & x(t) = Ax(t) + Bu(t), \\ & \sigma = \mathrm{Cx(t)}, \\ & \mathrm{f}(\sigma) = \begin{pmatrix} f_1(\sigma_1) \\ \dots \\ f_M(\sigma_M) \end{pmatrix}, \\ & f(0) = 0, \end{aligned} \tag{12}$$

where $\underline{k}\sigma_1^2 \le \sigma_i f_i(\sigma_1) \le \overline{k}\sigma_1^2$ or $\underline{k} \le \dfrac{f_1(\sigma_1)}{\sigma_1} \le \overline{k}$, $0 \le \underline{k} \le \overline{k} \le \infty$.

External factors beyond control described with a high degree of uncertainty have a significant influence on a behaviour of real management systems. To overcome it, various methods of adaptive compensation for disturbances are applied (Aleksandrov 1989).

4. Discussion

Uncertainty models are intended for managerial decision-making. Choice appropriateness will depend on a quality of data used to describe a case. In terms of uncertainty, probability distribution corresponding to a state of the environment is either unknown or impossible to be accurately defined. This lack of information has led to a development of criteria for a case analysis. As arguments, decision-making criteria are used that differ in their degree of conservatism (Zaraté 2008), *i.e.* Laplace criterion, minimax criterion, Savage test, and Hurwitz's criterion.

To choose the most 'favourable' option from available alternatives $a_i(i=\overline{1,m})$ in terms of a given condition of the environment $s_i(j=\overline{1,n})$, they consider valuation (target) function $v(a_i,s_j)$ that assigns a result to each alternative solution. There is a need in taking the concept of value dominance as a basis of selection (Bessonov and Rozen 2013).

Laplace criterion is based on the principle of insufficient reason saying that as far as probability distribution for conditions of the environment s_j is unknown, there are no reasons to consider them different. Hence, an optimistic assumption is used saying that probabilities of all the conditions of the environment are equal, *i.e.*, $p\{s_1\}=p\{s_2\}=...=p\{s_n\}=1/n$. If we take this hypothesis as an estimate of the i-th alternative, the arithmetic mean of wins appears and they are in the i-th row of the decision matrix. If herewith v_{ij} is a revenue, the best solution is the solution which makes sure that:

$$\max_{a_i}\left\{\frac{1}{n}\sum_{j=1}^{n}v_{ij}(a_i,s_j)\right\}. \tag{13}$$

The main problem with Laplace criterion is that in finding of the average gain, there might be an effect of small wins balanced out by large ones, and a resulting arithmetic mean will be then quite a weak characteristic of acceptable alternatives.

Wald's criterion (criterion of maximin for revenue or minimax for costs, or MM-test) reduces itself to a conservative choice of the best alternative between the worst ones. By this criterion, the best is the solution (alternative), with which a minimum value of profit is the highest. In this case, if value v_{ij} is a profit, then in accordance with criterion of maximin as the best, the solution is chosen that makes sure that:

$$\max_{a_i}\left\{\min_{s_j}v(a,s)\right\}. \tag{14}$$

The solution chosen by Wald's criterion completely excludes the risk. The main problem with the maximin principle is that when choosing a solution, only one and the worst option is taken into account. This criterion is preferred by small firms whose survival depends on the losses, being financially conservative.

Savage test (criterion of minimax risk or minimization for the greatest possible losses) tends to mitigate conservatism of Wald criterion. To determine the best strategy by this criterion, the decision matrix is transformed into the loss matrix. Each element within the loss matrix is calculated according to formula:

$$r_{ij}=\begin{cases}\max\limits_{a_i}\left\{v(a_k,s_j)\right\}-v(a_i,s_j), & where\_v\ -\ revenue,\\ v(a_i,s_j)-\min\limits_{a_i}\left\{v(a_k,s_j)\right\}, & where\_v\ -\ losses.\end{cases} \tag{15}$$

In its meaning, $r_{i,j,}$ is interpreted as a measure of regret arising from an ignored true condition of the environment. For *Savage test*, the alternative that minimizes the highest risk is considered the best. So, to compute the regret, a matrix of regrets is built from the decision matrix.

For each column (state of nature) it decreases from the highest result (so the best variant in that state of nature) the current result. The difference is the measure of the regret of choosing each decision variant in that state of nature. After completing the regret matrix, the maximum regret associated with each variation is determined, of these maximum regrets being the lowest one. This minimizes the maximum regrets for a correct choice of strategies in different states of nature.

The motivation to use this criterion is simple: if any of the natural states occur in the future and the decision maker has chosen the strategy that brings the maximum gain for that state of nature, the regret is null; And if the decision-maker chooses another strategy, regret will be the difference between what has actually been achieved and what would have been gained if the optimal decision-making variant in that state of nature were adopted. Using this decision rule, the intent to maximize the outcome in favor of a variant which results in a satisfactory result of the low-risk outcome is abandoned. This criterion applies to investment projects staggered over a long period of time.

Hurwitz's criterion (criterion of 'optimism-pessimism' or 'alpha-test') includes a range of different approaches to decision-making, from the most optimistic to the most conservative and is connected with introduction of index $\alpha \in [0;1]$ as coefficient of optimism. If value $v(a_i, s_j)$ is a profit objective function, then the following corresponds to the solution chosen by *Hurwitz's criterion*:

$$\max_{a_i}\left\{\alpha \max_{s_j} v(a_i, s_j) + (1-\alpha)\min_{s_j} v(a_i, s_j)\right\}. \tag{16}$$

Parameter α is a criterion of optimism. It is possible to specify a degree of optimism (or pessimism) with an appropriate choice of value α from interval [0; 1]. By Hurwitz's criterion, for each solution the best and the worst results are considered. The hypothesis on the medium behaviour in this case says that with any choice between alternatives the worst option for a decision-maker is implemented with α probability, while the best with probability $(1 - \alpha)$. Then the weighted sum is an i - alternative evaluation.

As a probability, the optimism coefficient α takes values in the interval [0,1], depending on the attitude of the decision maker toward risk. If the decider is totally pessimistic, then $\alpha = 0$. The result will be the same as the maximin criterion. If the decision maker is optimistic then $\alpha = 1$ and the result will coincide with the one given by the maxi-max criterion.

Hurwicz's criterion allows the decision-maker to analyse both the best and the worst outcome of each decision variant and to associate them with a subjective probability of occurrence. For this criterion, the decision of the decision-maker is of great importance, depending on the value of the optimism coefficient α. Obviously, in this case, the decision adopted depends on the value of α which, in turn, depends on the decision-maker's attitude towards risk. By comparing the values one can determine the coefficient of optimism according to which the decisional variants are differentiated.

We note that if a strategy has more than two consequences for this decision, with the exception of the most beneficial and disadvantageous, others will receive zero probability. According to this criterion, the decision maker behaves as if there were only two possible extremes.

As a rule, such a criterion is recommended to be used in medium-sized firms, with the indication that if the degree of optimism of the decision maker is too high, significant income losses on the firm are possible.

In the general case, optimal resolutions got for the considered criteria might be incongruent, which is a surprise. Introducing a particular hypothesis on a behaviour of the environment, we hereby remove uncertainty. However, any hypothesis is an assumption only.

Optimistic criterion. This criterion is the application of the maximax principle, according to which the optimal variant is the one for which the greatest advantages are obtained, in the most favorable state of the objective conditions. The relationship of determining the optimal variant is:

$$V_0 = \max_i \left(\max_j a_{ij} \right) \quad (17)$$

Practically the maximum utilities of all variants are chosen, of which the maximum utility, which will designate the optimal option, will be chosen.

Maximum likelihood criterion. This criterion implies a probable distribution of the statuses and related earnings. The criterion is to take into account the state of the most probable or the most probable achievement and the choice of that decision to maximize the profit or profit corresponding to that state.

We will say that decision A_{j_0} is the best if:

$$C_{i_0 j_0} = \max_j \left\{ C_{i_0} \middle| p_{i_0} = \max_i (p_i) \right\} \quad (18)$$

If there is a multiple optimal decision, another appreciation procedure should be applied.

Criterion average profit of Bayes. Under this criterion, it is assumed that the value of the gain of strategy *j* is:

$$C_j = \sum_{i=1}^{m} p_i c_{ij} \text{ with } p_i > 0, \quad \sum_{i=1}^{m} p_i = 1, \quad (19)$$

Unknown probabilistic partition of the states of nature. Determining this distribution is based on various previous observations and experiences that decision-makers have, without the use of calculus formulas in probability theory. It is said that the system is in a state of balance or decisional indifference if there is a distribution $\{p_i\}$ such $c_j = c_{j+1}, j = \overline{0, n-1}$.

If we are in the state of decisional indifference, the n equality relations together with $\sum_{i=1}^{m} p_i = 1$ make a system of $n+1$ equations with m unknowns (p_i values). This system can allow a single solution (single equilibrium), indefinite (an infinite equilibrium situation), or it may be incompatible (there is no equilibrium). If the system accepts a single solution, we replace the p_i values in the earnings calculation and we choose the maximum gain. If the benefit distribution is known then it is said that the decision is optimal if it leads to a maximum average benefit, *i.e*:

$$C_{j_0} = \max_j (C_j) \quad (20)$$

Based on this relationship, in relation to the equilibrium point, the system of decisions can be analyzed according to the average profit values. If there is no balance, the analysis of the decision system becomes inconvenient.

The Bayesian analysis compensates for the lack of statistical information on the likelihoods of producing natural states with subjective probabilities granted by their decision-maker. An a priori bayesian analysis and a posterior one are distinguished. In the a priori analysis, after giving the subjective probabilities, for each strategy of the decision maker an average efficiency is calculated, weighing each consequence with the corresponding probabilities. Subjective probabilities give the decision maker a basis for substantiating the decision, and the issue is treated as under risk.

Posterior Bayesian analysis is therefore a way to reduce decision-making issues under uncertain conditions to decision-making issues in risk conditions using the decision-maker's reason (subjective probabilities) and the best information available at the time of the decision.

Criterion of simple information of Jeynes. This criterion extends Laplace's criterion using Jeynes' maximal information principle that it is chosen as a distribution of situations (benefits) that distribution that maximizes the amount of simple information:

$$H(p_1, p_2, \ldots, p_m) = -\sum_{i=1}^{n} p_i \ln p_i \text{ with the condition } p_i \geq 0, \sum_{i=1}^{n} p_i = 1 \quad (21)$$

Unless additional conditions are imposed, the uniform distribution is the optimal solution for the problem and we are in the Laplace criteria assumptions. If the condition is $C_j = C_{0j}$ with fixed j, where C_j represents the average gain obtained from the decision j, the optimal solution of the problem is:

$$p_i = \frac{e^{\beta C_{ij}}}{\sum_{i=1}^{m} e^{\beta C_{ij}}} \quad (22)$$

where: β represents the unique solution of the equation:

$$\sum_{i=1}^{m} (C_{ij} - C_{0j}) e^{\beta C_{ij}} = 0 \quad (23)$$

Determining the $(p_i)_i$ distribution we can also apply the criterion of the average profit or the criterion of maximum fidelity.

The criterion of the weighted maximum information of Guiaşu. This criterion is more rarely found in the books of the decision theory. It extends Jaynes' criterion, based on the amount of weighted information corresponding to the states. The weighted entropy introduced by Guiaşu (Purcaru 1996) is:

$$G(p_1, p_2, \ldots, p_m; u_1, u_2, \ldots, u_m) = -\sum_{i=1}^{m} u_i p_i \ln p_i, u_i > 0 \quad (24)$$

where: $(u_i)_i$ represent the utilities or weights of the amounts of information ($(-\ln p_i)$) or probabilities $(p_i)_i$, and therefore of the corresponding states (or benefits).

If $u_i = 1, i = \overline{1,m}$ we return to the simple information criterion. With the distribution condition $\sum_{i=1}^{m} p_i = 1, p_i \geq 0$, the problem:

$\max G = -\sum_{i=1}^{m} u_i p_i \ln p_i, \sum_{i=1}^{m} p_i = 1, p_i \geq 0$ have following solution:

$$\begin{cases} p_i = e^{\frac{\alpha}{u_c}} \\ i = \overline{1,m} \end{cases} \quad (25)$$

where: α is the unique solution of the equation $\sum_{i=1}^{m} e^{\frac{\alpha}{u_i}} = 1$.

If enforce the additional condition of the average of earnings:

$$\sum_{i=1}^{m} C_{ij} p_i = C_{0j}, j = \overline{1,n+1} \quad (26)$$

then the solution is:

$$p_i = e^{\frac{\alpha+\beta C_{ij}}{u_i}}, i = \overline{1,m} \text{ with fixed j} \quad (27)$$

where: (α, β) is the unique solution of the system:

$$\begin{cases} \sum_{i=1}^{m} e^{\frac{\alpha+\beta C_{ij}}{u_i}} = 1 \\ \sum_{i=1}^{m} (C_{ij} - C_{0j}) e^{\frac{\alpha+\beta C_{ij}}{u_i}} = 0 \end{cases} \quad (28)$$

4.1. Study case. Numerical application

A company wishes to organize a concert at which the costs with the participation of a rock band is 140000 u.m. (monetary units). From the organizational experience, the company appreciates that if there is sunny time the receipts will amount to 200,000 u.m., and if it will be rain only at 20000 u.m., which makes the difference of 120000 u.m. for the payment of the invited rock band to be borne from the company's funds.

Also, it is estimated that if cloudy proceeds will be 100000 u.m. In these situations, the company takes into account an A1 insurance for cloud time of 50000 u.m for a premium of 10000 u.m and a A2 rain insurance of 120000 u.m. for a premium of 40000 u.m. Thus, the benefit matrix is the following

Insurance / Weather condition	Yes		No
	A_1	A_2	A_3
Sunny	190000	160000	200000
Cloudy	140000	60000	100000
Rain	10000	140000	20000

Does the company have to make insurance? What kind of insurance should be done? To solve this situation occurs the following variants:

1. *According to Wald's criterion*:

$$\begin{cases} \min_j(C_{1j}) = \min\{190000;160000;200000\} = 160000 \text{u.m.} \\ \min_j(C_{2j}) = \min\{140000;60000;100000\} = 60000 \text{u.m.} \\ \min_j(C_{3j}) = \min\{10000;140000;20000\} = 10000 \text{u.m.} \end{cases} \quad (28)$$

So, $\max_i\left(\min_j C_j\right) = \max\{160000;60000;10000\} = 160000 \text{u.m.}$ and A2 type insurance for rain is decided.

2. *According to Hurwicz's criterion:*

$$\begin{cases} \max_j(C_{1j}) = \max\{190000;160000;200000\} = 200000 \text{u.m.} \\ \max_j(C_{2j}) = \max\{140000;60000;100000\} = 140000 \text{u.m.} \\ \max_j(C_{3j}) = \max\{10000;140000;20000\} = 140000 \text{u.m.} \end{cases} \quad (29)$$

So, $\max_i\left(\max_j C_{ij}\right) = \max\{200000;140000;140000\} = 200000 \text{u.m.}$ and the decision is not to make insurance.

3. *According to Savage's criterion:*

$$\begin{cases} \text{a) } \max\left(C_{1j}\right)=200000=C_{13} \\ \max\left(C_{13}-C_{1j}\right)=\max\{10000;40000;0\}=40000 \\ \text{b) } \max\left(C_{2j}\right)=140000=C_{21} \\ \max\left(C_{21}-C_{2j}\right)=\max\{0;80000;40000\}=80000 \\ \text{c) } \max\left(C_{3j}\right)=140000=C_{32} \\ \max\left(C_{32}-C_{3j}\right)=\max\{130000;0;120000\}=130000 \end{cases} \quad (30)$$

Because $\min\limits_{i}\left(\max\limits_{j}\left\{\max\limits_{j}\left(C_{ij}\right)-C_{ij}\right\}\right)=\min\limits_{i}\{40000;80000;130000\}=40000$ it turns out that the best decision is insurance against rainy weather.

4. *According to the maximum likelihood criterion:*

if $p_1=\max\{p_1,p_2,p_3\}$ non-insurance is recommended;
if $p_2=\max\{p_1,p_2,p_3\}$ A_1 type insurance is recommended;
if $p_3=\max\{p_1,p_2,p_3\}$ A_2 type insurance is recommended.

In this case it can occur a situation like $p_1=p_2>p_3$ and things become vague in terms of decision making.

5. *According to Bayes' criterion:*

$$\begin{cases} C\left(A_1\right)=190000p_1+140000p_2+10000p_3 \\ C\left(A_2\right)=160000p_1+60000p_2+140000p_3 \\ C\left(A_3\right)=200000p_1+100000p_2+20000p_3 \end{cases} \quad (31)$$

with the equilibrium conditions $C\left(A_1\right)=C\left(A_2\right)=C\left(A_3\right)$ and the distribution $p_1+p_2+p_3=1$ we obtain the system:

$$\begin{cases} 3p_1+8p_2-13p_3=0 \\ p_1-4p_2+p_3=0 \\ p_1+p_2+p_3=1 \end{cases} \quad (32)$$

With the unique solution $p_1=\frac{11}{20};p_2=\frac{1}{5};p_3=\frac{1}{4}$, for which we have the average profit $C\left(A_1\right)=C\left(A_2\right)=C\left(A_3\right)=135000$ resulting a decisional indifference.

If $\left(p_1,p_2,p_3\right)\neq\left(\frac{11}{20},\frac{1}{5},\frac{1}{4}\right)$ results $\left(C\left(A_1\right),C\left(A_2\right),C\left(A_3\right)\right)\neq\left(135000,135000,135000\right)$. As a result, one of the insurance decisions may be used on a case-by-case basis. *For example,* if $\left(p_1,p_2,p_3\right)=\left(\frac{1}{2},\frac{1}{4},\frac{1}{4}\right)$ then we get average profits $\left(C\left(A_1\right),C\left(A_2\right),C\left(A_3\right)\right)\neq\left(135000,130000,130000\right)$ and we prefer A1 type insurance.

6. *According to Laplace's criterion:*

$$\begin{cases} C(A_1)=\dfrac{190000+140000+10000}{3}=\dfrac{340000}{3}=113334 \text{ u.m.} \\ C(A_2)=\dfrac{160000+60000+140000}{3}=\dfrac{360000}{3}=120000 \text{ u.m.} \\ C(A_3)=\dfrac{200000+100000+20000}{3}=\dfrac{320000}{3}=106667 \text{ u.m.} \end{cases} \quad (33)$$

and A2 type insurance is recommended.

7. *According to the criterion of simple maximum information (Jeynes)*, if the medium profit condition is required $200000p_1+100000p_2+20000p_3=140000$, then the equation $\sum_{i=1}^{m}\left(C_{ij}-C_{0j}\right)e^{\beta C_{ij}}=0$ becomes $\left(3e^{5\beta}-2\right)e^{4\beta}=6$ and has a unique determined solution, $e^{\beta}\approx 1{,}135$.

It is then found using the relationships:

$$\begin{cases} p_i=\dfrac{e^{\beta C_{ij}}}{\sum_{i=1}^{m}e^{\beta C_{ij}}} \\ p_1=0{,}17;\quad p_2=0{,}29;\quad p_3=0{,}54 \end{cases} \quad (34)$$

Using the maximum likelihood method, an A2 type insurance is decided.

8. According to the *maximum weighted information criterion (Guiasu)*, and if hypothetically assumed, the situation in which $u_1=1;\ u_2=5;\ u_3=10$, according to the relationship $p_i=e^{\alpha/u_i}$, we have $p_1=e^{\alpha}$, $p_2=e^{\alpha/5}$, $p_3=e^{\alpha/10}$. How $p_1+p_2+p_3=1$ it follows that $p_1=0{,}0179$, $p_2=0{,}3721$ şi $p_3=0{,}61$ and $p_3=0{,}61$.

Applying the criterion of maximum likelihood, type A2 insurance is recommended.

Conclusion

In terms of the multidimensional nature of uncertainty as a category, a close definition of a number of funded features, properties, and characteristics of available uncertainties in economics is of critical importance. In this regard, the authors have reviewed the category to define basics of uncertainty. In the survey, they have examined mathematical models of uncertainty in economics, given their comparative typological characteristics, as well as discussed criteria for management decision-making and conditions under which any criterion gives the best effect.

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Efficiency of Applying Risks Management Systems at Industrial Enterprises under Market Conditions

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Abstract:

Under the modern conditions the risks analysis and management at enterprises are of great importance for taking and implementing management decisions. Today it is possible to say that this area in the management science has been formed and is successfully being developed both in theoretic and applied aspects. Nevertheless, under the modern economic conditions it has not only lost but even strengthened its urgency. This article is devoted to issues related to the efficiency of risk management under the modern conditions, and methods of increasing its efficiency. The authors position a system of risks management in the matrix form as a principle model of risk management at the enterprise. They single out various "risk zones" according to the degree of their acceptability for the enterprise. Herewith, the task of management is to lead the enterprise from the unacceptable risk zone to the zone of the low and most acceptable risk with the minimum losses.

Key words: risk management; enterprise; economic efficiency; optimization task

JEL Classification: D81; O10

Introduction

The modern economic situation can be characterized as highly risky for enterprises of various areas. Along with particularly urgent political risks, risk of a fall of demand for the manufactured products (services), slowing or complete lack of the economic growth (increase) of the market supply, inflation risks and risks of currency rates fluctuations, etc. increase. All risks must be obligatorily taken into account during situational and forecasting economic and financial calculations, when planning and taking measures within the policy of the production and financial management of the enterprise. In the context of the difficult market situation it is more and more difficult for the management to forecast, quantitatively measure, manage and foresee risks compensation when performing the production activity.

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Issues related to defining, classifying, and quantitative measuring of risks always held key positions in the economic science due to the fact that the risk is above all a probability of any event in the future as it is defined in the classical work of Knight (2003). The risk as a whole and its role in the everyday activity has been studied for long both by national (Algin 1989, Granaturiv 2002) and foreign researchers (Barton, Shenkir and Walker 2003, Jorion 1997, Dowd, Braleye, Mayers, Van Horn, Krushviz *et al*. 1998). Such researchers as Karlik and Diatlov (2013) paid their attention to peculiarities of Russian enterprises functioning and managing in the context of unstable external environment. Works of Demidenko et al. (2010, 2015), Osipov (2009) are devoted to principles of the enterprise growth "under the fall conditions".

1. Problem setting

In order to solve the above tasks on risks management at the enterprise, there is a system of risk management. Risk management is a system of risks management by taking management decisions aimed at minimizing possible losses related to implementing every specific type of risk associated with the activity. The risk management system is an element (subsystem) of the whole system of procedures related to the enterprise management and in case of a specific research does not resist them (Strizhakova and Strizhakov 2006).

When researching systems of risk management at enterprises, it is possible to single out two basic areas of the activity under risks analysis and management, and risks themselves, *i.e.* defining notions related to risks, revealing risks, composition and classification of types of risk, indicators and criteria of the qualitative and quantitative estimation of the risk and its value, revealing and eliminating reasons of risks, preventing risks, and optimizing expenses for decreasing the possibility of risks.

The second aspect includes optimization of economic results of risk management. In this case the object of the analysis and management is not the risks themselves but the possibility to optimize positioning of the enterprise in the environment of risks. The basic attention is focused on measures related to decreasing or compensating economic losses occurring from risks. So called "risks matrix" serves as a principle model (scheme) of risks management. At the present time it is widely spread. The Table 1 below, shows an exemplary form of the risks matrix.

Table 1. Risks Matrix

		Impact of risk on the enterprise economy		
		Small	Great	Critical
The possibility of the risk	Quite possible	Medium	Very high	
	Rather probably	Low	High	High
	Very unlikely	Low	Low	Low

The above "risks matrix" applied in modern systems of enterprises risk management allows to position the enterprise in the system of coordinates of discrete variables that characterize the efficiency of management (Pavlenko, Kovaleva and Radoutskiy 2015). Positioning of the enterprise means that it, while holding a specific place in the system of coordinates under consideration or a specific cell the risks matrix, suffers losses from implementing risks. It is clear that there can be more than two features of positioning (number of coordinates). In this case there is multidimensional positioning of the management object (or objects). The risks matrix will also be multidimensional. In order to make manipulations with multidimensional matrixes, it is necessary to apply more comprehensive mathematical models than those applied in the case under consideration. However, principles and techniques remain the same.

2. Methods of research

When using the risks matrix, zones of risk can be singled out depending on the degree of its acceptability for the enterprise: zone of low risk, medium risk, high risk, very high risk and unacceptably high risk. The task of management is to improve the position of the enterprise, "transfer" it from the zone of a less acceptable risk to the zone of a more acceptable risk (for example, from the zone of high risk to the zone of medium or low risk). As stated

above, positioning means that, when holding a specific place in the represented system of coordinates (*i.e.* a specific cell in the risks matrix), the enterprise suffers losses from implementing risks. Herewith, a specific degree/value of losses corresponds to every cell. The enterprise constantly suffers these losses while its positioning in the risks matrix (the cell in the matrix it occupies) remains unchangeable. Moving within the system of coordinates or changing the position "from worse to better" causes "expenses for position changing". Correlation of changing the level of losses with the expenses for position changing allows to estimate the efficiency of managing a risk of a certain enterprises at the certain period of time or in the dynamics, and to compare the efficiency of managing risks of various enterprises.

For example, the following variables (coordinates) can act as discrete variables that form the coordinate plane of positioning:

- risk. Discrete states: high, low;
- losses (discrete levels of fixing losses): high, medium, low, and small.

Mathematical setting of the task related to selecting the optimal path of the object (enterprise) in the matrix of positioning can be represented in the following form

$$\sum_{T=1}^{M} X_T * (\sum_{i=1}^{N} Z_{iT}) \rightarrow \min$$
$$X_T = 0;1 \quad (1)$$
$$\sum_{T=1}^{M} X_T = 1, i = 1...N, \quad T = 1...M$$

where: Z_{IT} – expenses for changing the position in the risks matrix (the length of the graph curve) on the "T" path during Stage I of solving the task expressed in cost/monetary units; X – a managing variable (it takes the value of 0.1); M – a number of possible paths of the position change.

The real risks matrix contains a lot of intermediate states of the system (enterprise). The table/matrix is large (it has a lot of cells). The task of risk management is to promote the production system in the "risks" – "losses from risk" and "from bad state to good" coordinates. Herewith, paths of movement that differ by the "transfer expenses" value are possible.

The enterprise management must choose such path that will ensure the minimum expenses for changing the position in the risks matrix. The limitation shows that as a result at least one path of moving in the matrix of positioning must be chosen. It means that if there are several variants of moving from one point of positioning (matrix cell) to another, it is necessary to choose only one variant of the path with the least expenses for the transfer.

The task could be solved by sorting out all possible variants/paths of changing the position in the matrix. However, if the risks matrix is large, the process of looking for an optimal solution could be too difficult or would require applying special calculation procedures. This model is an optimization integral-valued task of the mathematical programming. In order to solve it, it is offered to use the method of dynamic programming (Bellman method) (Bellman 2013).

The method of dynamic programming is the purposeful singling out of the final number of solutions variants, which provides optimal solving of the task by using the following rule:

$$\min_{T}(Z_{iT} + V_{i-1,\,r})$$
$$\min_{T}(Z_{i-1,\,T}) = V_{i-1,\,r} \quad (2)$$
$$I = 1 \ldots N, \qquad T = 1 \ldots M$$

where: Z_{IT} - expenses for changing the position in the risks matrix (the length of the graph curve) on the "T" path during stage I of solving the task expressed in cost/monetary units; $V_{i-1,\,r}$ - expenses for transferring to the point according to the "T" path at the specific "i" stage.

The offered method is usually applied to tasks where the required answer consists of the parts each giving an optimal solution of a sub-task. Such task may have many possible solutions but it is necessary to choose the optimal one when the value of a parameter will be minimum and maximum. Herewith, the target function, limitation of the optimization task, or both are simultaneously characterized by non-linear relation, not obligatorily in the analytical form.

3. Key results

The mathematical model of positioning the object (enterprise) in the risks matrix can be represented in the form of the graph (Figure 2). The graph peaks are points of positioning in the matrix (points from 1 to 8), and the graph "curves" reflect the relations between peaks (arrows in the figure). The length of every curve characterizes the value of expenses related to transferring from one state to another, or expenses for changing the position in the risks matrix. The methodology of defining the path of optimal positioning of the enterprise is applied for the risks matrix represented in Table 2.

Table 2. Applying the methodology of defining the path of optimal positioning of the enterprise

Risk			*B*			Losses (units)							
		1	3		**2**	6		**3**	8		**4**		
			→			→			→				
	↓	2	high	↓	2	medium	↓	2	moderate	↓	2		
		5	1		**6**	3		**7**	6		**8**		
			→			→			→				*H*

Stages of solving are defined according to one of the variables ("losses" in the case under consideration). Three stages are singled out. Points "B" (high risks and high losses) and "H" (low risks and low losses) are singled out in the matrix. It is necessary to define the optimal path for this matrix that provides the transfer of the enterprise from the "bad" position (point "B") to the "good" position (point "H") with the lowest expenses for changing the positioning or transferring. The transfer in the matrix is allowed only in the positive direction", *i.e.* according to the rule "downwards and to the right". Three intervals of changing the "loss" variable (high – medium, medium – low, low – small, they are also stages of solving the task) and one interval of the changing the "risk": interval (high - low) were singled out in the matrix. Points of positioning in the graph or matrix are defined by counting numbers from 1 to 8. Figures above the graph curves show expenses for changing the position.

Thus, for example, expenses for the transfer from position 2 to position 6 will make up 6 cost/monetary units. As it can be seen from the matrix, after the first stage of solving, the enterprise position can be defined in points 2 and 6, after the second stage – in points 3 and 7, and after the third stage the final decision in point 8. In order to define the optimal path, calculation Table 3 is made.

Table 3. Calculating expenses for positioning of objects in the risks matrix

Stage of solving "i"	Point of positioning	Path of the transfer between points of positioning	Expenses for the transfer to the "T" point in the path, minimal expenses "V_{iT}" are marked with (*)
1	2	1 → 2	3 (*)
	6	1 → 2 → 6	3+2=5
		1 → 5 → 6	2+1=3 (*)
2	3	2 → 3	3+6=9
	7	2 → 3 → 7	3+6+2=11
		2 → 6 → 7	3+2+3=8
		6 → 7	3+3=6(*)
3	8	3 → 4 → 8	9+8+2=19
		3 → 7 → 8	9+2+6=17
		7 → 8	6+6=12(*)

The result of the calculation table (Table 1) shows that the optimal path of changing the position of the enterprise in the risks matrix provides minimum expenses for positioning. In our case they will be equal to 12 monetary units. The only optimal path is determined in the direction that is opposite to the way of the task solving and is represented in the following form: $1 \rightarrow 5 \rightarrow 6 \rightarrow 7 \rightarrow 8$.

The optimal path is not obligatorily single. There can be several of them. In this case they are equal.

4. Discussion

The article sets a task related to optimal management of the enterprise risks (optimal path of moving in the matrix) in terms of theory. Issues related to the practical use of the offered model at enterprises such as defining expenses for positioning, determining the most acceptable zones of risks are open for further study.

Conclusion

Generalizing the provisions that characterize the state of modern risk management systems used by enterprises, it is possible to state that, if correctly applied, "the risks matrix" that allows to position the enterprise in the system of coordinates of discrete variables (in the case under consideration this is a degree of losses from the risk and probability or size of the risk) can be an efficient tool to manage risks. Herewith, it is possible to single out zones of risk according to the degree of its acceptability for the enterprise because the task of management is to improve the position of the enterprise, transfer it from the zone of a less acceptable risk to the zone of a more acceptable risk (for example, from the zone of high risk to the zone of medium or low risk). Being in a specific position in the system of coordinates under consideration, the enterprise suffers losses from risks. Moving within the system of coordinates "from the worse to better" causes "expenses related to changing the positioning". Correlating changes of losses with expenses related to the positioning change allows to estimate the efficiency of managing a risk of a specific enterprise and to compare the efficiency of enterprises management. However, herewith, it is necessary to define the criteria of efficiency that are not currently defined.

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The Role of Net Export on Economic Growth in United States of America

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Abstract:

The study analyses the role of net exports on economic growth in the United States of America (USA). This was necessitated by the resounding economic resilience that has been experienced by the USA and assertions have pointed to net exports but have also attracted different assertions from other studies. As such the study sought to analyze the role of net exports on economic growth with regards to the USA. The study was conducted using secondary data collected from the 1970: Q1 – 2015: Q1 and was analyzed using a Vector Error Correction Model (VECM). The results from the study showed that there is a long run co-integration between net exports and economic growth in USA. Import levels and unemployment were observed to be negatively related to economic growth.

Keywords: economic growth; net exports; gross domestic product; imports; unemployment

JEL Classification: C51; F10

Introduction

The economic growth rate of USA registered a level of -0.92% in December 2008, 3.88% in December 2014 and 2.93% in December 2015 estimates by Bureau of Economic Analysis (2015) revealed that the 1.5% increase in economic growth in the third quarter of 2015 was as a result of positive contributions from non-residential fixed, residential fixed investments, personal consumption expenditure, state and local government spending. During the same period, the Bureau of Economic Analysis (2015) revealed exports had decelerated in the third quarter of 2015. Such a decline in exports is assumed to have not played a part to the increase in GDP.

On the other hand, various studies have been undertaken to determine what drives economic growth. A study done by Sun (1998) revealed that foreign direct investment (FDI) has a positive contribution to economic growth. On the contrary, Aslanoglou (2002) used time series data from the period 1975 to 19995 to examine the impact of foreign direct investment economic growth in Turkey. The results from the study showed that foreign direct investment has an insignificant positive contribution to economic growth.

Fischer (1993) undertook a study to examine the determinants of economic growth. This study was based on a panel of nine developing countries. The results showed that there is non-linear relationship between inflation and economic growth at break points of 15% and 40% in spline regression. Studies on the role of net exports on economic growth are still underway as they try to establish what exactly drives economic growth.

1. Problem statement

Most economic theories and empirical studies postulates that economic growth is as a result of domestic investments while others argue that net exports are an engine of economic growth as it brings in the much needed foreign currency to further finance the production of both capital and consumer goods. Other researchers such as Darrat (1987) argued that net export contributions are not significant enough to cause major changes in economic

growth. This sentiment was echoed by who contends that Worz (2003) net exports are just an indicator of an economy's productive capacity. There is no consensus among the available studies about the nature of roles played by net exports towards promoting economic growth. Others argue that factors such as foreign direct investment and domestic capital formation are the major influencers of economic growth. This is in contrary to the Export Led Hypothesis which contends that exports promotion stimulates the economy into producing more goods and hence stretching the productive capacity of that economy. As a result, there is no common agreement as to the exact role played by net exports on economic growth. This study therefore seeks to examine the role played by net exports on economic growth.

2. Scope of the study

The study is centered on analyzing the role of net exports on economic growth in the United States of America. The present study will dwell on United States of America because it is relevant to the objective of the study as one of the fastest growing economies in the world. The period of study will span from 1977 to 2014. This is because longer periods are so essential when dealing with time series data. The variables used are real Gross Domestic Product (GDP) without exports, net exports, employment level, domestic investment and real gross capital information.

3. Significance of the study

This study is of significant importance because a significant number of studies have focused on the role of FDI on economic growth in USA. Those that address the role of net exports on economic growth in the USA have depth problems. That is, they do not cover significant ground in explaining the role of net exports on economic growth. This is because of weak methodological approaches. Moreover, the Export led Hypothesis still plays a significant role in modern economies and considering the rate at which economic development has evolved, there is greater need to establish new facts based on such development to ensure that proposed recommendations are relevant to the time under consideration.

4. Theoretical considerations

The role of net exports on economic growth has its theoretical underpinnings based on the national income equation. The national income equation is based on the assertion that total output produced is a function of consumption (C), investment (I), government expenditure (G), exports (X) and imports (M). The national income approach further contends that total output can be expressed in a mathematical expression of the following nature;

$$Y = C + I + G + (X - M) \quad (1)$$

This equation can be differentiated with respect to Y, that is, Y = dY / dt giving the following form;

$$\frac{Y}{Y} = \frac{dC}{dY} + \frac{dI}{dY} + \frac{dG}{dY} + \frac{dNE}{dY} \quad (2)$$

where: NE is net exports obtained by deducting imports from exports (X – M).

Based on equation 3, each element of the national income equation will exert difference impacts on economic growth denoted by (Y). Thus the role of net exports on economic growth can be estimated by the ratio, $\frac{dNE}{dY}$. This ratio represents changes in economic growth attributed to changes in net exports. This mathematical expression can be used to determine the role of net exports on economic growth in the USA. McConnell, *et al.* (1999) produced a tabular form of this mathematical expression and this is shown in Table1.

Table 1. Decomposition of the United States' growth for the periods 1959-83 and 1984-83

	Standard Deviation		Difference
	1959-83	1984-98	
GDP	4.4	2.2	-2.2
Consumer spending			
Goods	4.7	3.8	-0.9
Services	1.9	1.5	-0.4
Investment			
Residential	23.9	11.6	-12.3
Business	10.0	7.9	-2.1
Government Purchases			
Federal	7.5	7.2	-0.3
State and Local	4.1	2.1	-2.0
Net exports			
Exports	18.8	7.7	-11.1
Imports	17.8	7.8	-10.0

Source: McConnell *et al.* (1999)

Form the above table, it can be deduced that net exports having been positively contributing to economic growth. The margin of contribution however declined from a margin of 1% in the period 1959-1983 to -0.1 in the period 1984-1998. Possible reasons point to a decline in exports' standard deviation from 18.8 to 7.7. This is however insufficient for one to construct explanations upon which logical deductions can be made to explain the role of net export on economic growth in the United States of America. Theoretical concepts are a significant prerequisite of such explanations. Henceforth, this chapter will proceed to look at the theoretical concepts and frameworks that can be used to explain the role of net exports on economic growth in the United States of America.

5. Theoretical overview on export and economic growth

The role of exports on economic growth was observed to be explained theoretically by the Hecksher-Ohlin theory, of which Hecksher-Ohlin theorem posits that exports of goods will constitute those goods whose supply and use are cheaper and abundant. Alternatively, labour intensive economies will export more labour intensive products and capital intensive economies will export more labour intensive products. Thus this theory further asserts that comparative advantage is as result of factor abundance and factor intensity advantages. Hence, economies will export those goods in which they have relatively high comparative advantages. Differences in the prices of exports are thus attributed to differences in comparative advantages.

The second consideration for export and economic growth can be dependent on the neoclassical theory which is originated in a time when the world economy was suffering from problems of economic stagnation. Abedian and Standish (1992) justified the origins of the export-led growth strategy citing poor productivity capacity and lack of industrial competitiveness in most economies around the world. Furthermore, Abedian and Standish (1992) established that a lot of protective measures were hampering economic progress. As a result, great need arose to instill economic flexibility so as to resultantly attain productive levels were desired comparative advantages can be achieved. Krugman (1987) contrasts the idea of trade liberalization asserting that it affects production patterns and that the long term benefits are uncertain.

Insights by Cypher and Dietz (2004) revealed that are significant mutual gains that emanate from trade and can lead to an expansion in economic activity. Ultimately, it was established that specialization was the key to economic growth.

The third theory can be based on the supply side orientation. The supply side orientation offers great support for the adoption of export led strategies. Ideas by Adam Smith (1776) point to view that trade openness results in wealth accumulation and hence the need to promote exports. Srinivasan (2001) argues that only are exports an engine for growth but instead lead to an efficient allocation of resources. This idea was reinforced by Ram (1985)

who postulated that a growth in export oriented industries will cause a shift of resources from areas where their total factor productivity is low to areas where their total factor productivity is high.

It was evidenced from the employed theories that export promotion strategies have a positive effect on economic growth. The growth channels of export promotion pointed to an increase in employment of factors of production, improvements in productivity as a result of product and process innovation and an increase in foreign direct investment. Thus growth effect is contended to be emanating from positive changes in employment, technology and investment. Empirical literature has however diverged in consensus citing that the benefits from exports may not be significant enough to yield positive changes in economic growth or in investment. Suggested reasons suggested the presence of barriers and strict and lack of government regulation. The level of economic growth and development was also evidenced to be playing a significant role towards the effectiveness of exports in promoting economic growth.

6. Empirical literature on the role of net exports and economic growth

A significant number of studies have been put forward to explain the role of exports on economic growth. For instance, Kalaitizi (2013) employed the export-growth analysis in United Arab Emirates using time series data from the period 1980-2010. The analysis was based on the Johansen cointegration and the Two-step Engle Granger cointegration techniques. This technique was backed by the Vector Autoregression Model and the results of the study showed that a long run relationship exists between primary exports, manufactured exports and economic growth. Granger causality results showed evidence of a positive linkage between economic growth and manufactured exports that runs from manufactured exports to economic growth.

A similar study was conducted by Ahdi *et al.* (2013) and it attempted to examine whether a linkage exist between exports and economic growth. The study was focused on South Africa and used time series data spanning from the period 1991-2011. Granger causality test were undertaken to determine if a long run relationship exists between exports and economic growth. The results showed that exports do not significantly influence economic growth. However, nonlinear causality tests exhibited proof that there is a linkage between economic growth and export and it runs in that order. Contrasting results were obtained when they tested the model by applying tests by Diks and Panchenko (2005) and showed that there is negative association between exports and economic growth.

A study by Kim and Lin (2009) took a different twist and analyzed how export composition affect economic growth. The study focused on developing countries and results pointed to the idea that primary products that are meant for exports have no significant impact on growth. The reason suggested that export prices of primary products are prone to a lot of fluctuations. A significant relationship was discovered to exist between manufactured exports and economic growth.

Deeper insights of the role of exports on economic growth were uncovered by Abu al-Foul (2004) who examined the role of export-led strategies on economic growth in Jordan. The study covered the periods 1976-1997. Evidence revealed by the study showed strong support of export-led strategies and advocated for more policies to strengthen the role played by export-led strategies in Jordan. Policy initiatives were urged to focus on promoting investment and exports.

Abou Stait (2005) took a similar twist and analyzed the impact of export-led strategies in Egypt. The difference being that the period of study ranged from 1977-2003 and a Vector Auto Regression model was used to estimate the model. The study sought to determine if cointegration exists between exports and economic growth and whether exports granger cause foreign direct investments. It was concluded that economic growth and exports are cointegrated and that exports granger cause foreign direct investments.

Studies have extended the role of export led strategies and have adopted Granger causality tests to determine the nature and direction between exports and economic growth. Of particular is a study by Awokuse (2003) which employed Granger causality tests to examine the role of export led strategies on economic growth in Canada. A VAR model estimation was used as further support of the obtained results which showed that exports do Granger cause economic growth in Canada. The relationship was observed to run from exports to economic growth.

7. Model estimation

When conducting Vector Error Correction Model estimation using time series data, the variables must contain a unit root at levels but must be stationary at 1st difference. Such information can be provided through unit root tests such as the Augmented Dickey-Fuller Test (1979) and Phillips-Perron (PP) Unit Root Test (1988). The presence of a unit root signifies that the data is non-stationary. The model results are said to be 'spurious' results. It is in this regard that both the Augmented Dickey-Fuller Test (ADF) and Phillips-Perron (PP) will be used to test the variables for stationarity. This requires that an OLS be done using unrestricted regression.

$$Y_t - Y_{t-1} = \alpha + \beta_t + (p-1)Y_{t-1} + \sum_{j=1} \lambda j \, \Delta Y_{t-j} \quad (1)$$

And then, the restricted regression:

$$Y_t - Y_{t-1} = \alpha + \sum_{j=1}^{p} \lambda j \, \Delta Y_{t-j} \quad (2)$$

where: $\Delta Y_t = Y_t - Y_{t-1}$, is considered for calculating standard F ratio to test whether its restricted according to the β=0, ρ=I. Following to this F value is compared to the given table value by Dickey-Fuller. It is expected that the computed value will become greater than the table value for rejecting null hypothesis, which imply our estimation is significance.

A VECM is realized for obtaining information on existence of short run relationship between any two co-integrated variables. The VEC Model focus on analyzing the considered one period lagged error terms from the previously estimated co-integrating equations. By doing this lagged terms contribute for explaining short run deviations from the long-run equilibrium. Estimation of the long-run dynamic relationship between model variables may contribute to prevent any misleading assumption between endogeneity and exogeneity of variables which is considered. Vector Auto-regression Model (VAR) can be used for such situation estimation.

Considered model allow making systematic treat for all variables without any reference whether it is dependence or independence. VAR mode also helps for estimating 'Impulse Response Function' and 'Variance Decomposition' of variables. In this study these techniques all are considered.

8. Data analysis

According to the VECM estimation results it can be deduced that there is no long run causality that runs from economic growth to exports, imports, unemployment and gross fixed capital formation. Exports and gross fixed capital formation are positively related to economic growth. Table 2 shows the obtained VECM estimation result.

Table 2. VECM Estimation

Variables	Coefficient	Standard Error	T-Statistics
Constant	5.545787	-	-
LGFCF(-1)	0.740576	(0.28783)	[2.57300]
LEX(-1)	0.274382	(0.25442)	[1.07845]
LIMP(-1)	-1.030978	(0.41573)	[-2.47993]
LUNEMP(-1)	-3.030601	(1.57743)	[-1.92123]

Using the above results, the following expressions can be made about the estimated model:

LnGDP = 5.545787 + 0.740576LGFCF+ 0.274382LEX - 1.030978LIMP -3.030601LUNEMP (3)

It can be noted that the relationship between economic growth and gross fixed capital formation is positive. This entails that a 1% change in GFCF will initiate a 74.06% increase in economic growth. Possible reasons point to the idea that increasing returns to scale are be reaped and there is an expansion in the economy's productive capacity which is causing an increase in economic growth. This is in support of the study done by Pavalescu, (2007) and possible reasons suggest that the USA economy is spending or investing more towards projects that result in improvement in infrastructure and other capital related activities which foster economic growth.

The linkage between economic growth and imports can be observed to be negative and this is translating to a decline in economic growth by 1.03 units following an increase in imports by 1 unit. Study results by Habees and Rumman (2012) showed that the relationship between economic growth and imports can either be negative or positive. This suggests that the type of imports has a significant impact on economic growth. Producer goods are said to result in an increase in economic growth as compared to consumer goods.

Meanwhile the relationship between economic growth and exports is observed to be positive. This means that an increase in exports by 1% will initiate an increase in economic growth by 27.44%. This is in support of the study results obtained by Lee and Huang (2002) and it can be concluded that foreign currency inflows from exports is being positively used to finance growth related projects.

On the other hand, a negative association can be observed between economic growth and unemployment. Thus an increase in unemployment by 1 unit results in a decline in economic growth by 3.03 units. This is a further reinforcement to the study by Habees and Rumman (2012) which established that there is a negative linkage that exists between economic growth and unemployment. Unemployment is translating to a decline in income and productive capacity which manifest in the form of a decline in growth.

10-Error Correction Term Results (EC_{t-1})

The error correction was observed to be 0.4193 and this means that the speed at which the variables move towards long run stability or equilibrium is 41.93%. It is depicted in Table 3 that both the error correction term and the VECM model are significant at 1%. The Durbin Watson statistic around the limit of 2 and this signifies the absence of serial correlation.

Table 3. Error correction results

Coefficient	-0.419313*
Prob.	0.0000*
Std. Error	0.095053
t-Statistic	-4.411371
R^2	0.4878
DW	2.054549
Prob (F-statistic)	0.0000*

*Note**: Indicates significance at 1% significance level

9. Wald test

This study used Wald test to determine if there are short run relationships that span from gross fixed capital formation, exports, imports and unemployment to economic growth. Thus, Wald test will test the null hypothesis asserting that there exists no short run relationship that spans from the independent variables to the dependent variable. Results are presented in Table 4. All the probabilities provided but Wald test results are less than 5% and thus we reject the null hypothesis of no short run relationship. It can thus be concluded that there is no short run relationship that runs from gross fixed capital formation, exports, imports and unemployment to economic growth.

Table 4. Wald Tests Short Run VECM estimation results - dependent variable: LGDP

ll hypothesis	Test statistic	Value	df	Prob.
Null Hypothesis: C(2)=C(3)=C(4)=C(5)=C(6)=C(7)= 0	Chi-square	3.461	(6,142)	0.0032
	F-statistic	20.764	6	0.0020
Null Hypothesis: C(8)=C(9)=C(10)=C(11)=C(12)=C(13)=0	Chi-square	2.176	(6,142)	0.0487
	F-statistic	13.058	6	0.0421
Null Hypothesis: C(14) =C(15)=C(16)=C(17)=C(18)=C(19)=0	Chi-square	2.658	(6,142)	0.0179
	F-statistic	15.948	6	0.0140
Null Hypothesis: C(20)=C(21)=C(22)=C(23)=C(24)=C(25)=0	Chi-square	2.296	(6,142)	0.0381
	F-statistic	13.777	6	0.0322
Null Hypothesis: C(26)=C(27)=C(28)=C(29)=C(30)=C(31)=0	Chi-square	2.310	(6,142)	0.0370
	F-statistic	13.860	6	0.0312

Source: Computed by Author (E-Views 8.0 iterations Results)

10. Granger causality test

It can be noted that GDP and EX do not granger cause each other and hence the direction of causality is said to be bidirectional. Regarding to the table given below it can be concluded that between GFCF and EX, unemployment and export, and imports and exports.

The direction of causality is bidirectional. However, GFCF does granger GDP but GDP does not granger cause GFCF. Thus the directional of causality is said to be unidirectional and runs from growth. Imports however do granger cause growth and growth does granger cause growth imports. A bidirectional causality is said to exist. The same can be said for imports and GFCF, and unemployment and imports. Unidirectional causality exists between unemployment and GFCF, and unemployment and imports. The direction of causality runs from GFCF to unemployment and from unemployment to imports. It can be concluded that there is no causality between exports and economic growth.

Table 5. Granger Causality

Null Hypothesis:	Obs	F-Statistic	Prob.
GDP does not Granger Cause EX	179	1.23757	0.2926
EX does not Granger Cause GDP		2.94805	0.0551
GFCF does not Granger Cause EX	179	1.71816	0.1824
EX does not Granger Cause GFCF		0.25614	0.7743
IMP does not Granger Cause EX	179	2.89706	0.0579
EX does not Granger Cause IMP		0.79629	0.4526
UNEMP does not Granger Cause EX	179	0.61748	0.5405
EX does not Granger Cause UNEMP		3.40326	0.0355
GFCF does not Granger Cause GDP	179	4.72429	0.0100
GDP does not Granger Cause GFCF		0.66555	0.5153
IMP does not Granger Cause GDP	179	8.96791	0.0002
GDP does not Granger Cause IMP		6.85845	0.0014
UNEMP does not Granger Cause GDP	179	0.81068	0.4462
GDP does not Granger Cause UNEMP		1.79667	0.1689
IMP does not Granger Cause GFCF	179	3.26366	0.0406
GFCF does not Granger Cause IMP		4.05057	0.0191
UNEMP does not Granger Cause GFCF	179	0.84782	0.4301
GFCF does not Granger Cause UNEMP		3.87577	0.0226
UNEMP does not Granger Cause IMP	179	4.26851	0.0155
IMP does not Granger Cause UNEMP		2.30975	0.1023

11. Serial correlation test

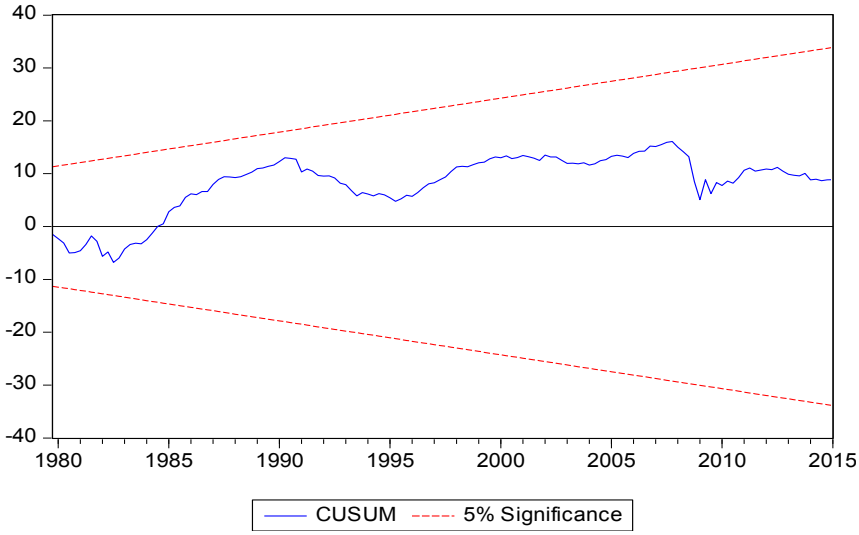
Serial correlation test was conducted using the Breusch-Godfrey Serial correlation LM test and sought to test the null hypothesis that there is no autocorrelation. Evidence provided in Table 6 shows that the estimated model does not suffer from serial correlation evidence.

Table 6. Breusch-Godfrey Serial Correlation LM Test Results

F-statistic	1.187483	Prob. F(2,15)	0.3080
Obs*R-squared	2.902505	Prob. Chi-Square(2)	0.2343

Source: Computed by Author (E-Views 8.0 Iterations Results)

Figure1. Stability Test



It can be observed that the model in within the stipulated bands and hence it is stable and it can thus be used for decision making and other policy related functions.

Conclusion

It can be concluded that there is a positive relationship that exists between exports and economic growth in the USA and such a relationship is being contributed by the positive influence of gross fixed capital formation. However, unemployment and import levels are standing as hindrances to economic growth.

Recommendations

The USA government is advised to increase investment or expenditure towards gross fixed capital formation. Such an increase will translate to improved infrastructure which is also a necessity for economic growth and development.

Measures can also be put in place to further increase export levels. This can be done through the use of export incentives and subsidies. Trade arrangements can also be made to eliminate trade barriers. This may also be reinforced by bilateral and multilateral trade agreements.

There is need to curb the negative impact that is being posed by imports. The negative association between imports and economic growth can be as a result of the effects of inflation. Therefore, efforts must ensure that imports must not stimulate inflationary pressure. This may be done by heavily taxing consumer goods and providing incentives for the import of producer goods.

Many funds must be injected towards financing domestic production so as to boost the employment of both factors of production which include labor. Taxes on personal income and corporate income must not be so high to an extent that they discourage investment and people from seeking employment. Measures can also be adopted that promote FDI inflows especially in productive sectors of the economy.

Suggestions for Future Research. Model stability tests and other tests results have shown that this study provides good estimates of the relationship between exports and economic growth in the USA. However, future studies can incorporate the impact of inflation on growth and can encompass variables such as money supply and exchange rate.

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The Concept of Evaluation of Cluster Development Strategic Outlooks with the Use of Multiples

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Abstract:

This paper suggests an approach making it possible to recognize a core company of a future innovational and industrial cluster in order to subsequently expand this type of business up to a pilot cluster of the region. For that end, it is proposed to use book value multiples, Tobin's *Q* multiple and revenue multiples. They allow determining whether the company in question will be able to become a core of a potential cluster in the very near future. The multiples can also help verify whether a large company meets its current position of the 'cluster core'. With this end in view, its book value multiple is compared with the profitability spread, and the revenue multiples are compared with the profit margin.

Keywords: cluster; the cluster core; the book value of the multiplier; multiplier of revenue; the company's brand value

JEL Classification: D20; D23; D24

Introduction

In the context of economic globalization, present-day globally accepted methods for economic management of countries and their regions become more and more relevant. Russia's continuing integration into the world economy charges both the Government and companies with new tasks, which are aimed to improve the country's compliance with the world's advanced technologies, including in management of the economy and finance. For instance, applying IFRS standards in financial statements of public companies has become a prerequisite of their recognition in the market and their future development.

Clusters are also of paramount importance in such globalization process (Porter 1998, Tukkel *et al.* 2013). Despite their great variety in the economy, this paper emphasizes regional innovational and industrial clusters. Such variety of rules and methods of economic management by regional companies, and most importantly, a variety of methods of interaction between companies result in formation and successful development of informal groups of companies. Such companies may operate in the same industry and in related industries. But the reality of the 21st century is such that clusters indirectly regulated by the government are the most efficient structures in

economic and social terms. This makes even stronger the well-known synergistic effect that is common to clusters themselves (Porter 1998, Tukkel *et al.* 2013).

In this connection, present-day advanced methods of cluster development management are of special relevance. In spite of a great abundance of books on management, where general principles of origination and evolution of clusters are described (Porter 1998, Gromyko 2007, Shvetsov 2014, Egorova 2014, Patrusheva and Bolshakova 2015), this paper pays attention to somewhat different issues. Namely, we have studied already existing and attempted to create our own cluster efficient development management model.

1. Theoretical models

Although there is a number of standard cluster management models, which may include, for instance, Leontyev's model (Tukkel *et al*. 2011, Prosvetov 2012), the matrix approach to cluster management (Bergman and Feser 1999), the gravity models (Bogomolov and Surina 2011), the model of creating an export-oriented regional cluster (Gnevko and Rokhchin 2004, Tukkel *et al*. 2013), the model of cluster construction based on the fractal theory (Fedorenko 2010), and the processes of cluster formation and evolution have not yet been studied in sufficient detail. The models required for this must adequately describe organizational issues and market mechanisms for their implementation using the relevant mathematical tools for that purpose.

Furthermore, one cannot but take into consideration the fact that even in the presence of efficient interaction between three key agent types: scientists, government officials and businessmen, it is required to orient a future pilot cluster and its potential further development to brand appreciation of such cluster, which is actually composed of brands of companies constituting its core.

2. General description of multiples required for analysis

At present time, there are a great number of various financial multiples, depending on what exactly an analyst wishes to clarify. However, multiples have the following basic classification (Damodaran 2002):

- earnings multiples (PE and PEG);
- book value multiples (PBV and Tobin's Q multiples);
- revenue multiples (PS and VS);
- specific sectoral multiples for IT companies.

We are not going to dwell on all the listed types of multiples. Let us only describe those groups of theirs, which will be useful to us in evaluating a potential core company of a cluster.

Thus, constructing simplest single-phase multiples is based on well-known Gordon model (Brigham and Gapenski 1993):

$$P_0 = \frac{\mathrm{DPS}_1}{k_s - g} \tag{1}$$

where: P_0 - current fair market value of company share (RUB); DPS_1 - dividend amount on one ordinary share in the next forecast period, such as a year after (RUB); k_s - cost of company equity capital (%); g - growth rate of company earnings and dividends (%).

The Gordon model makes it possible to construct simplest earnings multiples (PE), book value multiples (PBV) and revenue multiples (PS), which, as well as more complicated two-phase multiples, when being elementarily decomposed, offer an opportunity to detect changes in basic determinants (constituents) of the multiples and their impact on values of the multiples themselves:

$$\mathrm{PE} = \frac{P_0}{\mathrm{EPS}_0} = \frac{1}{\mathrm{EPS}_0} \cdot \frac{\mathrm{DPS}_1}{k_s - g} = \frac{\mathrm{DPS}_0(1+g)}{\mathrm{EPS}_0(k_s - g)} \tag{2}$$

$$PBV = \frac{P_0}{BV_0} = \frac{EPS_0}{BV_0} \cdot \frac{DPS_0(1+g)}{EPS_0(k_s - g)} = ROE \frac{DPS_0(1+g)}{EPS_0(k_s - g)}$$

$$PS = \frac{P_0}{S_0} = \frac{EPS_0}{S_0} \cdot \frac{DPS_0(1+g)}{EPS_0(k_s - g)}$$

where: EPS_0 - net profit on one ordinary share in the current year (RUB); BV_0 - book value of one ordinary share in the current year (RUB); ROE - return on equity (%); S_0 - revenue per one ordinary share in the current year (RUB); DPS_0/EPS_0 - payoff ratio (multiple); EPS_0/S_0 - net profit margin.

For more detailed evaluation of reasons leading to certain changes in the values of multiples, they are decomposed into even more fundamental variables. The same approach allows predicting for the short-term opportunities for growth of the company under review due to current changes in some fundamental variables.

3. Empirical results

As an example that we are going to consider in this paragraph, let us take JSC GAZ. This is a company that publishes its IFRS statements, from where one can obtain necessary balance sheet and market data. In addition, GAZ is currently included into the five anchor participants of the Nizhny Novgorod industrial innovation cluster (*www.cluster.hse.ru*). In this case, it is reasonable to check this company for its compliance with the cluster core.

Let us analyze GAZ IFRS statements for 10 years from 2007 to 2016 (*www.gazgroup.ru*). The presented statements contain annual EPS values, but there is no similar DPS data. The fact is that GAZ, practically every year within the space of 10 years, accrued dividends on ordinary shares but paid them out by no means at once. Delays continued for several years. As a result, there were arrears in dividends. Due to this fact, it makes no sense to take data on actually paid dividends because this will essentially misrepresent the company annual growth rates. Then let us calculate a dividend per ordinary share (DPS) on our own in Table 1 by dividing the total amount of dividends on ordinary shares ($\sum$DPS) into the actual number of these shares (N_s). Let us also present EPS values in the same table for comparison.

In the financial theory, there are three flagship approaches to estimation of the growth rate *g* by a marginal investor:

- historical growth rate of earnings and dividends;
- undistributed profit growth evaluation model;
- analysts' forecast of growth rate of earnings and dividends (Brigham and Gapenski 1993).

3.1. Company growth rate forecast

Let us at once abandon the classical forecast methods due to their serious error (Brigham and Gapenski 1993; Yashin *et al.* 2012) and pass on to the fundamental analysis of the rate *g*. An undistributed profit growth evaluation model based on free cash flows (Damodaran 2002) looks like this:

$$g = RIR \cdot ROC = RIR \cdot \frac{EBIT(1-T)}{BVC} = \frac{EBIT(1-T) - \sum DPS}{EBIT(1-T)} \cdot \frac{EBIT(1-T)}{NS} \cdot \frac{NS}{BVC} \quad (3)$$

where: RIR - reinvestment rate; EBIT(1–*T*)/NS - operating profit margin after taxes; NS/BVC - company revenue/book value of capital.

Let us collect data required for analysis in Table 1, including annual average book values of capital net of short-term liabilities (BVC) (*www.gazgroup.ru*). The dynamics of the obtained historical rates *g* may be approximated using polynomials of corresponding orders. This can be accomplished, for instance, in the *Mathematica* package (Polovko 2007, Dyakonov 2010), where the program text also implies construction of selected polynomials. Using the linear regression function, it is possible to calculate limiting values of the rate *g* for 2007 and 2016. They will be 5.4% and 51.66% respectively. Then the average value *g* will be 28.53%.

Table 1. JSC GAZ DPS calculation and EPS data for 10 years

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
$\sum DPS$ (RUB)	450,114	671,815	743,078	691,137	-	62,476	9,993	45,570	17,857	10,456
N_s (pcs.)	13,131,836	14,947,355	15,439,168	15,439,168	15,439,168	15,439,168	15,439,168	18,520,260	18,520 260	18,520 260
DPS (RUB)	34.28	44.95	48.13	44.77	-	4.05	0.65	2.46	0.96	0.56
EPS (RUB)	127	280	391	- 1,780	- 610	106.68	490.12	481.32	190.44	- 108.72

Thus, we have obtained an anomalously high growth rate of the company, where all the three polynomials predict its further growth. Since the rate *g* significantly exceeds the country's GDP growth rates, it is required to clarify how it will change in future, namely when, roughly speaking, the company will have the constant rate *g*, and what it will be like in this regard. Let us calculate annual changes in these determinants in Table 2 and show their polynomial approximation in the *Mathematica* package in Figures 6-8 (Polovko 2007, Dyakonov 2010).

Table 2. *G* rate calculation on an annual basis for JSC GAZ according to undistributed profit growth evaluation model

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
EBIT (RUB)	8,879,659	11,789,599	15,362,924	- 1,468,837	7,618,596	10,179,742	18,140,148	12,144,953	9,005,077	14,747,100
T (%)	24	24	24	24	20	20	20	20	20	20
$\sum DPS$ (RUB)	450,114	671,815	743,078	691,137	0	62,476	9,993	45,570	17,857	10,456
NS (RUB)	94,584,430	118,793,370	152,694,716	143,056,070	65,773,141	96,720,797	132,444,824	126,951,631	143,359,240	119,993,667
BVC (RUB)	15,849,268	25,574,740	27,822,203	12,110 859	- 48,472,482	- 21,683,501	23,011,704	35,740,362	27,543,838	9,627,817
g (%)	39.74	32.41	39.29	- 14.92	- 12.57	- 37.24	63.02	27.06	26.09	122.43

To smooth over a high value and growth of the future rate *g*, one can select reduction of the reinvestment rate RIR along the parabolic curve by accepting average values of the profit margin EBIT(1–*T*)/NS and the rate NS/BVC. The average values EBIT(1–*T*)/NS and NS/BVC can be obtained from equations of linear regression. They will be 0.072698 and 4.907128 respectively.

In practice, reducing the share of reinvestments RIR actually results in reduction of the company growth rates and, eventually, in achievement of continuous growth. According to model (3), its anticipated value in 2020 will be:

$$g_{16} = \mathrm{RIR}_{16} \cdot \frac{\mathrm{EBIT}(1-T)}{\mathrm{NS}} \cdot \frac{\mathrm{NS}}{\mathrm{BVC}} = 0.114579 \cdot 0.072698 \cdot 4.907128 = 0.040875 \ (4.09\%) \qquad (4)$$

3.2. Cluster core company brand value

Let us take two Russian companies operating in the same industry, AvtoVAZ and KAMAZ, as typical companies, with which we will compare GAZ.

Comparing GAZ with AvtoVAZ. Let us use the required information from AvtoVAZ IFRS statements for 2016 (*www.lada.ru*). Thus, the average book value of capital less current liabilities for this typical company in 2016 was

$$\mathrm{BVC} = 83{,}200{,}000 \text{ '000 RUB}$$

If GAZ earned the same profit margin as AvtoVAZ and had the same revenue/book value of capital ratio as AvtoVAZ in 2016, then the return on capital and the expected growth rates during GAZ rapid growth would be as follows:

$$\mathrm{ROC} = \frac{\mathrm{EBIT}(1-T)}{\mathrm{NS}} \cdot \frac{\mathrm{NS}}{\mathrm{BVC}} = \frac{14{,}429{,}000(1-0.2)}{190{,}734{,}000} \cdot \frac{190{,}734{,}000}{83{,}200{,}000}$$

$$= 0.06052 \cdot 2.292476 = 0.138741 \qquad (5)$$

$$g = \mathrm{RIR}_{10} \cdot \mathrm{ROC} = 0.921547 \cdot 0.138741 = 0.127856$$

Supposing that the profit margin equal to 0.06052 and the revenue/book value of capital ratio equal to 2.292476 will be maintained on and on. In this case, the reinvestment rate required for a stable growth will also increase to maintain the growth rates g_{16} = 0.040875:

$$RIR_{16} = \frac{g_{16}}{ROC} = \frac{0.040875}{0.138741} = 0.294614 \qquad (6)$$

With lower growth rates in the period of rapid growth and a higher reinvestment rate, we obtain a far lesser price/sales multiple for GAZ:

$$\mathrm{VS}_g = 0.06052\Big[(1-0.921547)1.127856 \times \left(1 - \frac{1.127856^6}{1.1937^6}\right)\frac{1}{0.1937-0.127856}$$

$$+ (1-0.294614)\frac{1.127856^6 \cdot 1.040875}{(0.1672-0.040875)1.1937^6}\Big] = 0.273723 \qquad (7)$$

The result is that we can find GAZ brand value in relation to this typical company:

$$B = (\mathrm{VS}_b - \mathrm{VS}_g)\,\mathrm{NS}_b = (0.871171 - 0.273723)119{,}993{,}667 = 71{,}689{,}976 \text{ ('000 RUB)} \qquad (8)$$

which is 68.58% of EV_b=104,535,003 thousand rubles. Therefore, 68.58% of GAZ estimated value equal to 104,535,003 thousand rubles is based on its brand that provides it with the market power making it possible to earn an excess profit margin and grow more rapidly.

Comparing GAZ with KAMAZ. Let us use the required information from KAMAZ IFRS statements for 2016 (*www.kamaz.ru*). Thus, the average book value of capital less current liabilities for this typical company in 2016 was:

$$BVC = 54{,}013{,}500 \text{ '000 RUB}$$

Let us step by step calculate GAZ brand value in relation to this typical company much as we did in relation to AvtoVAZ:

$$ROC = \frac{EBIT(1-T)}{NS} \cdot \frac{NS}{BVC} = \frac{6{,}331{,}000(1-0.2)}{110{,}599{,}000} \cdot \frac{110{,}599{,}000}{54{,}013{,}500}$$
$$= 0.045794 \cdot 2.047618 = 0.093769 \quad (9)$$

$$g = RIR_{10} \cdot ROC = 0.921547 \cdot 0.093769 = 0.086413 \quad (10)$$

$$RIR_{16} = \frac{g_{16}}{ROC} = \frac{0.040875}{0.093769} = 0.435912 \quad (11)$$

$$VS_g = 0.045794\left[(1-0.921547)1.086413 \times \left(1 - \frac{1.086413^6}{1.1937^6}\right)\frac{1}{0.1937-0.086413}\right.$$
$$\left. + (1-0.435912)\frac{1.086413^6 \cdot 1.040875}{(0.1672-0.040875)1.1937^6}\right] = 0.13667 \quad (12)$$

$$B = (VS_b - VS_g)NS_b = (0.871171 - 0.13667)119{,}993{,}667 = 88{,}135{,}468 \text{ ('000 RUB)} \quad (13)$$

In this case, the brand value of GAZ is 84.31% of its market value of EV_b=104,535,003 thousand rubles. Now it can be seen that comparing GAZ with the two typical companies operating in the same industry has shown that this company was legitimately selected to be a core of the Nizhny Novgorod industrial innovation cluster. Moreover, comparing such GAZ brand's ratings of 68.58% and 84.31% of the company estimated value, one can come to the conclusion that a brand value is not an absolute measure but a relative one.

4. Discussion

The principal theoretical result of this article includes the suggested approach making it possible to recognize a core company of a future innovational and industrial cluster in order to subsequently expand this type of business up to a pilot cluster of the region. For that end, it is proposed to use book value multiples (PBV), Tobin's *Q* multiple and revenue multiples (PS and VS). They allow determining whether the company in question will be able to become a core of a potential cluster in the very near future. The multiples can also help verify whether a large company meets its current position of the 'cluster core'.

As a result of the conducted empirical analysis, the following practical conclusions have been obtained in this article. Comparison of JSC GAZ with two typical companies operating in the same industry, *i.e*. JSC AvtoVAZ and PJSC KAMAZ, has shown that this company was legitimately selected to be a core of the Nizhny Novgorod industrial innovation cluster. Moreover, comparing such GAZ brand's ratings of 68.58% and 84.31% of the company estimated value, it may be concluded that a brand value is not an absolute measure but a relative one.

Conclusions

Although there are a great number of standard cluster management models, the processes of cluster appearance and evolution are not yet studied in sufficient detail. The models required for this must adequately describe organizational issues and market mechanisms for their implementation using the relevant mathematical tools for that purpose. Furthermore, one cannot but take into consideration the fact that even in the presence of efficient

interaction between three key agent types: scientists, government officials and businessmen, it is required to orient a future pilot cluster and its potential further development to brand appreciation of such cluster, which is actually composed of brands of companies constituting its core.

The results attained in the article may be useful to scientists, postgraduates, students, analysts and businessmen so as to create their own view on managing the processes of creating and developing clusters using, among other things, our model.

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The Oil Price Volatility and the Future of Saudi Arabian Service Sector: An Empirical Analysis

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Abstract:

The purpose of this paper is to tackle theoretically and empirically the effects of non-linear oil price changes on Saudi Arabian service (non-traded) sector for the period of 1970 till 2015, using structural vector autoregressive (SVAR) approach. As part of the Dutch disease literature, the non-traded goods sector (service) is considered, and the impacts of oil price variations (increase and decrease) on this sector are investigated. Johansen's testing procedure results assert the existence of stable long-run relationship between real service sectors (RS), oil price increase and decrease, real government expenditure (GOEX), real exchange rate (REX), and the mining sector (MINING). The findings confirm that OILPI, REX, spending effect GOEX, and MINING influence RS positively, while oil price decrease affects RS negatively, and the signs as expected a priori. Given, the obtained tests' results, the exchange rate REX appreciation and the spending effects confirm the existence of the Dutch disease, and consistent with the Dutch disease literature and findings. The service sector befits much during periods of oil booms.

Keywords: Dutch Disease; Saudi Arabia; a non-linear oil price shocks; SVAR.

JEL Classification: C22; F41; Q43

Introduction

The economies which depend on resource rents are likely to face severe decline in their income resulting from the sharp decline in the prices of crude oil. However, the exploitation of mineral discoveries through exports has an effect on the balance of payments of these lucky countries. Not recently, the discovery of oil and natural gas in Netherlands gave a boost to the Dutch currency, the Dutch guilder. As a consequence, the guilder became a highly sought currency. The value of the guilder appreciated relative to other currencies causing the price of Dutch exports in the currencies of the exporting countries to rise. Hence, the Dutch exports of manufacturing products felt down. This is called "de-industrialization". Some economists argue that the oil and natural resources are not only the causes of the Dutch disease, but that discovery of gold in Australia in the eighteenth century and the flow of goods to Spain in the sixteenth century from American colonies are other examples of the Dutch disease (Corden 1984). While raw materials revenues are considered a blessing, in fact they pose a real threat to traditional exports, and the import competing industries. Furthermore, this recent growth in mining such as oil and natural gas has led many economists to analyze the impacts of a booming industry on the domestic economy. Economists agree that there is a relative increase in the output of the non-mining traded sector (service) relative to the traded goods sector. Thus, the output of the traded sectors will shrink relatively (Neary and Corden 1982). Under fixed exchange rate, either high prices or production of raw materials (such as oil) will cause the domestic spending to go up. As a consequence, the short-run response to higher demand of goods and services will not be large, causing the prices of non-traded goods to go up. The service sector can afford to pay higher wages relative to the traded sector (because of high profitability) boosting the nominal wage in that sector. Hence, resources will move to the non-traded goods sector, reducing the output in the traditional sectors, agricultural and manufacturing sectors.

Not recently, Fardmanesh (1991) presented an interesting analysis using three-sector reduced form model. The incorporation of Dutch disease models of five oil producing countries proved that oil revenue and the "world-price effect" influenced positively manufacturing sectors and agricultural sector negatively. However, the findings

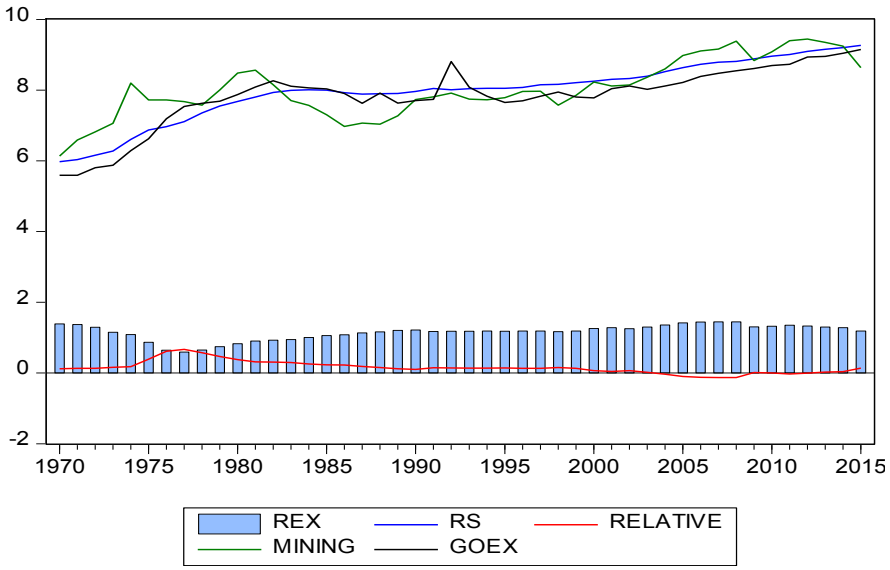
were not clear for the service sector. This study, however, excluded Saudi Arabia, among other countries, and he justified the exclusion on the grounds that the agriculture and the manufacturing sectors are small and not significant in terms of value. Not only the natural resources such as oil and gas cause negative effects on the traded sectors, but also other influxes could be a curse. Coffee boom is considered among different resources that cause the Dutch disease in Colombia, Kamas (1987). The rise in coffee prices in the late 1970s in Colombia brought a boom in the coffee sector at the expense of manufacturing and as a result of that, resources were reallocated into the agricultural sector. Moreover, Taguchi and Lama (2016), Eromenko (2016), and Acosta *et al*. (2007) study immigrant's remittances as a cause of the Dutch disease. Fielding and Gibson (2012), Lar, Taguchi and Sakurai (2016), Magud and Sosa (2010) investigated the relationship between Dutch disease and foreign aid, whereas Javaid (2011) concentrated on the effects of foreign currency inflows on the economic sectors.

It is worthwhile to mention that the earnings from oil booms have benefited and structured the Saudi economy. In fact, the benefits of oil revenues flourished through major sectors of the economy and participated in the transformation of the economy from a somewhat primitive to a well stand economy, which considered nowadays among other emerging economies. The changes in relative prices (P^n/P^t) induce a reallocation of production factors from traded sectors in favor of non-traded sectors (resource movement effects). The increase in non-traded goods (spending effects) causes an appreciation of the exchange rate. The relative price and the spending effects (proxied by real government spending) have influenced the service sector in Saudi Arabia. Although there is no consensus among economists concerning the empirical evidence of a resource curse, the impacts is somewhat mixed. The association between resource abundance and economic growth is not conclusive. Some economists found a positive relationship; while others found it negative (Trevion 2011). Hence, the existence evidence of the Dutch disease is a matter of empirical investigation case-by-case, in order to reach final and definite conclusions.

This paper is an attempt to explore the impacts of recent fluctuations in oil prices on the service sector in an emerging oil-based economy, and explain thoroughly whether this sector is still benefiting from the oil price boost since the last decade. It is clear that any oil price shocks (from the point of view of an oil-exporting country), will influence the earnings of oil and thereby spending and resource movement effects. This study differs from other studies in the following. First, SVAR methodology is applied to test the relationship between real service sectors (RS), oil price changes (oil price increase OILPI, and oil price decrease OILPD), government expenditure (GOEX), real exchange rate (REX), and the booming sector (MINING). Secondly, this analysis is directed towards the real service sector, where oil prices volatility are channeled via REX, GOEX, and MINING, causing variations in the real service sector. Thirdly, present the evidence that Saudi Arabia economy is infected with the Dutch disease. Figure 1 shows the behavior of the variables under consideration. RS, GOEX, and MINING move in the same direction. The rise in oil revenues raises GOEX then RS. By the same token, REX moves in line with the oil mining and GOEX. Relative price is likely to conform to the GOEX variable.

The main purpose of this paper is to analyze and investigate empirically the existence of symptoms of the Dutch disease, with reference to the non-traded goods sector (RS). Utilizing structural VAR (SVAR), it is of interest to determine the effects of changes in oil prices, REX, GOEX, and MINING on RS. The organization of this paper is as follows. Section 1 an introduction. Section 2 reviews and analyzes the theoretical and empirical related literature. Section 3 develops the theoretical model, estimation and discussion of the empirical evidence and its implications, and section 4 presents the conclusion and policy suggestions.

Figure 1. Relative price, real exchange, real gov expenditure, real mining sector, and service



Source: SAMA annual statistics 2016.

1. Review of literature and empirical studies

The basic model can be summarized based on the models developed by Neary and Wijnbergen (1986) and Corden (1984). There are three sectors, the booming sector (B), the lagging sector (L), and the non-traded sector (N). The first two sectors produce tradable goods face a given world price. Output is produced using neo-classical production function with capital and labor. Capital is fixed and non-shiftable. Labor is mobile between sectors. Assume an increase in the price of oil (similar to an exogenous increase in technology), this will increase the aggregate income of the factors employed there. It hinges on the presumption that the energy boom will improve the current account balance, and part of the revenues will be spent on the non-traded goods. The analysis confronts two effects resulting from the resource boom. One is the spending effect:

$$Q^n (P^n/P^t) = C^n (P^n/P^t, Y) \quad (1)$$

where: Q^n and C^n represent the output and consumption of the non-traded gods. The increase in the demand for non-traded goods will raise the price on non-traded goods.

Since the booming sector (oil) employs a negligible fraction of labor force "enclave", an increase in the price of oil or oil production will raise the income of the factors employed there. Spending will occur either by the owners of the factors or indirectly by the government.

The second is the resource movement effect. When the total labor endowment are divided between the three sectors, an increase in the marginal product of labor in the booming sector at constant wage rate (measured in terms of traded goods), leads to an increase in the demand for labor in the booming sector. So, labor will move from L and N to the booming sector B. The movement of labor from L into B lowers the output of L causing "de-industrialization". Combining both the resource movement and the spending effects, further appreciation will occur. While higher spending (along with the resource movement) increases the relative price of non-traded goods pulling resources from both B and L, reducing output of these sectors. Hence, L will decline but the net effect on output in N and B is indeterminate.

Acosta *et al.* (2007), utilized data for El Salvador using Bayesian techniques to estimate a two-sector dynamic stochastic general equilibrium model to see whether remittances cause a Dutch disease in El Salvador. They found that an increase in remittances flow cause a decline in labor supply and increase in consumption demand in favor of non-tradable goods. The rise in demand for non-tradable goods is associated with higher

production cost which causes an increase in relative prices for non-tradable sector. Thus, as a result of that exchange rate will appreciate. The rise in non-tradable goods leads to an expansion of the service sector. Moreover, this situation push forward to a reallocation of labor away from tradable sector and hence, a contraction of the tradable sector. Their findings are consistent with the VAR analysis results.

Magud and Sosa (2010), review the literature on Dutch disease. They looked at shocks that come from foreign exchange inflows such as remittances, resource boom, and foreign aids, which appreciate the exchange rate and cause resource reallocation, and hence reduce manufacturing sector. Their observations directed toward real exchange rate misalignment because of overvaluation and volatility of real exchange rate. There is no evidence of lowering growth rate. Also, they noticed mixed evidence regarding the effect of undervaluation of exchange rate. Furthermore, they concluded that there is no evidence in the literature supports the decline in overall growth due to the presence of the Dutch disease.

Trevino (2011), employs a comparative approach to diagnose the existence of Dutch disease in oil-rich countries of central African economic and monetary community (CEMAC) based on Ismail (2009) suggestion. He argues that despite these countries experienced years of high oil prices, they have suffered from real exchange rate appreciations. This situation shed light on the presence of Dutch disease and the ability to achieve long-run growth and employment. In this study, he concentrated on 14 member countries that constitute the CFA franc zone. He separated these countries into net oil exports and net oil import countries. Furthermore, he looked at economic growth, exchange rate and agricultural and external sectors. His findings are consistent with the presence of Dutch disease in second group during oil price boom. He suggested the need to implement case-by-case study due to the mixture nature of the results in the first group.

Javaid (2011), investigates the Dutch disease hypothesis concerning the effects of foreign inflows on the appreciation of the real exchange rate. He puts emphasis on the effects of the Dutch disease on the tradable sector in selected south-east Asian countries over the period of 1981-2007. He used static and dynamic panel data approach. He empirically tested for the real exchange rate appreciation as a result of foreign inflows and then examined the contraction of traded good sector and the expansion of the non-traded goods sector. He concluded that Dutch disease is present in the countries under study.

Battaile *et al*. (2014), show that Dutch disease work in effect solely because of the change in the demand following the discovery of natural resources. Due to non-homothetic preferences, the increase in rent increases the demand for non-tradable luxurious services. Hence, labor moves from tradable sectors to non-tradable sector. The result a decline in traded sectors and import goods from abroad. Low income eventually occurs due to diminishing natural resources. They concluded that unequal distribution of income will intensify the Dutch disease.

Koitsiwe and Adachi (2015), aim to test empirically the dynamic relationships between mining GDP, manufacturing GDP, service GDP, and the exchange rate using VAR approach for the period of 1975-2013. They found mixed evidence using IRF, while the VDC indicated an effect of mining sector on exchange rate. The results indicated too, that mining GDP contributes to variations in service sector. VAR Granger causality test suggests that exchange rate does Granger cause manufacturing. However, the mining GDP does Granger cause service sector. They suggested promotions to manufacturing and tourism sectors to elevate the burden of the Dutch disease.

Mironov and Petronevich (2015), examine the presence of the Dutch disease in Russian economy based on the classical model of the Dutch disease developed by Corden and Neary (1982). They analyze the relationship between changes in the real effective exchange rate of Ruble and the structural changes of the Russian economy for the period of 2002-2013. They estimated the resource movement and the spending effects and found signs of the Dutch disease. One of the signs is the negative impact of the effective exchange rate on the economic growth of the manufacturing sector, the growth of workers' income. They also found positive link between effective exchange rate and returns on capital in the three sectors. However, the shift of labor from the manufacturing sector to the service sector cannot be explained by the Ruble appreciation alone. There are other factors affecting it.

Oomes and Ponamorenk (2015), investigate the extent to which Russian economy infected with the Dutch disease, and to what extent the Russian regions suffer the symptoms of the Dutch disease. They reviewed the Dutch disease literature emphasizing on the model and its predictions. Furthermore, they tested these predictions and found the presence of the three key predictions: real exchange appreciation, de-industrialization, and the boom

of the service sector. They concluded that changes in oil price had strong and robust effects on the Russian real exchange rate and thereby reduced the competitiveness of the non-oil exports during the oil price hikes. Finally, cross-section regression for 77 Russian regions, they found that the more developed region on oil, the more proven to the Dutch disease.

Taguchi and Lama (2016), examine the effects of the Dutch disease of international migrant remittances using VAR approach for Nepal and Bangladesh covering the period of 1993-2013. The choice of Nepal and Bangladesh is to see the mechanisms of received remittances and how it leads to Dutch disease or not. Their findings support the existence of the Dutch disease in Nepal but not in Bangladesh from the point view of causalities and dynamic responses for remittances to manufacturing-service ratio. The Dutch disease effects could be caused by differences in demand structure and policy efforts to encourage manufacturing sectors via different incentives.

Lotfi and Karim (2016), study the Dutch disease phenomena and its consequences on the Moroccan economy using VECM approach in order to identify the channels through which Dutch disease affects it. They covered the period of 1980-2012. They concluded that the increase in income coming from exploitation of natural resources and other forms of income such as capital flows threaten the productive sectors. Furthermore, causes the tradable goods sector is less competitive. They suggested identifying sectors which threatened by Dutch disease and help to promote production with high added values.

Zuzana (2016), reviews the Dutch disease literature in the framework of three sectors model. It consists of a non-traded sector and two traded sectors. A non-traded sector is determined by domestic supply and demand, and the two tradable export sectors are a given price. Not only natural resources boom is considered, but also other forms of capital inflows such as financial aids. Literature has not concluded a definite evidence of the Dutch disease. Finally, it is worthwhile to consider the type of shock whether it is temporary or permanent, because each has to be treated properly on the basis of policy decisions.

Eromenko (2016), tests whether large foreign currency inflow to Kyrgyzstan and Tajikistan from labor working abroad cause the Dutch disease in these economies. Based on Corden (1984) and Neary and Corden (1982), he considers factors such as appreciation of the real exchange rate, decline in tradable sector, and an increase in non-tradable sectors in his analysis. He concluded that the econometric model estimations show the presence of symptoms of the Dutch disease partly in Kyrgyzstan and Tajikistan regarding the evidence of deindustrialization, growth rate of wage, and the large share of the service sector. Nonetheless, remittances do not cause appreciation of the real exchange rate.

Lar, Taguchi, and Sakurai (2016), examine the economic effects of the foreign aid from the point view of the Dutch disease. They focused on Cambodia, Lao PDR, Myanmar, and Vietnam. The importance of their study concerning these countries, stem from the fact that these countries had little attention in the economic literature, despite their dependence on foreign aids. They used VAR analysis covering the period of 1990-2012. Their finding suggests neither presence of Dutch disease, nor positive effects on production from foreign aid. They concluded that major foreign aid goes to infrastructure projects, which had little effects on raising consumption. However, infrastructure contributes to capital accumulations.

2. The theoretical model, estimation, and empirical investigations

Following the literature developed by Lama and Median (2012), a multi-sector small open economy is assumed, with nominal rigidities and learning by doing (LBD) externality in the traded goods sector is present. The merits of applying such model are that, it captures the economy with large commodity sector and an LBD externality is in the manufacturing sector. Since the model considers three sectors, manufactured home goods (H), non-traded goods sector (N), and commodity exported whose price determined internationally, it features New Keynesian in terms of sticky prices of traded goods sector. The importance here is that, changes in the monetary policy generates real effects, besides the inclusion of an LBD externality in the manufacturing sector. In this paper my analysis is mainly forwarded towards the non-traded goods (service), RS, sector. In light of this, the model which deals with non-traded sector will be analyzed. The household's preferences are defined over consumption and labor subject to the constraints given price of consumption, profit received from domestic firms, nominal wage and the nominal exchange rate. The final goods producers Y_t^F include home-produced inputs Y_t^{DH}, imports Y_t^M, and non-tradable

inputs Y_t^{DN} based on CES production function. A continuum firms in the non-traded goods sector with $\in [0,1]$, produce output $Y_t^N(n)$ with capital $K_t^N(n)$ and labor $L_t(n)$. The production function is as:

$$Y_t^N(n) = A_t^N [K_t^N(n)]^{\lambda N} [L_t^N(n)]^{1-\lambda N} \quad (2)$$

where: $A_{N,t}$ represents an aggregate productivity sector shock.

The traded goods sector is subject to LBD externality. Each firm $h \in [0,1]$ has a production function as:

$$Y_t^H(h) = A_t^H [H_t(h)]^{\delta H} [K_t^H(h)]^{\lambda H} [L_t^H(h)]^{\gamma H} \quad (3)$$

where: A_t^H, K_t^H (h), and L_t^H (h) represent an aggregate productivity shock; capital and labor; $H_t(h)$ is the level of capital in home goods sector. Since technology matches constant return to scale $\lambda H + \delta H + \gamma H = 1$. Capital producers J = H, N own and rent it to the firms in home and non-traded goods sectors.

The investment of capital is a composite of home, foreign, and non-traded goods sectors. The firm of each type of capital J faces the following problem:

$$V_t^J = \max_{K_{t+i}^J,\, I_{t+i}^J} E_t \{ \sum_{i=0}^{\infty} At, t+i \; Z_{t+i}^J K_{t+i}^J / P_{t+i}^C - P_{t+i}^C I_{t+i}^J / P_{t+i}^C \} \quad (4)$$

Subject to:

$$K_{t+i}^J = (1-\alpha) K_t^J + S(I_t^J / I_{t-1}^J) I_t^J \quad (5)$$

where: Z_t^J rate of capital rental; V_t^J present discounted value of profits and α is the depreciation rate of capital in sector J. S(·).

The assumption the exports of commodity X is exogenously determined as:

$$X_t = [X_{t-1}]^{\rho x} [X_0]^{1-\rho x} \exp(\varepsilon_t^x) \quad (6)$$

where: $\varepsilon_t^x \sim N(0, \sigma_x^2)$ is a stochastic shock; ρx measures processes' persistency.

$\rho_t x$ follows the stochastic process as:

$$P_t^x = [P_{t-1}^x]^{\rho px} [P_0^x]^{1-\rho px} \exp(\varepsilon_t^{px}), \quad (7)$$

where: $\varepsilon_t^{px} \sim N(0, \sigma_x^2)$, is a stochastic; $^{\rho px}$ measures commodity prices persistency.

The market for labor, capital intermediate home and non-traded goods always clear. The market clearing conditions are:

$$L_t = (\int_0^1 Lt^N(n)\, dn) + (\int_0^1 Lt^H(h)\, dh) ; \quad (8)$$

$$K_t^J = (\int_0^1 Kt^J(j)\, dj) ; \quad J = H, N. \quad (9)$$

The market clearing conditions for home and non-tradable intermediation goods are:

$$Y_t^{DN} = Y_t^N \quad (10)$$

$$Y_t^{DH} + C_t^{H*} = Y_t^H \quad (11)$$

where: $C_t^{H*} = \varphi^* (\rho_{H,t} / \varepsilon_t P^*_{F,t})^{-n^* Ct^*}$ is the foreign demand for home goods; C_t^* represents the aggregate foreign consumption.

The final equilibrium condition in the final goods production and intermediate bonds are:

$$Y_t^F = C_t + I_t^H + I_t^N \quad (12)$$

$$\varepsilon_t B^*_t = (1 + i_{t-1}^*) \Theta (B_{t-1}) \varepsilon_t B^*_{t-1} + P_t^M Y_t^M - P_t^H C_t^{H*} - P_t^x X_t \quad (13)$$

Since our attention here is concentrated on the real log service sector, the following eclectic model is specified:

$$RS = f(OILPI; REX; GOEX; MINING) \quad (14)$$

$$f_1,\ f_2,\ f_3, \text{ and } f_4 > 0$$

$$RS = f(OILPD; REX; GOEX; MINING) \quad (14a)$$

$$f_1 < 0; \text{ and } f_2,\ f_3,\ f_4 > 0$$

where: RS is real log service sector. It includes: wholesale and retail trade, restaurants and hotels, transportations, telecommunications and storage, finance, insurance, real estate and business services, community, social and personal services, and providers of government services; REX is real exchange rate calculated as: Riyal (Saudi Currency)*WCPI/ CPI; GOEX is real log government expenditure representing the spending effect. MINING is real log value of mining sector.

Based on the Dutch disease theory, government expenditure and real exchange rate should be highly correlated. If not, it is easy to include the variables in the regression without bothering with multicollinearity between them (Rudd 1996).

Table 1. Dependent variable real service sector (RS)

Dependent Variable	Intercept	OILPI	OILPD	REX	GOEX	MINING	R^2	F-statistic
Service-1	0.014533 (0.0516)	0.000774 (0.9779)		0.972433 (7.7343)*	0.872227 (24.8071)*		0.96	288.96
Service-2	-0.12273 (-0.4192)	0.000164 (0.18561)		0.914943 (7.0444)*	0.812663 (15.2847)*	0.084408 (1.4771)	0.96	223.67
Service-3	0.105867 (0.3838)		-0.000134 (-0.0645)	0.989851 (7.7537)*	0.860088 (24.680)*		0.95	279.58
Service-4	-0.12637 (-0.4327)		-0.002122 (-0.9431)	0.915536 (7.0859)*	0.785740 (15.460)*	0.110134 (1.9856)**	0.96	225.07

Note: *, **, and *** are statistically significant at 1%, 5% and 10% level respectively.

2.1. The non-linear oil price effects

In the standard literature, the non-linear price specification which proposed by Mork (1989) discusses the positive and the negative oil price shocks. In accordance, the non-linear oil price shock is specified as follows:

$$OILPI_t = \begin{cases} OILPt, & if\ OILPt > 0 \\ 0 & otherwise \end{cases} \qquad OILPD_t = \begin{cases} OILPt, & if\ OILPt < 0 \\ 0 & otherwise \end{cases}$$

where: OILPI represents the scaled oil price increase, and OILPD is scaled oil price decrease.

Furthermore, Lee *et al.* (1995) proposed scaled oil price increase (SOPI), and Hamilton (1996) used net price increase, NOPI. This measurement is defined as a value of oil price in quarter t, p_t, exceeds the highest value over the last four quarters. So, an increase in oil price may be a result of price correction to earlier levels, which may not affect the economy as a whole. Employing Hamilton's (1996) method, NOPI and NOPD are constructed as:

$$NOPI_t^{45} = \text{Max}\{0, OILP_t - \max(OILP_{t-1}, OILP_{t-1,\ldots,} OILP_{t-45})\} \quad (15)$$

$$NOPD_t^{45} = \text{Min}\{0, OILP_t - \min(OILP_{t-1}, OILP_{t-1,\ldots,} OILP_{t-45})\} \quad (15a)$$

The data used here, is collected from SAMA (Saudi Arabian Monetary Authority), annual statistics 2016. The real oil price implemented here is an OPEC basket price. The data covers the period of 1970-2015.

Table 1 shows estimates of Ordinary Least Squares (OLS). The impact of oil price increase on RS is positive as expected, and not significant. The effect of oil price decrease is negative, as expected a priori, but is not significant. Moreover, the magnitude of variations of the oil prices is negligible. The sign of GOEX and REX are positive indicating that 80-90 percent of the variations in RS come from spending effect and the appreciation of REX. However, the rest of the effects on the RS come from the MINING with about 10%. Nonetheless, the model is free of serial correlation and stable too.

2.2. Unit Root Test

Using ordinary least squares (OLS) on non-stationary variables causes a misleading result of the variables estimates. Due to the increase or decrease in macroeconomic variables, economists hope to quantify and decide the causal relationship between variables. Eliminating non-stationarity by taking first difference gets red of linear trend. However, the stationary stochastic part is over difference indicates short run cycle (Wolters and Hassler 2006). In order to make precise estimates, checking for stationarity is of importance for forecasting and the processes to choose into our models. Variables that increase over time are non-stationary. In addition, series that are not increase over time, but carry effects of innovations do not vanish as time passes (Mahadera 2004) in Algaeed (2017). Thus standard errors with non-stationary variables are biased and causal relationships between variables are not reliable and yield a spurious regression. According to Mahadera (2004), to achieve stationarity, one could subtract a trend or taking one or more difference. Furthermore, performing unit root tests is the goal to attain stationary variables, and avoid spurious regressions.

$$\Delta X_t = (\delta - 1)X_{t-1} + \varepsilon_t \quad (16)$$

Equation (16), represents Dicky-Fuller test. If $\delta > 1$, or $\delta = 1$, this implies that X_t is non-stationary. Augmented Dicky-Fuller test is developed to cure the presence of serial correlations in the Dicky-Fuller residuals. The idea is to add lagged dependent variables to eliminate residuals of serial correlations. To determine the unit roots, three regression models are used in the literature incorporate intercept, intercept and trend, and none. Augmented Dickey Fuller (ADF) and Phillips-Peron (PP) tests are employed to examine the stationarity of the time series. ADF test is implemented using the following equation:

$$y_t = \gamma_0 = \sum_{j=1}^{k} \gamma j Yt - j + \varepsilon t \quad (16a)$$

$$\varepsilon t \sim iid\ N(0, \sigma^2)$$

Δy is the first difference of Y series, n is the number of lagged first differenced term, and ε_t is the error term.

The Phillips and Perron test is performed using the following equation:

$$\Delta y_t = \varphi_0 + \sum_{j=1}^{k} \varphi j\ \Delta\ yt - j + \varphi kyt - k + \varepsilon_t \quad (16b)$$

$$\varepsilon t \sim iid\ N(0, \sigma^2)$$

where: $\varphi_0 = \gamma_0$ is a constant; $\varphi_j = \sum_j^k \gamma j - 1$, j=1,..., k. If $\varphi_j = 0$, then null hypothesis is accepted (presence of unit root).

However, when $\varphi_j < 0$, that means there is no presence of unit root. To go on in the analysis, Augmented Dickey-Fuller (ADF), and Phillips and Perron (PP) tests are applied. Results for these tests are similar and close to each other, and thus, reported in (Table 2). Both tests showed that variables are stationary at the difference in the ADF and PP tests. Some of the variables, such as REX_t, $GOEX_t$ and the $MINING_t$ variables, are not stationary at level I(0). Moreover, all variables are stationary at difference I(1) and significant at 1 and 5% level.

Table 2. Augmented-Dickey Fuller and Phillips-Perron tests

Series	Augmented-Dickey Fuller						Phillips-Perron					
	Level			1st Difference			Level			1st Difference		
	Intercept	T&I	None	Intercept	T&I	None	Intercept	T&I	None	Intercept	T&I	None
$OILPI_t$	6.37*	6.44*	5.48*	9.88*	9.73*	10.14*	6.43*	6.53*	5.47*	32.44*	34.01*	33.52*
$OILPD_t$	6.69*	6.65*	5.08*	7.61*	7.52*	7.67*	6.69*	6.65*	5.42*	17.04*	16.76*	17.08*
REX_t	1.20	2.01	0.89	3.39**	3.31**	3.43*	1.59	2.33	1.18	3.09**	3.10**	3.14*
$GOEX_t$	2.26	2.47	1.79	6.88*	6.98*	6.33*	2.30	2.43	1.79	6.87*	6.98*	6.33*
$MININ G_t$	2.14	2.55	0.91	5.63*	5.64*	5.62*	2.43	3.67	0.86	5.60*	5.62*	5.61*

Note: *, **, and *** are statistically significant at 1%, 5% and 10% level respectively. T&I: trend and intercept.

2.3. Johansen Co-integration Test Result

Based on Hjalmarsson and Osterhold (2007) in Algaeed (2017), Johansen's methodology starts with VAR(p) as:

$$y_t = \alpha + A_1 Y_{t-1} + A_p Y_{t-p} + \varepsilon_t \quad (17)$$

where: y_t is a nx1 vector of variables that are integrated of order one; ε_t is a nx1 vector of innovations.

The VAR model can be written as follows:

$$\Delta y_t = \alpha + \Pi\, y_{t-1} + \sum_{i=1}^{p-1} \Gamma_i \Delta y_{t-i} + \varepsilon_t \quad (17a)$$

where: $\Pi = \sum_{i=1}^{p} Ai - I$; $\Gamma_i = -\sum_{j=i+1}^{p} Aj$.

If coefficients matrix Π has reduced rank r < n, then there exist nxr matrices γ and δ each with rank r such that: $\Pi = \gamma\delta'$ and $\delta' y_t$ is stationary. Moreover, the reduced rank of the Π matrix is the trace test and the maximum eigenvalue test as:

$$J_{Trace} = -T \sum_{i=r+1}^{n} \ln\,(1 - \hat{\lambda}_i) \quad (17b)$$

$$J_{Max} = -T \ln\,(1 - \hat{\lambda}_{r+1}) \quad (17c)$$

where: T is the sample size; $\hat{\lambda}_i$ is the i^{th} largest correlation.

Johansen's co-integration test requires deciding the lag length which can be calculated through unrestricted VAR models. The analysis here used 3 lags for OILPD and 4 lags for OILPI depending on unrestricted VAR lag order, LR, FPE, AIC, and HQ. From table 3, trace statistic test confirms the existence of 3 and 4 co-integrated equations at the 5 percent level. The null hypotheses for the trace and max tests are that, there are no co-integrations between OILPI and OILPD, GOEX, REX, MINING, and RS. The null hypotheses are rejected. Thus, there exist long-run relationships among the variables.

Table 3. Johansen co-integration test

H_0	H_A	Eigenvalues	λ_{Trace}	95%	H_0	H_A	λ_{Max}	95%
With OILPI (lags = 4)								
r = 0	r = 1	0.9404	207.8351	69.8189	r = 0	r = 1	95.8639	33.877
r = 1	r = 2	0.8838	111.971	47.8561	r = 1	r = 2	61.9604	27.584
r = 2	r = 3	0.6879	50.0108	29.7971	r = 2	r = 3	39.5988	21.132
r ≤ 3	r = 4	0.2533	10.4119	15.4947	r ≤ 3	r = 4	9.93157	14.265
r ≤ 4	r = 5	0.0140	0.48037	3.84147	r ≤ 4	r = 5	0.48037	3.8415
With OILPD (lags = 3)								
r = 0	r = 1	0.6509	102.3026	69.8189	r = 0	r = 1	43.1482	33.877
r = 1	r = 2	0.5468	59.15435	47.8561	r = 1	r = 2	32.4521	27.584
r ≤ 2	r = 3	0.3706	26.70222	29.7971	r ≤ 2	r = 3	18.9799	21.132

H_0	H_A	Eigenvalues	λ_{Trace}	95%	H_0	H_A	λ_{Max}	95%
With OILPI (lags = 4)								
r ≤ 3	r = 4	0.1706	7.722312	15.4947	r ≤ 3	r = 4	7.67154	14.265
r ≤ 4	r = 5	0.0012	0.050768	3.84147	r ≤ 4	r = 5	0.05077	3.8415

Note: r indicates the number of co-integrating vector. Critical values are from Mackinnon *et al.* (1991) p-values. * indicates significance of the test statistic at 5 % level.

2.4. Causality tests

Based on Lin (2008), the definition of Granger causality is built on two assumptions. The future can't cause the past and the cause contains positive information that is not available elsewhere. X_t is said not to Granger cause Y_t if for all h > 0. That is:

$$F(Y_{t+h} \mid \Omega_t) = F(y_{t+h} \mid \Omega_t - X_t) \quad (18)$$

where: F represents conditional distribution; $\Omega_t - X_i$ is all information elsewhere except series X_t. It means that X_t does not Granger cause Y_t if X can't help in predicting Y.

If the definition is defined relatively, it becomes: X_t does not Granger Cause Y_{t+h} with respect to information J_t if:

$$E(Y_{t+h} \mid J_t, X_t) = E(Y_{t+h} \mid J_t) \quad (18a)$$

For a 1-dimention stationary process, Z_t, there exists a canonical MA representation as:

$$Z_t = \mu + \Phi(B)\, u_t$$

$$Z_t = \mu + \sum_{i=1}^{\infty} \Phi i\, u_{t-i}, \quad \Phi_0 = I_1 \quad (18b)$$

The necessary and sufficient condition for variable k not Granger cause variable j is that $\Phi_{jk,i} = 0$; for i = 1, 2. If the process is invertible, then:

$$Z_t = C + A(B)\, Z_{t-1} + u_t$$

$$Z_t = C + \sum_{i=1}^{\infty} Ai\, Z_{t-i} + u_t \quad (18c)$$

If there are two variables or two groups of variables *j* and *k*, then the necessary and sufficient condition for variable k not Granger because variable *j* is that $A_{jk,i} = 0$ for *i* = 1, 2. This condition is suitable for all forecast horizon *h*.

Tables 4, 5, 6 and 7 reveal the causality tests. VAR and VECM causality tests showed that causality is running from oil price shock that is OILPI to GOEX, REX and RS. On the other hand, pairwise causality test indicates clearly the acceptance of the null hypotheses that shock OILPI does not Granger cause GOEX, REX, and RS. Moreover, the null hypotheses for MINING and REX does not Granger on RS are clearly accepted.

Table 4. VEC and VAR Granger causality/Block Exogeneity Wald tests

Dependent Variable D(OILPI)			
Excluded	Chi-sq	df	Probability
D(GOEX)	8.691927	2	0.0130
D(REX)	8.400562	2	0.0150
D(MIMING)	11.59560	2	0.0030
D(RS)	20.03109	2	0.0000
Dependent Variable D(GOEX)			
D(OILPI)	6.815567	2	0.0331
D(REX)	16.76487	2	0.0002
D(MINING)	19.19638	2	0.0001
D(RS)	10.30525	2	0.0058
Dependent Variable D(REX)			

Dependent Variable D(OILPI)			
D(OILPI)	1.583716	2	0.4530
D(GOEX)	0.219299	2	0.8961
D(MINING)	4.806473	2	0.0904
D(RS)	0.441416	2	0.8020
Dependent Variable D(MINING)			
D(OILPI)	1.570926	2	0.4559
D(GOEX)	0.294491	2	0.8631
D(REX)	1.379690	2	0.5017
D(RS)	1.998950	2	0.3681
Dependent Variable (RS)			
D(OILPI)	24.76088	2	0.0000
D(GOEX)	9.437734	2	0.0089
D(REX)	0.260757	2	0.8778
D(MINING)	0.786751	2	0.6748
VAR Granger Causality/Block Exogeneity Wald Tests			
Dependent Variable OILPI			
GOEX	3.097183	2	0.2125
REX	0.090671	2	0.9557
MINING	0.916386	2	0.6324
RS	0.272955	2	0.8724
Dependent Variable GOEX			
OILPI	2.575161	2	0.2759
REX	14.03121	2	0.0009
MINING	5.763415	2	0.0560
RS	11.18659	2	0.0037
Dependent Variable REX			
OILPI	12.27151	2	0.0022
GOEX	1.573081	2	0.4554
MINING	1.253418	2	0.5343
RS	5.018279	2	0.0813
Dependent Variable MINING			
OILPI	10.71190	2	0.0047
GOEX	2.145272	2	0.3421
REX	0.339051	2	0.8441
RS	3.597395	2	0.1655
Dependent Variable RS			
OILPI	6.931131	2	0.0313
GOEX	0.815976	2	0.6650
REX	0.886116	2	0.6421
MINING	10.72982	2	0.0047

Table 5. Pairwise Granger causality tests, lags 4.

Null Hypothesis	Observations	F-statistic	Probability
GOEX does not Granger cause OILPI OILPI does not Granger cause GOEX	36	0.48625 1.67836	0.7457 0.1840
REX does not Granger cause OILPI OILPI does not Granger cause REX	36	0.32114 5.60160	0.8613 0.0020
MINING does no Granger on OILPI OILPI does no Granger on MINING	36	1.23015 1.95463	0.3215 0.1301
RS does not Granger on OILPI OILPI does not Granger on RS	36	0.99905 3.19536	0.4252 0.0285

Null Hypothesis	Observations	F-statistic	Probability
REX does not Granger on GOEX GOEX does not Granger on REX	42	0.71143 1.48590	0.5900 0.2289
MINING does not Granger on GOEX GOEX does not Granger on MINING	42	4.58016 0.66118	0.0047 0.6234
RS does not Granger on GOEX GOEX does not Granger on RS	42	6.72634 2.09338	0.0004 0.1040
MINING does not Granger on REX REX does not Granger on MINING	42	2.85346 1.43311	0.0390 0.2449
RS does not Granger on REX REX does not Granger on RS	42	2.35811 3.17722	0.0737 0.0259
RS does not Granger on MINING MINING does not Granger on RS	42	1.35365 5.25499	0.2711 0.0022

Table 6. VEC and VAR Granger causality/block Exogeneity Wald tests

Dependent Variable D(OILPD)			
Chi-sq	df		Probability
D(GOEX)	0.869509	2	0.6474
D(REX)	0.471013	2	0.7902
D(MIMING)	0.546171	2	0.7610
D(RS)	5.168325	2	0.0755
Dependent Variable D(GOEX)			
D(OILPD)	1.639527	2	0.4405
D(REX)	6.315063	2	0.0425
D(MINING)	7.289322	2	0.0261
D(RS)	0.387801	2	0.8237
Dependent Variable D(REX)			
D(OILPD)	0.375119	2	0.8290
D(GOEX)	0.545004	2	0.7615
D(MINING)	6.975902	2	0.0306
D(RS)	00154986	2	0.9254
Dependent Variable D(MINING)			
D(OILPD)	1.365756	2	0.5052
D(GOEX)	4.070299	2	0.1307
D(REX)	2.111681	2	0.3479
D(RS)	6.803977	2	0.0333
Dependent Variable (RS)			
D(OILPD)	1.844320	2	0.3977
D(GOEX)	0.972915	2	0.6148
D(REX)	3.299999	2	0.1920
D(MINING)	4.084820	2	0.1297
VAR Granger causality/Block Exogeneity Wald tests			
Dependent Variable OILPD			
GOEX	0.148330	2	0.9285
REX	0.344798	2	0.8416
MINING	0.715160	2	0.6994
RS	0.194724	2	0.9072
Dependent Variable GOEX			
OILPD	0.044588	2	0.9780
REX	11.01356	2	0.0041
MINING	1.391992	2	0.4986
RS	11.52720	2	0.0031

Dependent Variable D(OILPD)			
Dependent Variable REX			
OILPD	0.064891	2	0.9681
GOEX	0.116515	2	0.9434
MINING	1.276486	2	0.5282
RS	1.886711	2	0.3893
Dependent Variable MINING			
OILPD	1.043933	2	0.5934
GOEX	1.446026	2	0.4853
REX	0.117384	2	0.9430
RS	0.552897	2	0.7585
Dependent Variable RS			
OILPD	0.149567	2	0.9279
GOEX	0.240524	2	0.8867
REX	0.557852	2	0.7566
MINING	9.450580	2	0.0089

Table 7. Pairwise Granger causality tests, lags 4

Null Hypothesis	Observations	F-statistic	Probability
GOEX does not Granger cause OILPD OILPD does not Granger cause GOEX	41	0.30679 1.21243	0.8713 0.3248
REX does not Granger cause OILPD OILPD does not Granger cause REX	41	0.05110 0.87334	0.9949 0.4907
MINING does no Granger on OILPD OILPD does no Granger on MINING	41	1.10157 1.63822	0.3727 0.1888
RS does not Granger on OILPD OILPD does not Granger on RS	41	1.92318 0.48745	0.1306 0.7448
REX does not Granger on GOEX GOEX does not Granger on REX	42	0.71143 1.48590	0.5900 0.2289
MINING does not Granger on GOEX GOEX does not Granger on MINING	42	4.58016 0.66118	0.0047 0.6234
RS does not Granger on GOEX GOEX does not Granger on RS	42	6.72634 2.09338	0.0004 0.1040
MINING does not Granger on REX REX does not Granger on MINING	42	2.85346 1.43311	0.0390 0.2449
RS does not Granger on REX REX does not Granger on RS	42	2.35811 3.17722	0.0737 0.0259
RS does not Granger on MINING MINING does not Granger on RS	42	1.35365 5.25499	0.2711 0.0022

2.5. The impulse response function

Granger-causality tests may not explain well the interaction between variables in a system contains different variables. In the real world, attention is paid to the response of one variable to an impulse in another variable in a system contains different variables. If a variable reacts to an impulse in another variable, this will yield the latter causal for the former (Rossi 2004), in Algaeed (2017).

Following Olanipekun (2016), the Saudi economy can be represented by structural equations as follows:

$$A(L)\, X_t + B(L)\, Y_t = U_t \quad (19)$$

where: A(L) and B(L) are n x m, and n x k matrices. X_t is an n x1 vector of exogenous variables and Y_t is k x1 vectors of endogenous variables. U_t is an n x1 vectors of random structural disturbances.

The SVAR explains the effects of one standard deviation shock in the error term over the model's endogenous variables. The model applied here will have five variables with 5-dimentional column vector.

The restrictions imposed and the contemporaneous structural parameter of the following order:

$$\begin{bmatrix} OILPi \\ GOEX \\ MINING \\ REX \\ RS \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 & 0 & 0 \\ a21 & 1 & 0 & 0 & 0 \\ a31 & a32 & 1 & 0 & 0 \\ a41 & a42 & a43 & 1 & 0 \\ a51 & a52 & a53 & a54 & 1 \end{bmatrix} \begin{bmatrix} \varepsilon 1t \\ \varepsilon 2t \\ \varepsilon 3t \\ \varepsilon 4t \\ \varepsilon 5t \end{bmatrix}; \text{ i = increase (+) and decrease (-)} \quad (20)$$

where: y_t = (OILP^i, GOEX$_t$, REX, MINING$_t$, RS$_t$) is a 5 x1vector of endogenous variables; A is a 5 x1 vector of constant terms; B_i is a 5 x 5 autoregressive coefficient matrices; U_t is a 5 x1 vector of serially mutual uncorrelated shocks. The ith is an oil price increase and decrease.

Equation (20) is built on the restriction that the oil price changes are exogenously determined, and do not respond to other motives. In order to test for the interactions and consolidate the causal relationships, VAR, and impulse response functions and variance decomposition functions are used. However, the impulse response function from a VAR is a guide to whether the effects are short lived or permanent. It shows dynamic properties of the model, which means the responses of dependent variables to unit shock of independent variables.

Moreover, it traces the effects of a one standard deviation shock in a certain variable on the current and future values of the rest of macro variables. Figure 2, 3, and Tables 8 and 9 show the IRFs of each variable in the study to a one standard deviation shock in the oil price. The response of RS to OILPI is positive and continues positive till the 10th period then disappears. At the beginning the response of RS to MINING and REX and GOEX are positive and continue positive. It is clear that the response of GOEX to MINING is positive as expected till the 10th year, and then disappears. On the other hand, the response of REX to OILPD is positive till the 5th year, and then became negative.

After that, it turned into positive. Furthermore, the response of MINING to OILPD is positive, and continues till the end of the period. The response of RS to OILPD is negative all over the period. The IRFs is consistent with the causality tests where the effects run from oil price changes to GOEX and REX then RS. Looking at the negative oil price shocks (from the point of view of an oil producer), a one standard deviation shock to negative oil price causes MINING to decline on average negatively by 3%, and continue to become negative over the time span.

On the other hand, RS is declined, on average by 3% due to the decline in oil prices which caused by the fall in oil prices in world oil market. It's worthwhile to note that, the fall in oil earnings accompanied by a fall in GOEX and hence, RS. Also, it should be noted that, with OILPI, ECT is negative and significant at 5% level and is about 255%. The error correcting term, explains the speed at which the system adjusts to equilibrium at the rate of 255% annually. Nonetheless, with OILPD, ECT is negative and significant and is about 45%. The result is warranted and shows the immense effects of the oil price changes on the Saudi economy. Thus, changes in earnings, changes in GOEX and either rise or fall in RS. The SVAR model is stable (stationary), because all roots modulus are less than one in value, and lie inside the circle (Figure 4). However, if VAR is not stable (not stationary), then impulse response standard error does not exist.

Table 8. Impulse response to Cholesky (d. f. adjusted) One S. D. Innovations

Variance Decomposition for Oil Price Increase, OILPI					
Period	OILPI	GOEX	MINING	REX	RS
1	34.50007	0.000000	0.000000	0.000000	0.000000
5	-1.073920	-0.795125	0.877284	1.313596	-0.352874
10	-0.228441	0.584471	-1.412810	-0.025190	-0.811094
15	0.089243	0.086180	-0.232818	-0.101579	-0.318863
20	-0.078792	0.111200	-0.153154	0.019749	-0.199147
Variance Decomposition for GOEX					

Variance Decomposition for Oil Price Increase, OILPI					
1	-0.024391	0.183722	0.000000	0.000000	0.000000
5	0.056021	-0.048945	0.075022	-0.043764	0.065394
10	0.015407	-0.034680	0.081919	-0.000588	0.062001
15	0.004226	-0.016385	0.033244	0.002340	0.035379
20	0.009759	-0.015629	0.027950	-0.002449	0.027620
Variance Decomposition for MINING					
1	0.211556	-0.029561	0.205235	0.000000	0.000000
5	0.033203	-0.075529	0.178917	-0.014096	0.121173
10	-0.000320	-0.021461	0.053468	0.007441	0.054452
15	0.008741	-0.017090	0.028165	-0.000461	0.033059
20	0.013524	-0.019625	0.036426	-0.004452	0.032627
Variance Decomposition for REX					
1	0.016728	0.000149	0.028062	0.028264	0.000000
5	-0.017997	0.001139	-0.004404	0.018701	0.008168
10	0.010530	-0.008304	0.007748	-0.006014	0.011112
15	0.008381	-0.011334	0.023350	-0.003318	0.017462
20	0.002425	-0.006371	0.013993	0.000101	0.012467
Variance Decomposition for RS					
1	0.025403	-0.012636	0.004097	-0.000209	0.039151
5	0.038154	-0.043152	0.072541	-0.012660	0.064813
10	0.024199	-0.039300	0.080404	-0.007481	0.063677
15	0.012392	-0.026118	0.053519	-0.001331	0.049187
20	0.010975	-0.020240	0.038866	-0.001979	0.037078
Cholesky Ordering OILPI, GOEX, MINING, REX, and RS					

Table 9. Impulse response to Cholesky (d. f. adjusted) One S. D. Innovations

Variance Decomposition for Oil Price Increase, OILPD					
Period	OILPD	GOEX	MINING	REX	RS
1	14.34571	0.000000	0.000000	0.000000	0.000000
5	-0.059880	-0.088937	0.349542	0.285197	-0.106005
10	-0.111623	0.065065	-0.275696	0.009048	-0.056146
15	-0.082571	0.030065	-0.136941	-0.068078	-0.020299
20	-0.025260	0.013048	-0.045963	-0.019579	-0.025716
Variance Decomposition for GOEX					
1	-0.022026	0.191209	0.000000	0.000000	0.000000
5	0.044858	-0.033499	0.124277	-0.023105	0.036113
10	0.050272	-0.020143	0.090996	0.031738	0.011917
15	0.017040	-0.007327	0.028185	0.015718	0.011912
20	0.012189	-0.007402	0.027158	0.002959	0.011725
Variance Decomposition for MINING					
1	0.203268	0.006078	0.254000	0.0000000	0.000000
5	0.096528	-0.040921	0.180848	0.048515	0.013715
10	0.27159	-0.008911	0.037614	0.032956	0.011691
15	0.010933	-0.007803	0.025848	0.001865	0.015988
20	0.017436	-0.009415	0.037540	0.004719	0.010920
Variance Decomposition for REX					
1	0.028428	0.002692	0.025340	0.031010	0.000000
5	0.001700	0.003054	-0.012968	0.020956	0.004654
10	-5.93E-5	-0.003226	0.007020	-0.007040	0.010576
15	0.011443	-0.006034	0.025050	0.002233	0.005503

Variance Decomposition for Oil Price Increase, OILPD					
20	0.007552	-0.003128	0.013348	0.005421	0.003056
Variance Decomposition for RS					
1	0.008583	-0.011677	0.027483	0.006141	0.041307
5	0.040630	-0.024851	0.093852	0.004376	0.035325
10	0.042431	-0.020396	0.084005	0.019862	0.021567
15	0.026692	-0.012775	0.050957	0.015449	0.016289
20	0.018755	-0.009793	0.038030	0.008399	0.013344
Cholesky Ordering OILPD, GOEX, MINING, REX, and RS					

Figure 2. Responses of GOEX, MINING, and RS to an OILPI

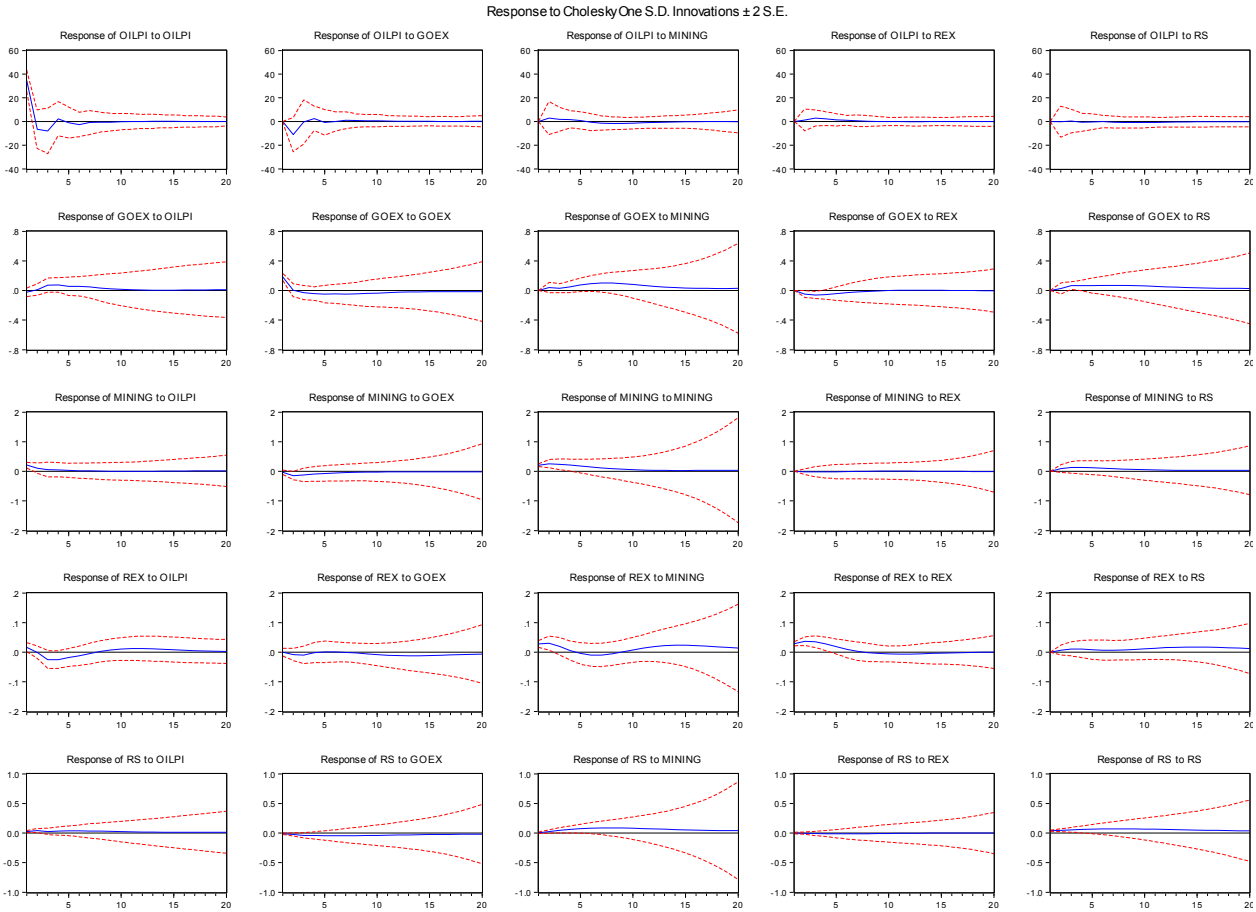


Figure 3. Responses of GOEX, MINING, and RS to an OILPD

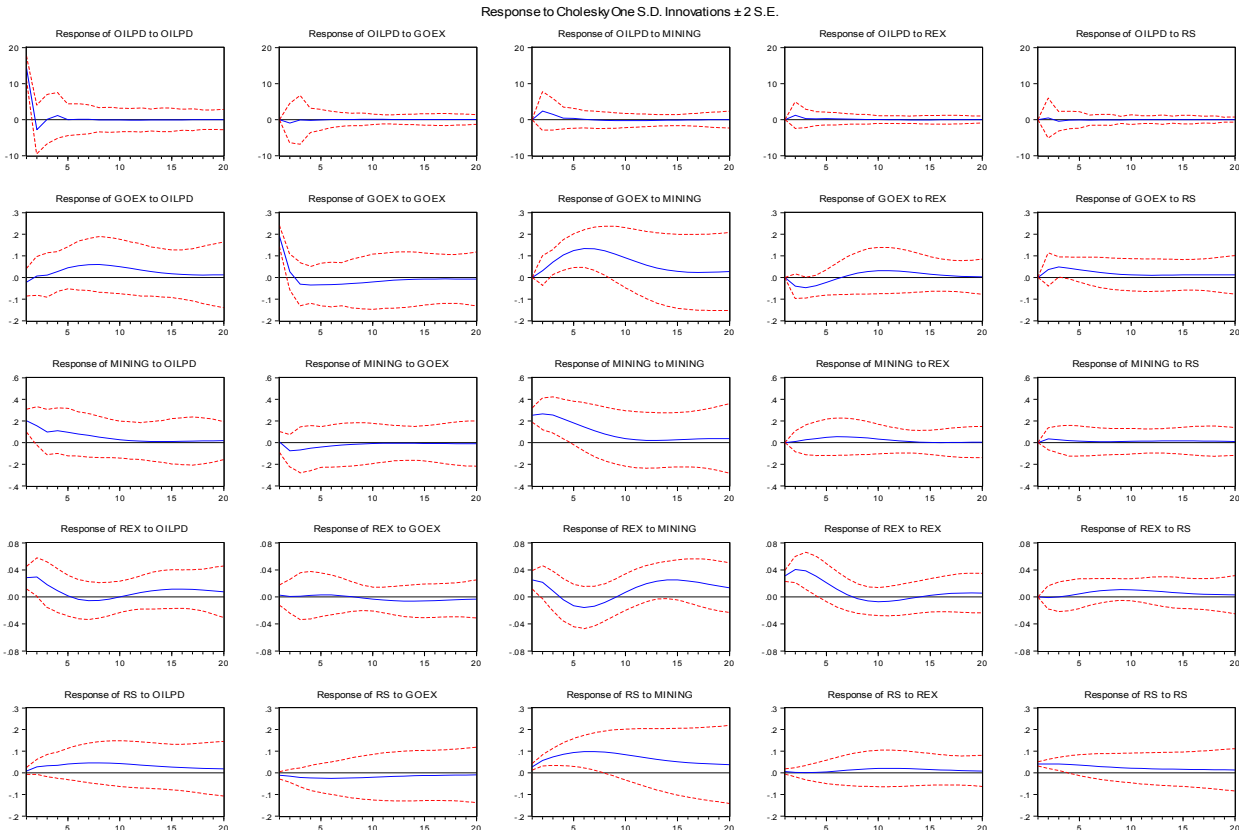
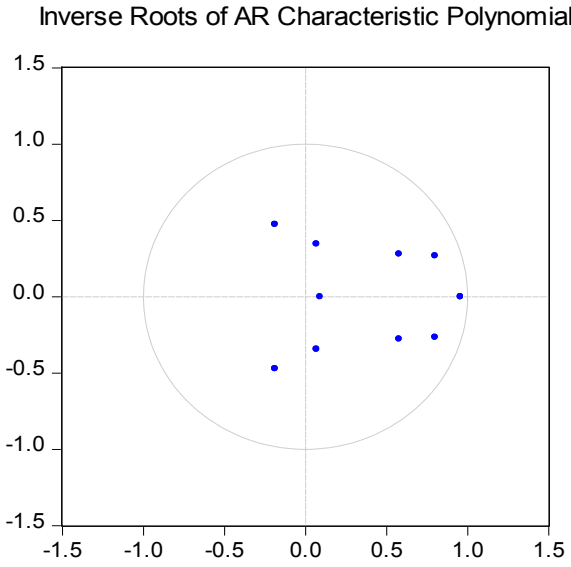


Figure 4. Inverse roots of AR characteristic polynomial



Conclusion and Policy Recommendations

In the last few years, the oil prices have experienced sharp ups and downs in international oil market. This situation reflected heavily on the Saudi Arabian budget and on the macroeconomic variables. In light of the non-linear oil price variations, this paper has examined thoroughly the impacts of such a shock (increase and decrease) on the

service sector for the period of 1975-2015. The non-linear oil price changes have been investigated using structural VAR (SVAR) model. The Johansen co-integration tests showed an existence of long-run relationships among the variables, a non-linear oil price shocks (OILPI and OILPD), GOEX, REX, MINING, and RS. However, in the short-run, the findings showed that OILPI, REX, GOEX, and MINING have positively influenced RS.

Furthermore, the results indicated that the real service sector responded positively to one standard deviation of a nonlinear positive oil price variations. The positive effect is about 25%. Based on the results obtained from equations 14, and 14a, a positive oil price shock (say 10%) causes an increase in RS by 0.008%. From the same equations, an increase in government expenditure, spending effect, (say 10%) leads to a rise in RS by 8 percent. Similarly, from the same equations, a 10% increase in REX causes an increase in RS, by 9%. On the other hand, a negative oil price change by 10% leads to a decrease in RS by about 0.002%. The effects of REX, GOEX, Mining on RS is positive indicating the influence of government expenditure and the real exchange rate on RS. The finding here is consistent with the findings in the Dutch disease literature. Facing the sharp decline in oil revenues which will definitely affects the macroeconomic variables; the Saudi authority has to think urgently in diversifying the resources of income. Nonetheless, the role of government is to strengthen the macroeconomic structure in order to mitigate the negative effects via implementing policies that encourage the development of traded goods sectors.

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Efficiency Assessment and Development Forecast of the Institutions Stimulating the Innovative Behavior of Economic Entities in a Resource-Extraction Region

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Abstract:

The objective of the research is to assess efficiency and to forecast development of the institutions that stimulate innovative behavior of economic entities in a resource-extraction region, using the example of the Khanti-Mansi autonomous Okrug – Yugra. The assessment is done using two methods – indirect and direct. The indirect one is carried through the level of innovative intensity and demand for these institutions. The direct method is based on the results of questionnaire survey to innovative activity's participants. Indirect assessment reveals the fact that the correlation between institutions stimulating the innovative behavior and the level of innovative intensity prove to be weak and transient. Direct assessment testifies subsidies and grants to be the most effective institutions, though their effect is transient. Technology parks and tax concessions are found to be more effective, with more sustained effect. Other stimulating institutions within the Yugra region have not been proved to be effective yet. Based on efficiency assessment and revealed institutional traps, we forecast the development of the stimulating institutions, which appears to be pessimistic for the most institutions. We also suggest measures to modernize and adapt institutions stimulating the innovative behavior adjusted for impact of foreign economic factors and business environment. Academic novelty of the research lies in the fact that the author's method of assessing the transactional efficiency of institutions has been applied.

Keywords: stimulating institutions; innovative behavior; efficiency; development forecast; adaptation; modernization.

JEL Classifications: O10; C13

Introduction

Amid protracted crisis in Russia, which threatens to go into recession, institutions stimulating the innovative behavior of economic entities become important, since the innovation can become a driver of an economic slowdown. Therefore, governments of countries, that are in a recession, in any way, stimulate innovative behavior of their entrepreneurs. However, in times of crisis such measures and stimulating institutions have to be more efficient due to toughening requirements. Thus, great importance attaches to the methods and approaches for assessing their efficiency. Many authors assess the efficiency of measures to stimulate innovation activity in the Russian Federation (Kondratyeva 2009, Lamberova 2012, Nikonov 2009) and abroad (Cincera and Capron 2000, Borner, Bodmer and Kobler 2004, Ton, Rau, de Grip and Klerkx 2011), that have shown a correlation between the efficiency of stimulating institutions and the level of transaction costs.

1. Research methods

In this paper (Islamutdinov 2012) we have summarized the efficiency assessment methods for institutions, and proposed an assessment method for transactional efficiency of institutions stimulating the innovative behavior. Efficiency assessment methods for stimulating institutions should be divided into two groups – indirect and direct. Indirect methods are based on a comparison of different data on the functioning of institutions and the innovation activity of economic entities. The disadvantage of indirect methods is that the innovation activity and the prevalence

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of innovative behavior are influenced by many factors, the effect of which can both enhance and neutralize the effect of stimulating institutions. For example, sanctions crisis both reinforces the innovation activity, owing to the increased protection of domestic markets from foreign competitors, and reduces this activity, as financial capabilities decreased significantly. Direct methods involve numerical efficiency assessment of institutions based on data obtained either from annual reports or questionnaires. The disadvantage of direct methods consists in the difficulty of obtaining data, as the most innovation activity relates to the field of trade secrets.

2. Findings

The following factors may serve as an indirect efficiency assessment of institutions stimulating the innovative behavior:

- changing of innovation activity and distribution of innovative behavior after any given stimulating institution has been introduced;
- demand for organizations' services providing operation of stimulating institutions.

Table 1 presents the comparison of changes in the innovation activity after any given institution began to operate.

Table 1. The correlation between the innovation activity level after any given stimulating institution in the Khanty-Mansi autonomous okrug – Yugra began to operate and the influence of external factors.

Years	Innovation active organizations, year end, number.	Share of innovation active organizations, %	Start of use of institutions stimulating the innovative behavior	External factors affecting innovation activity
2003	18	7	Regional Business Incubator	Rise in oil prices
2004	18	6,7		
2005	18	5,3	The Law of the Khanty-Mansi autonomous okrug – Yugra "On tax concessions"	
2006	34	8,6		
2007	33	7,7		
2008	33	5,2	Federal innovation tax concessions package	Economic crisis, fall in oil prices
2009	44	7	High Technology Park Regional Investment Center	
2010	48	7,5	Microfinance Fund	
2011	53	8,3		
2012	39	6,1		Recovery of oil prices
2013	40	6,6	Export Promotion Center of Yugra	
2014	35	5,5		Sanctions crisis, fall in oil prices

From Table 1 we see a clear correlation between the economic crisis caused by the fall in oil prices and the level of innovation activity in Yugra. Both in 2008 and in 2014 there was a reduction in the share of innovation active organizations. Thus, we can say the main factor negatively influencing the innovative behavior, is lack of financial resources, inflicted by crisis events. At the same time, we can see bursts of innovation activity in the period immediately after the institutions stimulating innovative behavior came into force. For instance, 2005, the year when the Law of the Khanty-Mansi autonomous okrug – Yugra "On tax concessions" was passed, followed by a double-up in innovation active organizations established next year. Similarly, the Microfinance Fund was put into operation in 2010, having increased the number of innovation active organizations by 10%. However, the effect turned out to be temporary, the innovation activity level was decreasing even with no crisis in sight. Concerning the demand for the stimulating institutions, the data is fragmented, because statistics are often not collected at all. Demand for tax

concessions institution can be evaluated on the basis of data from the analytical report on the assessment results of fiscal, social and economic performance owing to tax concessions in Yugra (Table 2).

Table 2. Demand for innovations tax concessions in the Khanty-Mansi autonomous okrug – Yugra.

Criteria	2011	2012	2013	2014	2015	2015 to 2011, times
Organizations benefited from "research and development" privileged category, number	0	0	0	0	0	-
Organizations benefited from reduced tax on profits, number	34	47	51	48	45	1,3
With organizations among them nominally related to innovation active organizations, number	2	7	5	7	4	2,0
Taxpayer funds released as a result of the use of exemptions for tax on profits for the implementation of innovative projects, as well as the creation of innovative infrastructure and its operations, million rubles.	no data	no data	3.213,1	23.492,5	23.446,1	-
Organizations benefited from property tax exemptions, number	11	14	84	73,0	352	32,0
With organizations among them nominally related to innovation active organizations, number	1	4	7	11	11	11,0
Taxpayer funds released as a result of the use of exemptions for property tax for the implementation of innovative projects, as well as the creation of innovative infrastructure and its operations, million rubles.	no data	no data	480,8	1119,9	1126,9	-

The tax on profits exemption for the period under study has not demanded by the organizations belong to the "research and development" privileged category. Overall, the number of organizations that benefited from a reduced income tax rate has increased from 34 to 45 companies, with some companies among them that may have been attributed to the innovation active ones by occupation, such as dealing with the separation and recovery of petroleum (associated) gas fractions, and manufacturing industries. The number of such organizations increased in 2015 by half.

As for the property tax, the number of organizations that benefited from this has increased 32 times, where the innovation active ones by occupation include organizations carrying out investment projects in the field of separation and recovery of petroleum (associated) gas fractions and other investment projects, their number also increased 11 times. That is, the benefits from property tax were much more popular than from tax on profits.

According to information on the use of funds as a result of tax exemptions on organizations' income tax and property tax, the amount of funds allocated by taxpayers on the implementation of innovative projects and the creation of innovative infrastructure and its operations has increased significantly. So, due to the funds released as a result of the use of exemptions for tax on profits, this amount has increased by 7 times, and due to the funds released as a result of the use of exemptions on property tax, by 2.5 times. Another institution, the effectiveness of which can be estimated through demand, is an ability to provide financial support for innovation companies in the form of grants and subsidies (Table 3).

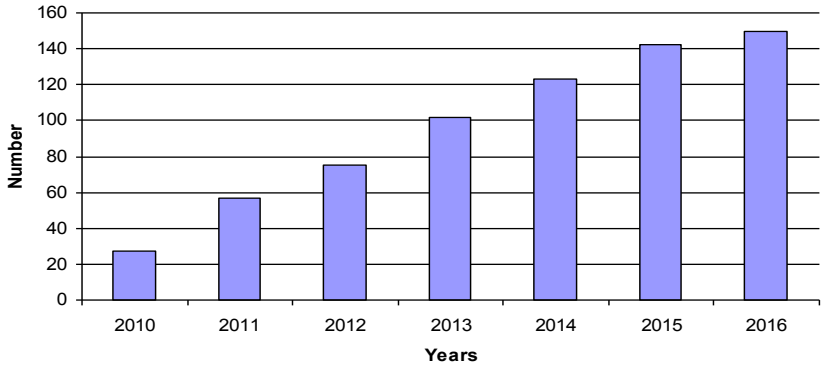
Table 3. The demand for innovation grants and subsidies in the Khanty-Mansi autonomous okrug – Yugra

Criteria	2011	2012	2013	2014	2015
Organizations awarded with a grant for innovation start-ups, number	24	12	24	1	5
Amount of grants awarded, thousand rubles	12.000,0	6.000,0	12.000,0	500,0	2.500,0
Organizations awarded with a subsidy for innovation companies, number	16	12	11	1	2
Amount of subsidies paid to innovation companies, thousand rubles	25.498,9	16.000,0	16.000,0	498,8	601,7

Criteria	2011	2012	2013	2014	2015
Organizations awarded with a cash prize for winning the competition, number	6	6	13	-	-
Amount of cash prizes paid, thousand rubles	1.980,0	1.980,0	4.800,0	-	-

It should be noted that in the period of 2011-2013 strong support for innovation active organizations was given, though, since 2014 the amount of support has fallen dozens of times, that has less to do with the lack of demand for these forms of support, but with reduced funding and the complexity of their awarding process. To understand the situation with the demand for institutions stimulating the innovative behavior, one can use information on demand for technology parks services, particularly the High Technology Park. As of today, 150 innovation companies enjoy resident status at the High Technology Park of Yugra (see Figure 1).

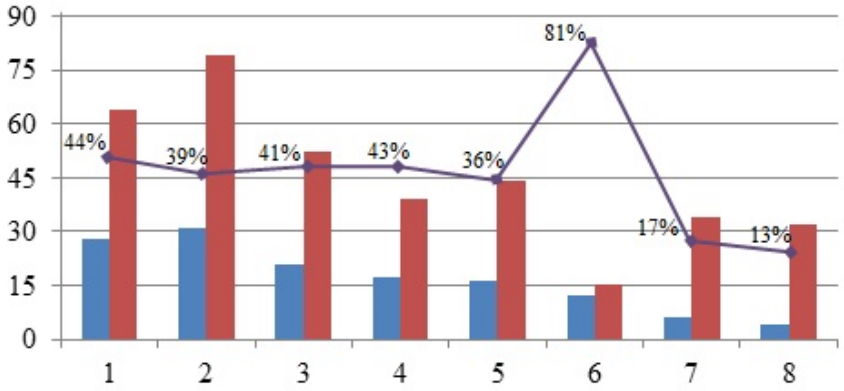
Figure 1. Number of innovation companies – residents at the High Technology Park



The number of residents at the park has nearly reached its maximum, since there is no unused space left. However, the number of residents and the use of space do not fully show the demand for the park's services, because the range of services offered by the park may not meet the needs of innovation active companies.

According to the opinion poll among innovation companies – residents at technology parks in the Tyumen region – the list of services poorly meets their needs. Figure 2 shows the main services provided by the technology parks of the Tyumen region, and the percentage of innovation companies found them relevant.

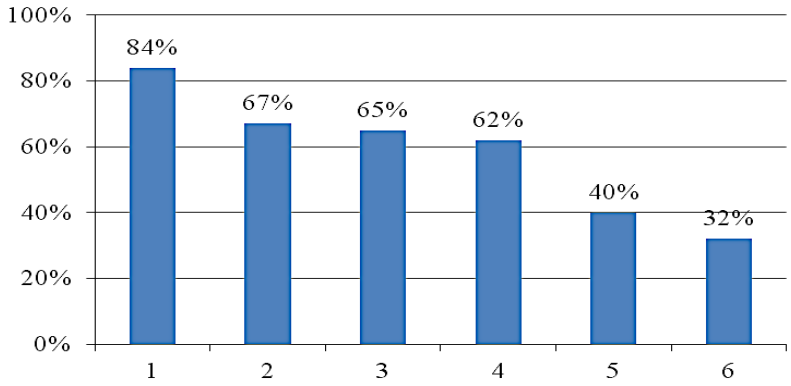
Figure 2. How innovation companies' needs comply with rendered services



Note: ■ Core services rendered by Technology Parks; ■ Innovation companies' needs; 1 Office lease; 2 Exhibition showcase; 3 Arrange meetings with prospective customers; 4 Patenting promotion; 5 Business plan drafting; 6 Product certification; 7 Research and Development contracts; 8 Prototyping

Technology parks occasionally render additional services for innovation companies, the demand is shown in Figure 3.

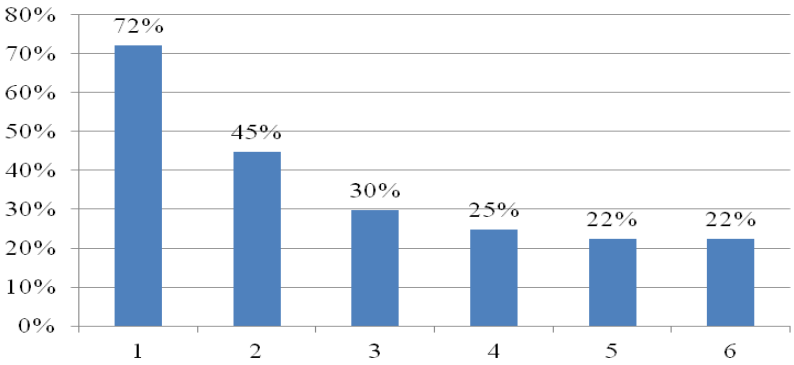
Figure 3. Demand for technology parks' services rendered for innovation companies occasionally



Note: 1. Source and information support; 2. Investment promotion; 3. Media coverage for projects powered by innovation companies; 4. Printing service; 5. Website development; 6. Recruitment

Meanwhile, there is a whole spectrum of needs among innovation companies that are satisfied in no way (Figure 4).

Figure 4. Demand for services among innovation companies that are not rendered by technology parks

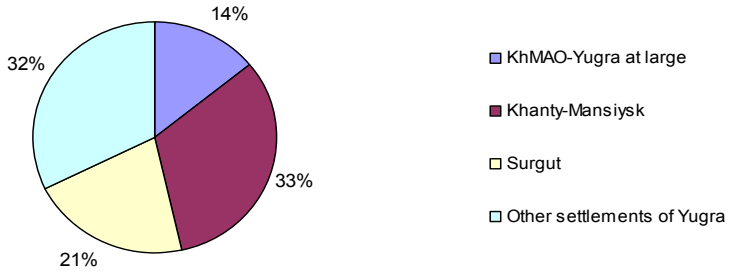


Note: 1. Marketing research; 2. Legal support for projects; 3. Accounting services for projects; 4. Intellectual property assessment; 5. Business partners' enquiry; 6. Sale or purchase of patents\licenses

Thus, technology parks' services may be said to have been in demand, though the range of services does not meet the needs of innovation active companies.

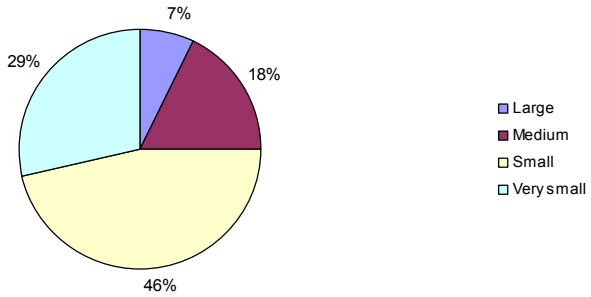
To assess efficiency of stimulating institutions we conducted a questionnaire survey among companies with innovation activity experience. The survey comprised 27 companies, with 23 of them engaged in innovation activity to date. Companies that do not innovate, as the main reasons pointed out: poor investment climate, lack of development of innovation infrastructure and lack of resources. Direct financial assistance could encourage them to innovate. At the same time the vast majority of respondents, which is 70.4%, were either creators and business owners or top managers, while 81.5% said the implementation of innovative reforms belonged to their direct duties. According to the geographical distribution most of the companies surveyed is located in cities of Khanty-Mansiysk and Surgut (Figure 5).

Figure 5. Surveyed companies scheme, as per geographical location



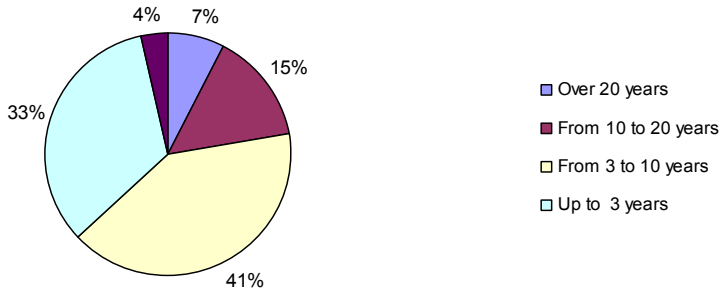
As concerns the size, the prevailing part of innovation companies (74%) consider themselves to be small and very small (Figure 6).

Figure 6. Surveyed companies scheme, as per size



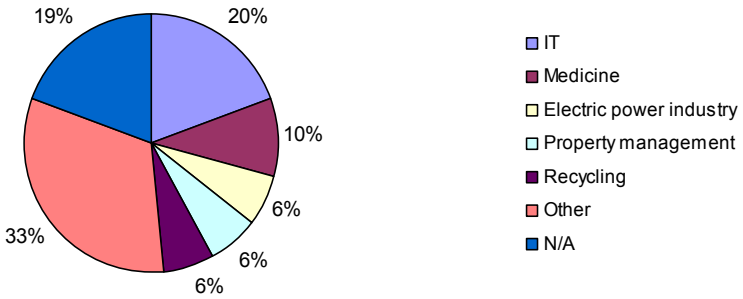
As per maturity, companies that have been on the market from 3 to 10 years are prevailing (Figure 7).

Figure 7. Surveyed companies scheme, as per maturity



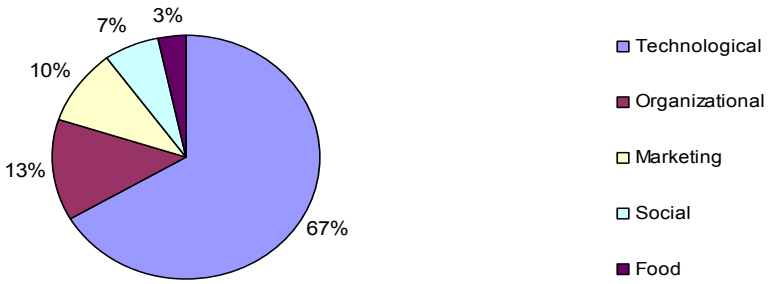
IT companies prevail among different economic sectors (Figure 8).

Figure 8. Surveyed companies scheme, as per economic sector



As we proceed to the survey results, it should be noted that technological innovations are found to be the predominant type of all innovations being implemented (Figure 9).

Figure 9. Distribution of innovation companies, as per innovation type.



As for specific institutions stimulating the innovative behavior, opinions have split up as follows (Table 4).

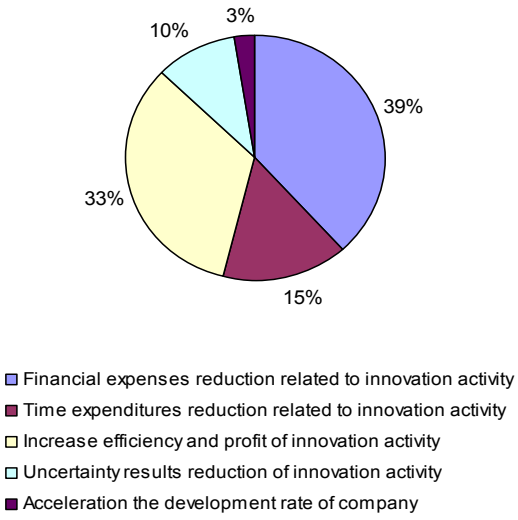
Table 4. Response dispersion on type of stimulating institutions.

Stimulating institutions	Aware	Used	Consider to be effective
Grants	24	13	5
Venture capital funding	10	2	0
Concessional lending (microfinance)	18	4	3
Finance lease	8	2	0
Subsidies	18	6	6
Tax concessions	12	4	2
Business incubators	9	2	3
Technology parks (technopolis)	21	11	6
Patenting	10	2	1
Business angels	10	2	0
Own response option	5	5	7
Non response	0	7	5

Consequently, the most well-known stimulating institutions are grants and tech parks. The surveyed companies often used these same institutions. At the same time subsidies are considered to be the most effective institution because all of 6 users noted the effectiveness of the institution, while grants and technological parks are believed to be effective only by half of those who used it.

Venture financing, leasing and business angels are the least effective – no one having brought into use these institutions considered them effective. With all that, there is an interesting interrelation between efficiency assessment and company size. Small ones find technology parks effective, while large companies do tax concessions. An intriguing finding relates to the companies' maturity – start-ups have no special preferences but mature ones favour subsidies. Feedback on the question "How does the efficiency of stimulating institutions show itself?" is as follows (Figure 10). That is the predominant effects, according to the respondents are the cash costs reduction associated with innovation and increasing the efficiency and profitability of innovation.

Figure 10. Response scheme to "How does the efficiency of stimulating institutions show itself?"



The specific effect value is shown in Table 5. Almost all of the respondents appreciated the effectiveness of stimulating institutions when it came to costs reduction associated with innovation activity (by 39%), as well as increasing the financial results (profits) due to the innovation (by 35%). The institutions' effectiveness was said to be twice as much effective when it concerned an increased persistence of the effect due to innovations (the period during which you can generate more revenue). However, the respondents told it could cut this period by 37%. As for other criteria of effectiveness, there is no consensus on positive effect produced by stimulating institutions, though the respondents noted a slight rise in financial capability (initial capital), slight reduction of time spent on innovation activities and slight resolving of uncertainties associated with innovation process, both in terms of resource overrun and profit from implemented innovations.

Table 5. The average effectiveness assessment of the institutions stimulating the innovative behavior.

#	Efficiency criteria	Support tool	
		Reduce (by % or n-fold)	Boost (by % or n-fold)
1.	Financial expenses related to innovation activity	39%	0
2.	Financial results (profit) from innovation activity	1%	35%
3.	Financial capacity (initial capital)	5%	16%
4.	Time expenditures related to innovation activity	22%	4%
5.	Time manifestations of the effect of innovation	37%	108%
6.	Reserve of time for the implementation of innovation	15%	12%
7.	Resource overrun risk compared to planned value	16%	3%
8.	Uncertainty of obtaining profit from implemented innovations	13%	8%

As for the effectiveness of particular stimulating institutions, those who used the subsidy, noted that this institution significantly reduced (by 46%) the financial expenses, increased the financial capacity and the results of innovative activities (by 26 and 30%), reduced the uncertainty of resources overrun by 31%, but at the same time increased the uncertainty of obtaining additional profit from implemented innovations by 25%.

Those awarded with grants also noted this institution to reduce significantly (by 47%) the financial expenses, to increase the financial capacity and the results of innovative activities (by 73 and 23%), to increase the time allowance for innovations to be implemented by 33%, to reduces the uncertainty of the resources overrun by 27% and the uncertainty of obtaining profit from the implemented innovations by 27%.

The respondents who used the technology park services, said this institution were effective in reducing time needed to make innovative ideas mature by 25%, making it commercially viable, and somewhat reducing financial expenses (by 20%), and increasing financial results (by 20%).

Therefore, having compared the effectiveness of institutions on statistical data and survey results, we can conclude that the most effective institutions are subsidies and grants, but their effect is short. Technology parks and tax concessions are less effective, with longer effect. The effectiveness of other stimulating institutions in Yugra is not proved.

More than half of the respondents (51.9%) admitted they felt how specific features of the regional economy impacted the effectiveness of institutions stimulating the innovative behavior. The most frequently interviewed mentioned low density of industrial enterprises as a feature, which results in poor development of the innovative activity in Yugra.

3. Results discussion

Data on the effectiveness of these institutions enables us to predict their further development. When predicting the evolution of institutions, they need to be divided into two groups with case scenarios: evolutionary, which concerns institutions with long history of operation and revolutionary, when institutions are imported relatively not long ago. Institutions stimulating the innovative behavior belong to the second group, recently imported.

With regard to the institutions that function for a long time, in the paper (Islamutdinov 2014) we have revealed a positive feedback between the efficiency of institutions and demand for them. What is more, the relation is bilateral: on the one hand effective institutions are more in demand, on the other hand, more popular institutions become more efficient due to economies of scale, learning effect, etc.

As for the imported institutions, according to Polterovich (Polterovich 2007), there are several possible scenarios for them to evolve, that affect the efficiency: the adoption, when the institute takes root; atrophy, when the institution remains unclaimed; degeneration, when the institution survives, but begins to function unusually compared to initial duties; and rejection resulted from the conflict of institutions (mainly informal).

In addition, we carried out a classification of institutions through their way of functioning, according to which we can distinguish three groups: institutions, acting directly on the basis of trust and business practices; institutions, acting through public and administrative authorities; and institutions acting through specially created organizations (development institutions).

Development forecast for the institutions of the first group is described by a function we elicited in our research (Islamutdinov 2014), that is, it all depends on the ratio of costs to master an institution and of saving transaction costs, provided by the institution. These institutions refer to “Schumpeter’s” market competition, innovation networks (ecosystems), business angels and industry standards. Only industry standards may be noted among these institutions within Yugra, and this is in the only industry – oil and gas geologic exploration, which has adopted best international practices of companies like Schlumberger and Halliburton. In such case, the institution has already passed through the initial expansion stage, and most likely will continue to spread, despite the crash of “easy-to-access foreign technology traps”. As for the other institutions in this group, they are likely to fall into the institutional trap, as their development cost appeared to be prohibitively high in terms of widespread rent-seeking behavior of economic entities.

The institutions of the second group include tax concessions, subsidies, environmental regulations and penalties, patents, compulsory licensing, national standards. Grants may also fall under this group in part, as much of it provided by the government. Yugra is in possession of tax concessions, subsidies, grants, environmental regulations and penalties and patents. As we mentioned before, this group includes institutions with high, but short-term effect, *i.e.* subsidies and grants. These institutions, as well as the tax benefits may be considered as established ones. As for environmental standards and penalties, it is worthwhile noticing the rejection of the institution, as many companies perceive them as a nuisance rather than an incentive to introduce new technologies. As for patents it can be said that there is a degeneration of the institution, in Russia it performs initially unusual functions to assess the effectiveness of scientific research. Development forecast for this group of institutions is entirely determined by the state policy in the field of innovation. We should note established institutional traps so far, which reduce the effectiveness of these institutions; so called “lack of innovation offering” and “excess money and excessive requests”. These traps may induce public authorities to find it ineffective to continue further state support, it means a forecast to be more likely a pessimistic one.

Institutions of the third group aggregate venture capital funding, private grants, business incubation, residence in tech parks, concessionary loan (microfinance), leasing, shared use of scientific equipment, transfer of knowledge and technologies. Yugra region enjoys business incubation, residence in tech parks, concessionary loan (microfinance), leasing. There have been attempts to develop venture capital funding, shared use of scientific equipment, as well as the transfer of knowledge and technology, but they came to nothing, that is, there was atrophy of these institutions. Business incubation also shows signs of atrophy. Due to the fact that all of the organizations are funded by the state, the development forecast for this group of institutions is also completely determined by the state policy (and funding) in the field of innovation. Established institutional traps – lack of innovation offering, rent-seeking behavior and "Skolkovo syndrome" – are an obstacle for the institutions' evolution as well (Strambach 2011). So the forecast is pessimistic again, the only organization that has the potential to reach the breakeven point is the Yugra Leasing Company. A corruption scandal surfaced over the High Technology Park of Yugra indicates changes in state policy of funding institutions, stimulating the innovative behavior is underway.

Generalized development forecast for stimulating institutions is shown in Table 6.

Table 6. Development forecast for institutions stimulating the innovative behavior in the Khanty-Mansi autonomous okrug – Yugra.

Group of institutions as per type of performance	Name of institution	Presence in Yugra region	Evolution scenario	Development forecast
Institutions acting directly on the basis of principles of trust and business practice	"Schumpeter's" market competition	No	-	Pessimistic
	Innovation networks (ecosystems)	No	-	Pessimistic
	Business angels	No	-	Pessimistic
	Industry standards	Yes	Adaptation	Neutral
Institutions acting through public and administrative authorities	Tax concessions	Yes	Adaptation	Neutral
	Subsidies	Yes	Adaptation	Neutral
	Government grants	Yes	Adaptation	Neutral
	Environmental standards and penalties	Yes	Rejection	Pessimistic
	Patenting	Yes	Regeneration	Pessimistic
	Compulsory licensing	No	-	Pessimistic
	National standards	No	-	Pessimistic
Institutions acting through specially established organizations (Development institutions)	Residence at technology parks	Yes	Adaptation	Neutral / Pessimistic
	Concessionary loan (microfinancing)	Yes	Adaptation	Neutral
	Business incubation	Yes	Adaptation/ Atrophy	Neutral / Pessimistic
	Leasing	Yes	Adaptation	Neutral
	Shared use of scientific equipment	Yes	Atrophy	Pessimistic
	Transfer of knowledge and technology	No	Atrophy	Pessimistic
	Venture capital funding	No	Regeneration	Pessimistic
	Private grants	No	-	Pessimistic

Unfavourable development forecast for institutions stimulating the innovative behavior sets the task to identify the need and opportunities for these institutions to be modernized, taking into account the impact of changes in foreign economic environment and market conditions (Table 7).

Table 7. The need for modernization and adaptation of institutions, taking into account the impact of changes in foreign economic environment and market conditions.

Group of institutions as per type of performance	Name of institution	Impact of changes in foreign economic environment and market conditions	Modernization\adaptation measures
Institutions acting directly on the basis of principles of trust and business practice	"Schumpeter's" market competition	Competition globalization on foreign market, competition weakening on domestic market	Institution is not subject to modernization due to its natural makeup
	Innovation networks (ecosystems)	National companies' failure to join the global ecosystems	Institution is not subject to modernization due to its natural makeup
	Business angels	Slowdown activity of international business angels	Institute is not subject to modernization due to its natural makeup
	Industry standards	Dependence on foreign standards	Localize industry standards
Institutions acting through public and administrative authorities	Tax concessions	Benefits cuts	Improve results-benefits link
	Subsidies	Subsidies cuts	Transition to support particular types of products and services
	Government grants	Grant financing cuts	Specify innovation signs of projects
	Environmental standards and penalties	Does not affect	Not required
	Patenting	Does not affect	Not required
	Compulsory licensing	Does not affect	Not required
	National standards	Does not affect	Not required
Institutions acting through specially established organizations (Development institutions)	Residence at technology parks	Financing cuts	Ensure the rotation of residents
	Concessionary loan (microfinancing)	Financing cuts	Raise private capital for co-funding
	Business incubation	Financing cuts	Switch to self-sustaining
	Leasing	Financing cuts	Involve retirement savings
	Shared use of scientific equipment	Does not affect	Not required
	Transfer of knowledge and technology	Restricting access to foreign technology	Establish transfer of knowledge and technologies from BRICS states
	Venture capital funding	Financing cuts	Raise private capital for co-funding
	Private grants	Financing cuts	Extend tax concessions for private grantmakers

In general, the impact of changes in foreign economic environment and market conditions is negative, and is manifested in the reduction of public funding and the isolation of the Russian domestic market.

Conclusions

Thus, the efficiency of institutions stimulating the innovative behavior in Yugra is assessed to be insufficient. There are several institutions which show high efficiency in the short term, these are grants and subsidies. Tax concessions, industry standards and residency at technology parks have longer effect, but their effectiveness is

low. For the latter we can predict neutral scenario, for the rest of institutions it is a pessimistic one. The effect of changes in foreign economic environment and market conditions is generally negative and worsens the prognosis.

An issue of the joint acting of stimulating institutions and mutual influence on their efficiency remains to be open. Further research to identify the efficiency of individual stimulating institutions, including simulation methods and BigData technology, is also needed.

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The Complexity of Poverty Among Benteng Chinese in Tangerang District, Indonesia

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Abstract:

The purpose of this research is to investigate what are determinants of the poverty among Benteng Chinese in Tangerang district, Indonesia. The research utilises a grounded theory based on in-depth interviews with key informants which most are Benteng Chinese. The research conducted data triangulation to get data saturation and data quality, rigor, trustworthiness and confirmability or validity and reliability in quantitative term. The result of the study shows that the determinants of poverty are complex. Integration of the structural theory of poverty, the cultural theory of poverty, the individual theory of poverty and the cyclical interdependencies theory of poverty are used to explore the complexity of the poverty. Finally, a mini theory of the complexity of poverty is built on findings of the research.

Keywords: poverty; theories of poverty; complexity of poverty; poor Chinese

JEL Classification: I38; P36; P46

Introduction

Benteng Chinese are the Chinese of Tangerang district, Indonesia. Their ancestors have lived in Tangerang since the 1400s. Tjwan (2008:12) said that Jakarta urbanites call Peranakan Chinese in Tangerang as Cina Benteng (Fortress Chinese). Because an ancient name of the Tangerang district is Benteng city, then Benteng Chinese refer to Chinese residents in Tangerang district. Benteng is the Indonesian word for fortress. Dutch in the colonial era built a fortress on the banks of the Cisadane river. It was the front-line defence for the Dutch port of Batavia against attacks from the Sultanate of Banten. During the Dutch colonial era, Chinese residents lived in the fortress, so they were called Fortress Chinese (Cina Benteng). Currently, Jakarta urbanites stereotype Benteng Chinese as backward Chinese or poor Chinese because of the fact that many poor Chinese live in this district.

This fact is in contrast with the prosperity of other Chinese in Indonesia. Prosperity usually is attached to identity of the overseas Chinese because of their economic domination, such as in Southeast Asia and especially in Indonesia. Redding (1993), Hamilton (1998), Hefner (1998), and Mackie (1998) chronicled the economic

superiority of overseas Chinese compared with indigenous people. Hefner (1998) stated that the Chinese population is about 4 per cent of Indonesian population, but they may dominate 70 to 75% of middle and large enterprises in Indonesia.

Therefore, there are three primary reasons we have chosen to research poverty in the Benteng Chinese community. First, in our observation, the social, economic, and cultural characteristics of the Benteng Chinese community are unique compared to other overseas Chinese communities in Indonesia. In particular, while most overseas Chinese communities in Indonesia are relatively prosperous, poverty is the norm for the Benteng Chinese. Secondly, the causes for this poverty are complex, and the usual theories of poverty do not appear to adequately explain it. Finally, there is a scarcity of published research on factors contributing to poverty in the Benteng Chinese community.

The structural theory of poverty, the cultural theory of poverty, the individual theory of poverty, and the cyclical interdependencies theory of poverty, which is an integration of the previous theories, are four theories of poverty that are found in contemporary literature (Bradshaw 2005). Based on the theories of poverty, this research investigated:

- the characteristics of poverty of Benteng Chinese in Tangerang district;
- how the structural theory of poverty explores the poverty of Benteng Chinese;
- how the cultural theory of poverty explores the poverty of Benteng Chinese;
- how the individual theory of poverty explores the poverty of Benteng Chinese;
- how the cyclical interdependencies theory of poverty explores the poverty of Benteng Chinese?

This research uses grounded theory to conduct in-depth analysis and build a model or theory of poverty. The complexity of the poverty model is proposed as the climax of the research.

1. Literature review

In his famous book, *The Mystery of Capital: Why Capitalism Triumphs in the West and Fails Everywhere Else* (1941, 2000), Hernando de Soto said that much of the marginalization of the poor in developing and former communist nations comes from their inability to benefit from the six effects that property provides, namely: (1) fixing the economic potential of assets, (2) integrating dispersed information into one system, (3) making people accountable, (4) making assets fungible, (5) networking people, and (6) protecting transactions (de Soto 2000, 49-62). According to de Soto (2000, 62-63), the six effects of an integrated property process shows that Westerners' houses no longer merely keep the rain and cold out, but our endowed with representational existence, these houses can now lead a parallel life, doing *economic* things they could not have done before.

In his acclaimed book, *The End of Poverty: Economic Possibilities for Our Time* (2005), Jeffrey Sachs recognized de Soto's argument that security of private property, including the ability to borrow against land, represents the true 'mystery of capital' and that the poor in most of developing world hold their assets, such as housing and land. Sachs (2005, 321) criticized de Soto, however, because according to him de Soto's analysis is insufficient because it relies on a single factor, namely the lack of titles and deeds, to explain single-handedly the failures of development.

According to Sachs (2005, 244-245), the extreme poor lack six major kinds of capital:

- human capital, which includes health, nutrition, and skills needed for each person to be economically productive;
- business capital, which includes the machinery, facilities, and motorized transport used in agriculture, industry, and services;
- infrastructure, namely road, power, water and sanitation, airports and seaports, and telecommunications systems, that are critical inputs into business productivity;
- natural capital, which includes arable land, healthy soils, biodiversity, and well-functioning ecosystem that provide the environmental services needed by human society;
- public institutional capital, namely the commercial law, judicial systems, government service and policing that underpin the peaceful and prosperous division of labour;

- knowledge capital, including the scientific and technological know-how that raises productivity in business output and the promotion of physical and natural capital.

According to Sachs (2005, 244), the key to ending extreme poverty at the most basic level is to enable the poorest of the poor to get their foot on the ladder of development. They need outside helps, namely foreign aids.

In his great book, *The White Man's Burden: Why the West Efforts to Aid the Rest Have Done So Much Ill and So Little Good* (2006), William Easterly said, "Professor Sachs has played an important role in calling upon the West to do more for the Rest, but the implementation strategy is less constructive" (Easterly 2006, 6). Easterly (2006, 11) said, "Aid agencies cannot end world poverty and give them new opportunities," and continuing to say, "Yet helping the poor today requires learning from past efforts." Therefore, "instead of trying to "develop" Ethiopia, aid agencies could devise a program to give cash subsidies to parents to keep their children in school. Such a program has worked in other places." "Insecticide-treated bed nets can protect people from being bitten by malarial mosquitoes while they sleep. Such nets are often diverted to the black market, become out of stock in health clinics, or wind up being used as fishing nets or wedding veils" (Easterly 2006, 9-12). So Easterly exalted PSI (Population Service International) that sold bed nets to richer urban Malawians and the profits from this were used to pay for the subsidized nets sold at the clinics, so that the program pays for itself. Easterly (2006, 90) agreed with de Soto that "property rights are an incentive to accumulate assets over time and across generations, which is often necessary to have the productive capacity to meet consumer needs." He said, "Property rights also determine whether markets work."

Stephen C. Smith (2005), in his book, *Ending Global Poverty*, said that the poor cannot provide investment capital because they are poor - they are in what economists call the "poverty trap" or exist within the confines of "structural poverty." Smith listed sixteen poverty traps, namely: family child labour traps, illiteracy traps, working capital traps, uninsurable-risk traps, debt bondage traps, information traps, under-nutrition and illness traps, low-skill traps, high fertility traps, subsistence traps, farm erosion traps, common property mismanagement traps, collective action traps, criminality traps, mental health traps, and powerlessness traps (Smith 2005, 12-17).

Bradshaw (2006) explained five theories of poverty in contemporary literature*, i.e.*:

- individual theory of poverty, in which poverty is caused by individual deficiencies;
- the cultural theory of poverty, which states that poverty is caused by cultural belief systems that support subcultures of poverty;
- the structural theory of poverty, which provides that poverty is caused by economic, political, and social distortions or discrimination;
- poverty caused by geographical disparities;
- poverty caused by cumulative and cyclical interdependencies.

2. Method

2.1. Research design

This research used one of the more common and validated qualitative research approaches, grounded theory. According to Bitsch (2005), grounded theory by Glaser and Strauss (1967) is "the master metaphor of qualitative research." Bitsch (2005) said, "Grounded theory is a methodology of developing inductive theories that are grounded in systematically gathered and analysed data. Data collection, analysis, interpretation, and theory development proceed interdependent and iterative."

2.2. Data collection and triangulation

Triangulation is defined by data collection of any sources of which all that is relevant to research phenomena (Locke 2001, 45). Fusch and Ness (2015) said that "the application of triangulation (multiple sources of data) will go a long way towards enhancing the reliability of results and the attainment of data saturation." They said, "Interviews are one method by which one's study results reach data saturation." This research conducted in-depth interviews with many key informants and conducted data triangulation to achieve data saturation and do depth analysis.

2.3. Key informants

This research was conducted in Tangerang district, Indonesia from January 2008 to March 2012 using several Chinese residents in Tangerang as key informants who have been involved in the in-depth interviews. The following are several of the key informants: Miss RH is an NGO activist for poor and stateless Chinese in Tangerang district, Mr. OHK is Benteng Chinese, Mr. NT is Benteng Chinese, Mr. TTH is Benteng Chinese, Mr. JST is Benteng Chinese, Mr. TWT is Benteng Chinese, Mrs. LYN is Benteng Chinese, Mr. OMF is Benteng Chinese, Mrs. KSN is Benteng Chinese, Mr. SK is teacher for Benteng Chinese children, Mr. SD is pastor of a church of which most of its member are Benteng Chinese.

3. Findings and discussion

3.1. Portrait of poverty among the Benteng Chinese community

We created a portrait of the poverty among Benteng Chinese community through in-depth interviews with our informants as follows: Most of the Benteng Chinese have difficulty in fulfilment basic subsistence or providing food for their family; they also stated that many head of Benteng Chinese households have not yet had permanent jobs. Mr. NT said, "The conditions of the poor people of the Benteng Chinese are very alarming. Sometimes to eat also results and disadvantages. They even expect to get rice for the poor people (RASKIN) from the head of indigenous households who don't want it, so they can survive (Interview on June 6, 2010). Mr. TTH told us about the conditions of the poor Chinese in Gunung Batu area, "Many of them are very poor, even sometimes they can't find food to be eaten." Mr. TTH also said, "Many of them don't have the permanent jobs. Sometimes if someone asks them to help, they can get some money. But the opportunity like that is very rare. I pity someone who sometimes visit my house. So sometimes I share something with him so that he can provide food for his family" (Interview on July 1, 2010). Mr. SK gave the portrait of the conditions of the many households of the Benteng Chinese in Kedaung and Kelor areas, which are similar with their conditions in Gunung Batu as portrayed by Mr. TTH.

According to Mr. SK, in Kelor and Kedaung areas, houses of the poorest residents are built with of wood or bamboo, have no ceramic tiles, and looks like a slum. Several of the poor people settle in the fairly large houses, the inheritance from the previous generation, but these large houses are crowded by many heads of families and the majority of household heads are unemployed (Interview on June 6, 2010). This resident situation is similar with houses of the poor Chinese in Kampung Melayu, Kajangan, Sela Pajang, Kedaung, Cigaling, and Legok areas that Mr. NT described (Interview on June 6, 2010), as well as that described by Mr. TTH about the settlement of poor Chinese in Gunung Batu area" (Interview on July 1, 2010).

Regarding the fulfilment of health needs, Mr. NT said, "They almost don't have the ability to pay hospital expenses. So they will not go to a hospital for treatment if they are sick because they have a financial problem. If they get seriously ill, they will go to a shaman because it will not result in an expensive cost" (Interview on June 6, 2010). In addition, Mr. SK also said, "They don't have money to go to a medical doctor because it is expensive. At least they will buy a cheap 'unclear medicines'" (Interview on June 6, 2010). Mr. TTH said, "When they get sick, they will go to Puskesmas (Public Health Center) for the poor people or they will go to the shaman. Many Chinese our like that here. They don't have money, if a man is sick and doesn't have money to go to the medicine doctor, the final choice he believes in is to drink 'white water' from the shaman so that they get well" (Interview on July 1, 2010).

All of above information our real portraits of the poverty among the Benteng Chinese people in Tangerang district. But what are the factors that caused the poverty among these Chinese when other Chinese groups in Southeast Asia are usually prosperous? The following are our findings in the research.

3.2. The impact of political distortions on poverty

In the research we find that firstly, the poverty among the Benteng Chinese community is caused by the lack of civil rights accessibility. According to our informant Miss RH, the poor Chinese did not have civil rights access. For example, they have troubles to get letters from the RT (head of neighborhood) or the RW (head of hamlet) that proves if they are poor, which is needed to access free treatment at Puskesmas (Public Health Center) and get

other aid. As Narwoko and Suyanto (2006, 179) said, poverty is suffered by a community group as an impact of social structure, so they cannot access income sources that our really available for them. Unjust social structure is one of the sources of poverty.

Secondly, the lack of civil rights accessibility is caused by their statelessness. According to Couldrey and Herson (2009), "A 'stateless person' is someone who is not recognized as a national by any state." Manly and Persaud (2009) said, "In legal terms, being stateless means that no state considers you a national under the operation of its law." The Jakarta Post, February 12, 2010, reported the life stories of Miss Sian and Miss Lenah, which reported they cannot get civil rights access because of their statelessness. Kompas, April 14, 2010 also reported, "In addition to obtaining ID cards [for Benteng Chinese] are complicated, they are often denied when taking care of a poor family card. They are hard to take care of birth certificate, marry documents, divorce, and family card (KK) because often "dipalak" (is asked money) simply because they are not native." People who do not have clear citizenship will not automatically have access to civil rights. Civil rights that include the right of political participation, equality before the law, and freedom from discrimination based on race, religion, or gender would not be owned by a stateless people, because the stateless condition itself is a manifestation of not possessing civil rights in the first place. As Goris et al. (2009) said, "Recognition of nationality serves as a key to a host of other rights, such as education, health care, employment, and equality before the law."

Thirdly, statelessness also caused lack of employment. Legal status of citizenship is very important and is needed to access job opportunities. The case of Miss Sian, a Chinese woman, as was reported by The Jakarta Post, their statelessness prevented getting higher education, so Miss Sian was only able to get a job as a shop assistant with a wage of IDR43,000.00 (about US$ 3.00) monthly. White (2009) said that formal sector employment would not normally be available to non-citizens or stateless people. The lack of employment caused the rate of unemployment and this unemployment impacts their poverty.

Fourthly, the statelessness impacts political discrimination, bureaucracy barriers, social pressers, and their careless attitude to obtain the required documents. According to Goris et al. (2009) "Statelessness may result from various circumstances. States may simply cease to exist while individuals fail to get citizenship in their successor states; political considerations may dictate changes in the way that citizenship laws are applied; an ethnic minority may be persecuted by being denied citizenship." Goris (ibid) further states "there are individuals who become stateless due to personal circumstances," with an example of this being careless to take care of documents. Failure to register the birth of a child also caused statelessness. According to Setiono (2008, 721) in 1953, many Chinese citizens who previously had had their citizenship status, but because of political discrimination they became stateless.

Bureaucracy barriers further led these Chinese to be stateless. According to Setiono (2008, 721-722), the citizenship bill proposed in 1953 requires difficult conditions to be met by Chinese people at that time to get their citizenship and he said that for many Chinese people, satisfying these conditions and meeting these requirements is impossible. The Jakarta Post (in Suhandinata 2009, 330) stated that Ling Ling (19 years old) had troubles to obtain education at the university level because she could not show her SBKRI (Indonesian Citizenship Certificate). A long and complicated bureaucratic process, coupled with corrupt officials who wanted a bribe, made it is more difficult to obtain an Indonesian Citizenship Certificate and other citizenship documents.

Besides bureaucracy barriers, these people also suffer social pressers that led them into statelessness. This is illustrated in the life story of Yu Mo Hei and San Nio, a Benteng Chinese couple, in Harsono's book (2008, 33-46). Yu Mo Hei and San Nio did not have ID cards, and Yu Mo Hei needed one to get a job. They got a social presser from the head of neighbourhood (RT), in which he will help them if Yu Mo Hei and San Nio convert from their religion into the majority religion and change their name. Because they needed the documents very much, so they were willing to convert their religion on there ID cards and change their names, San Nio became Sani, and Yu Mo Hei became Arshan. Because they experienced many political discriminations, bureaucracy barriers, and social pressers to get citizenship documents, finally many of them were careless about them. So the political discrimination, bureaucracy barriers, social pressers, and their carelessness to obtain the documents have caused their statelessness.

Why are they stateless? They are statelessness as impact of political discrimination, bureaucracy barriers, social pressers, and their careless to obtain the documents. This patterns form poverty cycle, which finally the poverty caused the political discrimination, bureaucracy barriers, social pressers, and take careless to obtain the documents. Political discrimination also caused the take careless to obtain the documents. Therefore, the finding of the research is that the poverty among Benteng Chinese community is caused by the lack of civil rights accessibility, and the lack of civil rights accessibility is caused by their statelessness, and then the statelessness also caused a lack of employment, and this lack of employment caused the rate of unemployment and that this unemployment impacts their poverty.

3.3. The impact of social distortions on poverty

Beside the impact of political distortions on poverty among Benteng Chinese, we also find that the poverty is caused by social distortions. Firstly, it was explained above that the rate of unemployment causes the poverty and the rate of unemployment itself is affected by lack of employment and social distortion. Chinese people are known to be hard workers, but as stereotyped, Benteng Chinese our known as lazy people. From this stereotyped, other Chinese community do not recognize them as part of the Chinese people. This social distortion or stereotype caused a lack of employment. Mrs. KSN, our informant, said that Benteng Chinese people are often accused of being people who are lazy to work when in fact they are not lazy. They do not work because there is no job to be done. Bradshaw (2006, 11) said that poor people do not have influence in the political system, their legal protections are ignored, some are stigmatized; the result is a wide range of their opportunities declines.

Secondly, the social distortion and lack of employment are caused by lack of xinyong. Xinyong is a Chinese term meaning a trust relationship or social network that is built through a trust relationship. According to Suyanto and Karanji (2006, 181), a person or a poor family are often able to survive and even bounce back, especially when they have a network or social institutions that protect and save them. But lack of a network can lead to vulnerability and powerlessness. In the social institutions of the Chinese community, the absence of xinyong not only leads to lower employment, but the absence of xinyong can also cause social distortion against the poor Chinese people. The absence of xinyong causes poor Benteng Chinese increasingly to be marginalized from the Chinese community itself (Purwanto 2012, 339).

Thirdly, lack of xinyong is affected by ethnic stigma, social class awareness, primordial conflict, gong xiao and education level. Blank (2005) said, “Stigmatized behaviour is costly because of the disapproval it engenders among one’s friends or family, even though there might be economic incentives to engage in this behaviour.” According to Efferin and Pontjoharyo (2006,126), limited and bound trust among ethnic Chinese is often considered to be ethnic-based trust. Limited and bound trust that is based on ethnic-based trust can disappear when a person has left the values of ethnic culture or is a mixture of Chinese and indigenous descent (Purwanto 2012, 333).

There is social class awareness among Benteng Chinese community, especially between rich and poor. Our informants told us that there are borders between rich and poor households. When visiting their village, there were high walls that literally separate the rich and poor houses. Inside the wall there is big and beautiful house and expensive car in the house, and outside the wall there is a poor house that is built with bamboo. When an informant said that the rich and poor households are related by kinship, that fact came as a surprise. The informant stated that the rich separated himself from his poor relations because he does not want the poor household to disturb his pleasures. As Mr. SD said, “Even there is no network among Benteng Chinese itself. If you go down in their villages, you will find big walls that show a separation wall of social class” (Interview on February 1, 2010).

There is primordial conflict between Totok and Peranakan among Chinese people. Suryadinata (2002), Efferin and Pontjoharyo (2006, 105) propose four categories of Chinese Indonesian: Peranakan and new-style Peranakan, Totok and new-style Totok. Trijono (2004) said, “The identity of ethnic group is rooted to primordial sentiment.” Tan (2008, 19) stated that there is social stratification in the Chinese community between Totok and Peranakan. Mr. TTH explain that there is no good relation between Totok and Benteng Chinese (Interview on July 1, 2010). This lack of good relation is caused by Totok not recognizing Benteng Chinese as Chinese people like them. So the primordial conflict caused a lack of xinyong between Benteng Chinese and Totok or other Chinese communities.

According to Hamilton (1998) xinyong in Chinese business networks is usually also based on binding norms of reciprocity (huibao). And gong xiao is one of dialect words of Benteng Chinese to show the condition of being an ungrateful, dishonesty, lazy, and distrusted person. So gong xiao can cause a lack of xinyong. We find many Chinese people, especially rich people who call poor Benteng Chinese, gong xiao. So Benteng Chinese does not have xinyong in their relationship with rich Chinese households. Furthermore, lower education levels of poor Benteng Chinese also caused a lack xinyong.

So in the research we find that the rate of unemployment caused the poverty and the rate of unemployment itself is affected by a lack of employment and the existence of social distortion. The social distortion and lack of employment are caused by lack of xinyong (trust relationship). This lack of xinyong is affected by ethnicity stigma, social class awareness, primordial conflict, gong xiao and education level. The poverty itself is affected by ethnic stigma, social class awareness and education level and they formed a social distortions cycle of poverty.

3.4. The impact of economic distortions on poverty

This research also finds that economic distortions affected poverty among Benteng Chinese. The poverty cycle in economic dimensions are as follows: Their poverty is caused by low income, and the low income is affected by most people depending on subsistence farming and many people experience under employment. Economic distortions are caused by the lack of gaunxi, and guanxi is the Chinese term for personal relationship. The lack of guanxi is caused by social class awareness, the superior sense of Totok Chinese, marginalization, acculturation, assimilation and political discrimination. Assimilation itself is caused by political discrimination. Together they form a poverty cycle, in which the poverty caused social class awareness and social class awareness caused the superior sense of Totok Chinese. Poverty also caused the marginalization.

Social class awareness can grow in both a superior and inferior sense. A group that is reputed two come from a high class will grow a strong superior sense, whereas a group that comes from a low class will grow a strong inferior sense. Mr. NT said that social class awareness among Totok or rich Chinese as the high class group raised a superior sense among themselves such that they separate their selves from the poor Chinese. This led to a lack of guanxi of Benteng Chinese (Interview on June 6, 2010). Mr. TTH also stated that the rich Chinese do not care for the poor Chinese (Interview on July 1, 2010). Mrs. KSN confirmed that rich Chinese keep a distance from poor Chinese (Interview on July 1, 2010). It shows that social stratification between rich and poor Chinese can disrupt the personal relationship or guanxi. As said by Miss RH, “Rich Chinese do not socially bond with poor Chinese” (Interview on January 31, 2010).

Hamilton (1998) said that guanxi is a relationship bound by the norms of reciprocity (huibao) or by what is more commonly called as the Chinese people's feelings (renqing and ganqing). The main relationship for Chinese is the relationship between father and his sons, and this expanded to include other family members in the relationship, then comes the relationship with friends and business partners. So poor Chinese are not included in the relationships and will be considered strangers. Poverty caused poor Chinese to be marginalized and viewed as strangers by rich Chinese. So marginality is caused by the lack of guanxi of Benteng Chinese. Strong cultural acculturation and assimilation of Benteng Chinese also factors of their lack of guanxi. Rich Chinese told Miss RH, “Benteng Chinese our lazy. I have tried to help them. But they are like the indigenous” (Interview on January 31, 2010).

Lack of guanxi prevented poor Chinese to access jobs or capital in the Chinese business network. This economic distortion compels them to meet their livelihood by being subsistence farmers and suffering underemployment. Mr. SD told us that many Benteng Chinese do not have a steady job. They work whatever can be worked to make a living (Interview on February 1, 2010). Mrs. KSN, as a Benteng Chinese person, pleads, “Many said that poor Benteng Chinese our lazy. But in my mind they are not lazy. It is just there is no job to be worked by them” (Interview on July 1, 2010). Mr. SK also told us that poor Chinese do not have a steady job (Interview on June 6, 2010). Mr. JST said, “My grandfather is a subsistence farmer, and my father is a subsistence farmer too. They never were successful in trading. I think most of Benteng Chinese in Kampoeng Melayu area our subsistence farmers” (Interview on May 14, 2009). Mr. NT also said that most Benteng Chinese in Tangerang our subsistence farmers (Interview on June 6, 2010). Mr. TTH stated that most Benteng Chinese in Cengklong area

our subsistance farmers (Interview on July 1, 2010). Mrs. KSN also said that many Benteng Chinese work as subsistence farmers (Interview on July 1, 2010). This underemployment and subsistence job causes their low income and poverty.

3.5. The impact of cultural distortions on poverty

Through this research, we find that cultural distortions affect poverty among Benteng Chinese. Political discriminations forced them to engage in behaviours of cultural acculturation and assimilation. The cultural acculturation and assimilation caused cultural distortions. The cultural distortions can be scene in their profligacy, polygamy, and gambling habits. This style of life led them into poverty.

Mr. TTH said, "Benteng Chinese in Tangerang assimilated with the indigenous and you will not able to distinguish between Benteng Chinese and indigenous people" (Interview on July 1, 2010). Mrs. KSN said that the cultural acculturation between Benteng Chinese with the indigenous can be seen at a wedding party and in art, as such Gambang Kromong music and the Cokek dance (Interview on July 1 2010). Mr. NT said that the acculturation and assimilation causes their low work ethic. Hard work is one of characteristics of Chinese work ethic, but the impact of acculturation and assimilation leads Benteng Chinese to lose the good work ethic and become lazy to work. The assimilation makes them different from Totok Chinese in culture, life style, and passion to hard work (Interview on June 6, 2010).

Their profligacy can be seen in their wedding party practices. Miss RH told us that a Benteng Chinese family will feel ashamed if they marry their son or daughter without a festive wedding party. They even sell their lands as a wedding party cost; losing land is better than to not have a wedding party. The party will go on as long as two days and two nights or more (Interview on January 31, 2010). In the party, men will ngibing or dance with Cokek girl dancers. Men will show their pride through giving much money (nyawer) to girl dancers in front of those who attend to the party. Miss RH said that men of Benteng Chinese will drop his dignity if when they are designated to dance with Cokek girl dancer, they reject it and do not give money to the Cokek dancer (saweran) (Interview on January 31, 2010). Mr. TTH, who lives in Gunung Batu area, told us that men of Benteng Chinese revel in dancing with Cokek girl dancers (ngibing) and it is an open scene in wedding parties in the Gunung Batu area (Interview on July 1, 2010).

Mr. NT told us that Benteng Chinese men revels dance and squander money with the girl dancers and that this is one of factors that caused their poverty. Mr. NT also stated that the high divorce and remarriage rate among Benteng Chinese is due to infidelity of Chinese men with the Cokek dancers. Mr. NT gives his testimony stating, "My father has many wives. He revels in infidelity. We are, as his children, victims of the bad behaviour" (Interview on June 6, 2010). Mr. TTH confirmed that many men of Benteng Chinese divorced his wife and remarried with another woman. He said, "I know someone. He has a wife, but he divorced his wife and married with the widow of someone. After he married with her, he divorced the woman and remarried with yet another woman" (Interview on July 1, 2010). In the research we also interview Mr. TWT, an old Benteng Chinese man. He lives with his young wife. His young wife is a former of Cokek dancer. He told us that he met his young wife when they danced together at a wedding party. He fell in love and married her. His old wife and children left him. Mr. SK also confirmed that the divorce rate is high among Benteng Chinese in his area. He said, "Many of them are men with low income and underemployment, but they left their wife and children and have affairs with other women. I so do not understand it" (Interview on June 6, 2010). We met with Mr. CL and Mr. G's son who are two of the poor Benteng Chinese men who have had affairs with other women.

Besides profligacy, polygamy, high divorce and remarry rate, gambling habits is also one of factors that causes the poverty. According to Tan (2008, 65-66), "Confucius said that people should not be gambling because gambling is morally bad. But on another occasion Confucius said that gambling is still better than the lazy or not doing anything." Mr. SD said that poverty of Benteng Chinese in his area, Kampoeng Melayu, is caused by three factors, i.e. gambling habits, divorce and remarry rate and prostitution. He said that someone told him that gambling is his livelihood (Interview on February 1, 2010). Mr. NT stated that gambling is not just among adult men, but it is also among women and children. They spend their low income at the gambling table. They will get debts to meet their livelihood. So they will live in a debt trap (Interview on June 6, 2010).

3.6. The impact of individual deficiencies on poverty

Bradshaw (2005) stated, "The belief that poverty stems from individual deficiencies is old." This research found that the individual deficiencies of poor Benteng Chinese were caused by self-image (pride), low work motivation and low creativity. Many believe that their superior behaviour, cultural acculturation, assimilation and uneducated are determinants of the self-image, low work motivation and low creativity.

Low self-image will impact low pride, so high self-image will impact high pride, and the high pride prevents someone to work at what he considers to be a lowly job. According to Suyanto and Karnaji (2006, 178), most of the lower social classes sometimes try to imitate the attributes of higher social class lifestyle. Miss RH said that the superior sense of the indigenous people still exists within many Benteng Chinese despite their poor life. They prefer to keep prestige as Chinese than to work at a lowly job (Interview on January 31, 2010). Mr. OHK said, "The character of most of was ugly. They are stubborn and would not hear advice" (Interview on June 29, 2010). Why? Because they feel they have superior ethnicity. Miss RH also said, "Benteng Chinese people our stubborn and will not budge" (Interview on January 31, 2010). Mr. NT said, "They are stubborn. So if they are reproved by their superiors, they become offended and resign from the job. They don't like advice to improve their performance in the job" (Interview on June 29, 2010).

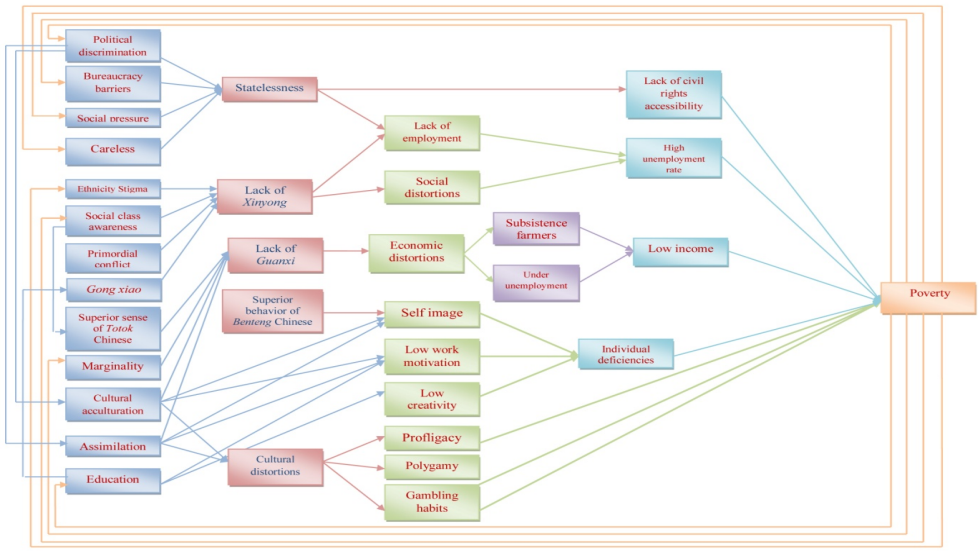
Their individual deficiencies are also influenced by low work motivation and low creativity. Acculturation, assimilation and being uneducated are viewed as its determinants. Mr. SK said "Their work passion and creativity are lower. They don't have a long term orientation in their life" (Interview on June 6, 2010). Mr. NT said, "They have no creativity… do not want to develop themselves. Their work passion is low. It is not like other Chinese" (Interview on June 6, 2010). Our informants also stated that low education rate is one of factors of their negative self-image, low work motivation and creativity.

4. A Mini Theory

Based on above findings and discussion, this mini theory is built. Jonker and Pennink (2010, 10) said, "A mini theory is a theory that is applicable for one particular situation. It still needs to prove its general validity. By repeating the research, the mini-theory may develop into a theory that is useful in various situations and at particular times: a grand theory."

This mini theory is built to relate concepts into propositions and propositions into model or theory as at Figure 1.

Figure 1. A Mini Theory of Complexity of Poverty



Conclusions

While existing theories of poverty typically explain poverty as stemming from political, social, and economic distortion or discrimination factors (the structural theory of poverty), or as a result of cultural disadvantages (the cultural theory of poverty), or as produced by individual deficiencies (the individual theory of poverty), or as a result of the cumulative or cyclical interdependence of the structural, cultural and individual distortions (the cycle theory of poverty), this new theory provides a fresh and more realistic explanation. The research indicates, for example, that political discrimination is not an independent variable directly causing poverty as the dependent variable. The new theory postulates that poverty in this community is caused by both unemployment and a lack of civil rights accessibility. The lack of civil rights accessibility is in turn caused by statelessness which itself is often a result of political discrimination, bureaucracy barriers, social pressures, and carelessness. Unemployment is caused by the lack of job opportunities, a situation quite often caused by statelessness factors.

The structural theory of poverty indicates that social distortion is a direct cause of Benteng Chinese poverty, the new theory suggests that in reality social distortions lead to unemployment, and the unemployment inevitably contributes to poverty. These social distortions are traceable to a lack of trust relationships (xinyong), in which xinyong is the strength in overseas Chinese business networks. This lack of trust relationship then contributes to ethnicity stigmas and social class awareness among the Benteng Chinese people, along with primordial bounding, ultimately resulting in gong xiao, which is the term in the Chinese dialect referring to the bad habit of forgetting the kindliness or assistance of others.

The structural theory of poverty explains poverty in terms of economic distortions, the new theory that it is proposed here suggests that the economic distortions alone are not causing this poverty directly. Rather, economic distortions lead to disguised unemployment and the multiplication of subsistence workers (*i.e*. subsistence farmers) which in turn impacts community income levels and contributes to Benteng Chinese poverty. These economic distortions then are just one link in a long chain of conditions, all of which may be indicted as indirectly causes of poverty. Some economic distortions, for example, are rooted in a lack of guanxi, which is the term in Chinese business networks for personal relationships. Furthermore, this lack of the guanxi is often caused by the Totok Chineses' superiority feelings and the marginalization of the Benteng Chinese in Indonesia's Chinese communities, with a further result of cultural acculturations and lack of assimilation of Benteng Chinese with the indigenous culture and people.

The cultural theory of poverty explains poverty as a product of cultural disadvantages. The new theory proposed here suggests that cultural disadvantages alone are not a direct cause of Benteng Chinese poverty. Rather, such cultural distortions affect life-style, resulting in deficits such as unstable marriages and gambling habits which inevitably contribute to poverty in the community. These cultural distortions are in turn linked with problems related to cultural acculturation and assimilation.

As the individual theory of poverty broadly explains poverty in terms of individual deficits. The new theory proposes that there are a number of additional factors behind these individual deficits which must be considered. Among these are individual self-image, low motivation and lack of creativity in the workplace, and these in turn can be traced back to cultural acculturation and assimilation difficulties as well as problems related to lack of education.

In the structural dimension, poverty in and of itself can cause a poor experience in the area of political discrimination, bureaucracy barriers and social pressures that are an inevitable result. These in turn can lead to the statelessness state. Poverty creates a distinct ethnicity stigma for the Benteng Chinese in other Chinese communities, leading to excessive social class awareness among the Benteng Chinese people. This further contributes to a lack of trust relationships (xinyong), so that the poverty itself eventually leads to further marginalization of the Benteng Chinese in Indonesian Chinese communities. In the individual dimension, poverty also results in a low level of education, further exacerbating the other contributing factors. The relationship between micro and macro can be seen in terms of political discrimination causing problems both with assimilation and with cultural acculturation, and these further aggravate social distortions among the poor Benteng Chinese.

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Analysis of the Development of Regional Disparities in Slovakia

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Abstract:

Currently exited the problem of slow economic growth, the development in backward regions of Slovakia came sharply to the forefront. Consistent implementation of new economic theories to the economic practice can help to the sustainable development of each region as well as to the revitalization of their business environment. There are various approaches and methods used in evaluation of regional differences. Among the most commonly used methods based on the analysis of the indicator of the region GDP per capita (b. c.) is the analysis on the basis of the direct method, *i.e.* measuring speed (m) and Gini coefficient (IG). The aim of this article is to evaluate the level of economic development of Presov region (the most backward region of Slovakia) relative to other regions of Slovakia and to point out the economic divergence in the Slovak Republic. We assume that within the period under review the widening of regional disparities occurs. This analysis confirmed our assumption.

Keywords: economic growth; regional development; regional GDP; measured speed (m)

JEL Classification: O4 ; R5; M20

Introduction

The economy transformation from a centrally planned to a market economy is accompanied by a fall in GDP and industrial production practically in all countries of Central and Eastern Europe. The decline was due to a variety of factors already known, such as: deformed structure of the economy, trade liberalization, and related work is the very tough competitive environment. Catching up with the developed regions of the European Union is lengthy in terms of time, what is dealt with in a variety of domestic and international studies and publications Adamišin (2008), Rajčaková (2009), Huttmanová and Synčáková (2009), Kotulič and Adamišin (2012), Maier and Tôdtling (1998), Sloboda (2006), Enea *et al*. (2012), Ungureanu and Matei (2007), Bogdan (2011), Bogdănoiu (2008), Văcărescu Hobeanu (2016), Štefko and Nowak (2014), Nedomlelova *et al.* (2017).

At present, there is outputted problem of slow economic growth in underdeveloped regions of Slovakia. It is, therefore, necessary to find new solutions to new approaches and sophisticated regional policy approach. Consistent implementation of new economic theories in economic practice can help the long-term sustainable development of each region as well as the recovery of their business environment. The use of such expertise in economic policy concept will be a prerequisite for the revitalization of the microspheres in the conditions of transitional economies (Kotulič 2006).

1. Literature review

According to optimistic estimates by renowned economists, it will not last a decade; rather it will be a long-term process that could measure to a period of one human generation. Theories of regional development are distributed

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into two main pillars. It is the most common breakdown of categories of regional development. It is important to point out that there is a substantial range of distribution and access for the formation of regional growth and development. The second pillar is based on the theory of regional imbalance (*i.e.* divergent theories), which considers the group that during development there is a further widening of interregional disparities (Blažek and Uhlíř 2002).

In general, the notion of regional disparities can be accessed on a number of approaches. In the work aimed to identify and analyze various aspects of the transformation period, regional disparities are understood as "differences in the socio-economic development of regions that are the result of irregularities". (Matlovič and Matlovičová 2004)

The regionalization is understood as the process of creating territorial units based on the criteria of homogeneity or functionality, *i.e*. creating regions. Regionalization takes place in three stages:

- the registration phase - conducted on the basis of criteria of homogeneity;
- structural phase - is the definition of regions as subsystems of socio - spatial system;
- implementation phase - an institutional and practical roofing regions routinely exercise activity.

Regional disparities are the subject of discussion of many politicians, economists and experienced specialists; therefore the topic is often mentioned. The aim of the regional policy is to take measures to ensure that the regional disparities in the regions appeared as little as possible. The issue of regional disparities, particularly in the context of regional development which is dealt with in a variety of literature, publications and policy debates, is one of the most serious problems not only in Slovakia but also in the wider global context. For assessing regional disparities there is a large number of indicators (Gburová and Marchevská 2016).

Stabilization of the region is the final stage of its formation, which leads to stabilization of internal activities. During the formation and transformation of the region, there is a crystallization of space - material structure in the spheres of economic, cultural and political. Achieving the final phase does not mean that the region remains unchanged in relation to its space - material structure, on the contrary, there is a continuous oriented activity to maintain, respectively strengthen the position (Chojnicki 1996).

Authors of this article agree with the statement of the author of the of “Spatial Economics” proclaiming that “the region is a geographically defined territory that disposes of a set of quantitative and qualitative conditions for the creation of a diversified administrative and supply as well as social system, in which the high intensity of economic and social inner relations develops optimal relations with other regions and is able to reproduce the growth needs mainly from its own resources” (Buček 1992).

The term “region” is considered as an old term comparably to the term of geography. It is derived from the Latin word of “regio” (kingdom, area, part, space); it can generally refer to a country in the political sense of the area. Of great importance are residential subsystems. Key aspects of the region as stated by the author are already mentioned population, lack, surrounding area and bonds of the region that create relations (Matlovič and Matlovičová 2004).

The economic regional development is present if (Buček 1992):

- “the autonomous growth of the actual income per inhabitant in the area increases the effective demand for the increased level of production in the area;
- the increase of the effective demand creates a market for increased production;
- the level of the increase of the export of the area is higher than the level of the increase of its import;
- it increases the level of inter-area exchange and market relations in the area;
- there exist and are permanently increased savings in the area”.

Indicators that allow measurement of regional development disparities should satisfy the following requirements (Klamár: in Michaeli *et al.* 2010):

- indicators should reflect changes in the socio-economic development;
- are statistically monitored and detectable, *t. j.* their statistics currently provides or will provide in the future;
- the system of indicators should be optimal for their use in analysis;

- the selection of indicators can narrow in a functional relationship with others (*e.g.* urbanization of the share of non-agricultural active population or the number of university-educated residents, and so on.).

Economic performance can be assessed by production volume, *i.e.:* what volume of production economy can produce per capita. Gross domestic product backed by the population of the country shows how the volume of product economy would get on average for each resident (Lisý 2007).

Gross domestic product (GDP) is among the most commonly used indicators, which can be used to express the maturity of the economy and living standards. Regional gross domestic product (RGDP) is calculated as the sum of value added for the sector in the region, and taxes on products minus subsidies on products. In comparison the RGDP expressed in purchasing power parity (PPP), purchasing power parity calculated based on prices eliminates the effects of different price levels between countries (Sloboda 2006).

The issue of the definition of business performance, management needs of enterprises. GDP per capita in PPP per capita are fundamental indicators of regional development and regional disparities, are stressed by various authors (Gallo *et al.* 2016, Hurbanková 2007, Vidová 2008).

Rajčáková (2009) describes individual characteristics (classification) of regions as follows: country regions, town regions, border regions, mountain regions, structurally weak regions, regions impacted by the industrial recession, open regions, stagnant and non-developed peripheral regions, problem regions, developed regions, regions with stagnating economic industries and other.

Adapted classification from Vanhove – Klaassen, is characterized by the author (Výrostková 2010) in the relation between the level of growth compared to the national level and the level of income compared to the national level. Table 1 describes the relation mentioned.

Table 1. Classification of region based on the level of income and the national level

Growth level compared to the national level	Level of income compared to the national level	
High (≥1)	Low (<1)	High (≥1)
High (≥1)	Prospering region	Stagnant region
Low (<1)	Potentially stagnant region	

Source: (Výrostková 2010).

The classification can be based on various criteria based on their qualities (Michaeli, Matlovič, Ištok *et al.* 2010): physical-geographic regions, human-geographic regions, totally geographical regions, nodal regions, contrasting regions, homogeneous regions.

2. Methodology

The aim of this paper is to assess the level of economic development of the Presov region (least developed region of Slovakia) with respect to other regions of Slovakia with measured speeds (m) referred to the economic divergence in the Slovak Republic. It is expected that within the reporting period, there is a deepening of regional disparities of the least developed region relative to other regions of Slovakia. The underlying data were drawn from the Statistical Office of the Slovak Republic, of scientific articles and technical books. In the evaluation process, standard mathematical relationships and numerical calculations were used.

Method of the analysis based on the measured speed (m). Input characteristics for evaluation analysis are based on the finding that there are regions A and B with an output value of gross domestic product GDP_A a GDP_B where per capita of the region accounts for a certain level of gross domestic product, expressed in Euros and in current prices as GDP_A/S_A a GDP_B/S_B. The population of the region A and B represent variables S_A and S_B. Prešov Region represents the area A, other regions of Slovakia (the diameter) represent the area B.

Calculation of the specific speed (m) by direct methods of regional development was calculated as follows (Tvrdoň *et al.* 1995; Hurbankova 2007):

$$d_A = \frac{GDP_A^{\,t}}{S_A^{\,t}} - \frac{GDP_A^{\,t-1}}{S_A^{\,t-1}} \quad (1)$$

$$d_B = \frac{GDP_B^{\,t}}{S_B^{\,t}} - \frac{GDP_B^{\,t-1}}{S_B^{\,t-1}} \quad (2)$$

$$m = \frac{d_A}{d_B} \quad (3)$$

Specific speed of regional development can take the following values:

- m < 1, there is no the elimination of disparities in the economic level of regions;
- m = 1, the level of differences does not change;
- m > 1, it leads to the elimination of disparities in the economic level of regions.

Due to the unavailability of some inconsistencies and sources of information, this was dropped from some analysis and comparison. Especially since some of the results may have only a partial effect for evaluation analysis.

3. Results

The main objective of the regional policy is to promote the development of regions whose development diverges. Due to the openness of the Slovak economy and the policy effort, there is a divergence of regional disparities between the more developed and less developed regions. The basis of this method is to confirm the convergence or possible divergence of regions in Slovakia.

Table 2. Input data for calculating the specific speed (m) in the monitored regions

Year/ Indicator	GDP**mil. Eur	Population	GDP**mil. Eur	Population	GDP** mil. Eur	Population
	Bratislava region (most developed region)		Presov region (least developed region)		Average of Slovakia*	
2001	8.318,3	599.042	3.037,3	791.335	4.406,3	65.5373,7
2002	9.264,6	599.736	3.357,6	793.182	4.738,8	65.5139,9
2003	10.184,1	599.787	3.634,8	794.814	5.282,0	65.5034,1
2004	11.379,4	601.132	3.996,4	796.745	5.880,7	65.5439,6
2005	13.415,8	603.699	4.295,1	798.596	6.431,3	65.5797,7
2006	14.386,8	606.753	4.463,8	800.483	7.219,7	65.6164,9
2007	16.392,9	610.850	5.013,8	801.939	8.062,3	65.7008,4
2008	17.515,5	616.578	5.835,6	803.955	8.728,1	65.8328,4
2009	17.620,7	622.706	5.358,7	807.011	8.219,5	65.9702,0

Source: Own processing based on Statistical office of the Slovak Republic, 2012.
Notes: * Average regions except the region of Presov, ** Gross domestic product at current prices (mil. EUR)

Table 3 describes the change of the measuring rate (m), depending on the reference period in compared regions. Based on the research, it can be concluded that for the period 2001-2007 there was a constant divergence of regional differences (disparities) between the Presov region and the Slovak average. The year 2008, however, recorded a doubling of average value compared to 2007. The default value (1.02) in 2008, shows phasing out (convergence) differences in the economic level of Slovakia; which relates the value of m > 1 which means an increase in the economic development of the Presov region and other regions of Slovakia. The specific rate in 2009 stagnated and then came back to (0.77), reflecting the widening of regional disparities.

Table 3. Calculation of the specific speed (m) of the Presov region in the Slovak Republic

Year	2002	2003	2004	2005	2006	2007	2008	2009
Moderate speed (m)	0,77	0,41	0,49	0,43	0,17	0,53	1,02	0,77
Convergence of region	No	No	No	No	No	No	Yes	No

Source: Author's calculation.

The dynamics of the development of the Presov region in 2001-2009 compared to the rest of Slovakia was so low that even its doubling would not suffice for maintaining of a steady pace of the region development. On the basis of this analysis, it is possible to state that in the monitored period there was a deepening of regional differences between the Presov region and the rest of Slovakia. In 2008, the measured value was doubled which can be explained by the loss of the economic performance in the rest of Slovakia on a higher scale as in the monitored Presov region due to economic recession initiated by the financial crisis in the United States of America. Such a significant break of the dynamics of the development of the rest of Slovakia can be initiated by strikes, epidemics, floods, fires and in regions with strengthening export industries, it is mainly caused by turbulence in world markets.

Conclusion

Using the assessment of regional development based on measuring the speed, it may be pointed out that the most backward region of Slovakia (Presov region) is not achieving the desired level of convergence in regional development with the rest of Slovakia. This fact is consistent with the classical theory of regional development, especially in terms of the theory of central places by W. Christaller, the successor to J. Friedmann's theory of polarized development, according to which the country's economic growth could be enhanced by the hierarchical system of cities and their functional regions. Strengthening the hierarchical system of places, however, inevitably leads to the selection of growth poles, which does not guarantee the achievement of the desired convergence regions (Blažek 1993, Asaturov *et al.* 2015).

Less developed regions always come across many obstacles. Low income leads to low savings; low savings slows the growth of capital; lack of capital prevents the introduction of new machinery and rapid productivity growth; Low productivity leads again to a low pension. How to break this vicious circle is a question that will occupy the country in this century? One of the possible ways to improve the conditions for small and medium-sized enterprises is eliminating bureaucratic obstacles, in doing so their low-skilled workforce would be able to be effectively used in a trade or other form of business, which would allow accelerating the process of convergence of underdeveloped regions to the level of developed countries.

The need to eliminate the backwardness of underdeveloped regions through higher dynamics of economic growth also comes up against real limits of uncompleted standard road infrastructure, without which in the near future the actual start of the innovation potential of any of the less developed regions in the Slovak Republic would not be possible. As a consequence of the agglomerate model of economy and development of polarization threatens the Slovak Republic even greater deepening economic disparities between the more developed and lagging regions.

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The Relationship between Public Expenditures on Research and Development and Economic Growth -Example for the Czech Republic, Denmark and Slovakia

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Abstract:

This article is devoted to the examination of public expenditures on research and development (R&D) in terms of volume, use, forms of aid and its aim is to verify the relationship between public R&D expenditures and economic growth in the Czech Republic, Denmark and Slovakia in the period 1995 – 2014. Empirical evidence is based primarily on data collected from the OECD database. The Johansen cointegration test is applied for analysing the long-term relationship and the Error Correction Model is added for short-term dynamics. The results of estimations have confirmed the positive long-term relationship between Gross Domestic Expenditure on R&D and economic growth in Denmark and Slovakia. Anyway, the testing of public expenditures on R&D by sectors has provided for a verified cointegration for one sector in all countries at least. Concretely, the long-term relationship has been proven for all sectors in Denmark, for government, private non-profit and higher education sectors in Slovakia and for the government sector in the Czech Republic.

Keywords: research and development; economic growth; public expenditure; tax incentives; Error Correction Model

JEL Classification: O38; H25; F63

Introduction

Research and development (R&D), and its support is an economic-political issue, its scope and the forms are significantly affected by economic policy, as well as historical experience and country-specific priorities. The significance of R&D is highlighted in particular for its key role in the creation of new knowledge, products, and technologies that are essential for stable and sustainable economic growth and development of competitive advantages, as reported for example by Solow (1956), Gumus and Celikay (2015), Hud and Hussinger (2015), Szarowská (2016), Freimane and Bāliņa (2016). Attention is paid to the issue of R&D at the level of the European Union (EU). The Europe 2020 Strategy, which aims to ensure the growth and competitiveness of the EU, has, among five fundamental objectives, investments of 3% of GDP in research and development.

In the empirical literature, it is possible to find results that confirm the positive, negative and zero relationship or the impact of R&D expenditures on economic growth. The goal of the article is, therefore, to determine whether there is a long-term relationship between expenditures on R&D and economic growth in the Czech Republic, Denmark and Slovakia. The introductory part will explore the support in the area of R&D in the Czech Republic, Denmark and Slovakia. Further, by using the cointegration method the empirical verification of the existence of relations between expenditures on R&D and economic growth in selected countries will also be carried out. Data on the size of public expenditures on R&D and economic development are drawn from the OECD database and other publicly available sources for the period 1995 -2014.

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1. The basic theoretical framework

The importance of R&D for economic growth is mentioned in most economic models (classic models of economic growth, neoclassical models of economic growth, new growth models). Dzambaska (2013) points out the development of endogenous growth theory has provided many new insights into the sources of economic growth. The essence of the new theory is that growth is a consequence of rational economic decisions. Urbancová *et al.* (2016) remind the knowledge economy corresponds both to the theories of endogenic growth and especially to the alternative directions for contemporary socio-economic approaches to the theory of growth. Theories incorporating the knowledge economy place an emphasis on the importance of knowledge, information and technical skills, *i.e.* know-how, as the basic resource for the development of the economy (Lilles and Rõigas, 2015). A detailed overview of the various models of economic growth focused on the role of R&D in them was elaborated by Valek (2015).

Svennson (2008) argues that investments and State interventions in the area of R&D are associated with two major reasons leading to the failure of the market of R&D. Firstly, in certain cases, an overall benefit from R&D investments may be for the company as a whole greater than the benefit to the enterprise investing in R&D and R&D brings positive externalities. Second, R&D is associated with high risks, which discourage companies from carrying out R&D. In both of these reasons, then the enterprises will invest generally less in R&D on the free market, what without the intervention of the State eventually would lead to the total underfunding of R&D in the country. Therefore, there are justified reasons why research and development should be supported by the State.

Support from the State includes both the real raising of the volume of money spent on R&D and encouraging business and non-business entities for investments and activities in this area, while each of the forms has its advantages and disadvantages from the economic-theoretical perspective (refer to more details David *et al.* (2000).

The examination of the relationship between expenditures on R&D and economic growth has been dealt with by a whole range of economic theories and studies in history. Kohler *et al.* (2010) summarizes the results of 18 published pieces of work claiming that regardless of the growing number of studies on the impact of incentives for R&D, knowledge about the effectiveness of expenditures on R&D remains limited. The study by Becker (2015) offers the most comprehensive and systematic overview of the critical discussions about 120 sources, which is focused on R&D literature with an emphasis on the mutual comparison between the conclusions of the published essays.

The empirical evidence is often focus on studies that econometrically analyse the impact of R&D tax incentives on key policy goals of the instrument. Since a primary goal of R&D tax incentives is to raise R&D spending by enterprises, most studies look at input additionality, *i.e.* the change in private R&D expenditure that can be attributed to the tax incentive (Castellacci and Lie 2015 or Hud and Hussinger 2015). Some of studies were official evaluations commissioned by governments and conducted as part of policy implementation and monitoring activities while others originated from academic work based on publically available or dedicated survey data (Faria *et al.,* 2011). Hall and Van Reenen (2000) survey the econometric evidence on the effectiveness of fiscal incentives for R&D. In the current (imperfect) state of knowledge they conclude that a dollar in tax credit for R&D stimulates a dollar of additional R&D. Bilbao-Osorio and Rodriguez-Pose (2004) present results which indicate that R&D investment, as a whole, and higher education R&D investment in peripheral regions of the EU, in particular, are positively associated with innovation. The existence and strength of this association are, however, contingent upon region-specific socio-economic characteristics, which affect the capacity of each region to transform R&D investment into innovation and, eventually, innovation into economic growth.

Berliant and Fujita (2011) state that long-run economic growth is positively related to the effectiveness of pairwise R&D worker interaction and to the effectiveness of public knowledge transmission. Kim (2011) investigates the effect of R&D stock for economic growth during the years 1976-2009. Based on the empirical results, he concludes that traditional production factors contribute about 65% to economic growth and the contribution ratio of overall R&D stock to economic growth is about 35%. Garnier *et al.* (2014) also confirm the hypothesis that the technological change stimulates the economic growth. Especially the less advanced EU regions, in which the public expenditure in R&D is higher, report the higher GDP growth rate.

Guellec and Pottelsberghe (2003) estimate that the effect of public funding is the strongest up to a level of approximately 10% of the companies own R&D investments – after which the effect declines. Halásková and Bazsová (2016) also use aggregate national data for evaluating the the efficiency of R&D in EU (28) member states. Neubig *et al*. (2017) state that government support for business R&D seeks to encourage firms to invest in knowledge that can result in innovations that transform markets and industries and result in benefits to society. Most often, support is provided to firms with the intention of correcting market failure.

Since the article verifies the existence of the relationship between expenditures on R&D and economic growth by using cointegration methods, therefore, attention is primarily focused on the studies applying the same method of research; the overview and results of others can be found in Szarowská (2016) or Žůrková (2016). All of these authors concluded that there was a cointegration relation between the two quantities, even in the long term.

Horowitz (1967) analyzed the relationship between expenditures on R&D and local economic growth of various US States by using data for the period 1920-1964 and found that the research and development activities were fully in line with the pace of economic growth.

Zachariadis (2004) examined the relationship of R&D and economic growth in the period 1971-1995 for 10 OECD countries using data from the manufacturing industry. The model data used in this study are related to the intensity of R&D in relation to efficiency growth, and subsequently performance. According to the results, the intensity of R&D is positively reflected in the efficiency and performance growth.

Peng (2010) checked for the relationship between expenditures on R&D and economic growth of China, and came to the conclusion that GDP would grow by around 0.92% if expenditures on R&D were increased by one percentage.

Yanyun and Mingqian (2004) analyzed the relationship between expenditures on R&D and economic growth in the Association of Southeast Asian Nations and also Korea, Japan and China in the years 1994 to 2003 by using panel data. According to the obtained results, the interactive relationship between R&D and economic growth was found. Therefore, the goal of the country should involve the increase in competitiveness and achievement of sustainable growth and hence the increase in expenditures on R&D.

According to Bozkurt (2015) authors like Korkmaz, Taban and Sengur or Gulmez and Yardimcioglu drew up studies, in which they analyzed the relationship between investments in R&D and economic growth by using the cointegration method.

2. Data and methodology

When modeling economic time series one can proceed from the assumption that the development of some of them is tied to a certain theoretical relationship. Time series satisfying these assumptions evolve similarly and are intertwined through long lasting relationships. If there are no long-term relationships between time series, there may be short term ones. An appropriate methodological tool for exploring relationships of time series of economic development and expenditures on R&D are the tools of the econometric analysis of time series: VAR models and the cointegration analysis.

The aim of the article is to determine whether there is a long-term relationship between expenditures on R&D and economic growth in the Czech Republic, Denmark and Slovakia in the years 1995-2014. Slovakia was chosen as a result of the common history and the same starting conditions as in the Czech Republic, in contrast, Denmark for a significantly different support system of R&D. The choice of the time period and the frequency of observation is subject to the availability of the requested data (the longest period available), because GDP and expenditures on R&D are only available on an annual basis. Expenditures on R&D are expressed by using indicators of GERD (Gross Expenditure on R&D), which represents total internal expenditures on R&D performed on the national territory during a given period. In addition to the total volume of GERD testing will also be performed for individual sectors of the implementation of R&D, *i.e.* for business (*BUS*), Government (*GOV*), the private non-profit sector (*NON*) and the sector of universities (*EDU*). Data for all variables were obtained from the OECD database (or missing values from the national statistical institutes) and are expressed in million EUR.

A key step for the testing of long-term relations is to determine the stationarity of the time series. For this reason, the testing of data stationarity or the unit root tests must precede each of the empirical analysis with

macroeconomic data. In the literature the Augmented Dickey-Fuller test (ADF test) is often used, which can be done according to the following equation:

$$\Delta y_t = \alpha + \beta t + (\rho - 1) y_{t-1} + \sum_{i=1}^{K-1} \theta_i \Delta y_{t-1} + \varepsilon_t \quad (1)$$

where y_t - macroeconomic variable; t - trend variable; ε_t - the process of approximation of white noise; k - the number of delays (displacement) of the variable, y_t, that are incorporated for the possibility of the autocorrelation of residues.

The null hypothesis is H_0: $\rho = 1$ and time series contains a unit root, or it is non-stationary, if the null hypothesis is rejected. When testing the unit root, it was found that none of the time series was stationary in their values. Not a single time series is integrated by the order of 0. All time series have proven to be stationary on the first differences and are considered as *I (1)*.

If the time series are integrated by the same order, you can proceed to test the cointegration relationship between the integrated variables. To identify the long-term relationship between time series the Johansen (1991) cointegration test was used, which uses the maximum likelihood procedure to verify the occurrence of the cointegration vectors in non-stationary time series based on the vector autoregressive (VAR) model:

$$\Delta Z_t = C + \sum_{i=1}^{K} \Gamma_i \Delta Z_{t-1} + \Delta Z_{t-1} + \varepsilon_t \quad (2)$$

where: Z_t - a vector of nonstationary variables (in logs); C - the constant.

The matrix of the coefficients of Π can be expressed also as $\Pi = \alpha\beta'$, where the relevant components of the matrix α are represented by adaptation coefficients and the matrix β contains the cointegration vectors. If the time series are non-stationary and cointegrated at the same time, then the optimal tool for exploring the mutual relationship between the variables is the error correction model (Vector Error Correction Model, VECM), which is the model of the VAR supplemented in the first differences by the vector of cointegration residues. This ensures that such a VAR system does not lose information about the long-term relationship of analyzed variables.

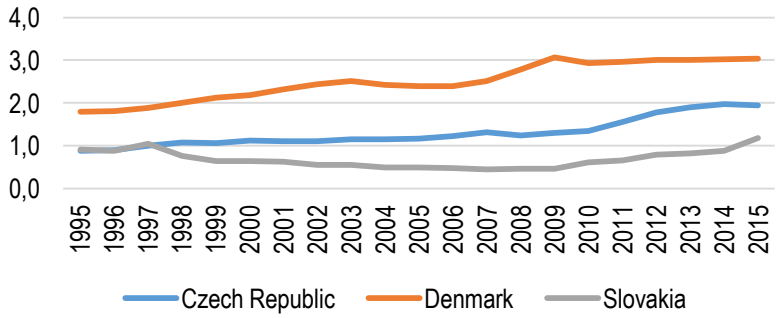
Due to the vector error correction mechanism, which is embedded in the Johansen cointegration technique, deviations from the long-term equilibrium relationship are corrected by the series of partial short-term adjustments. The VECM specification also assists in that, which reduces in the long-term the behavior of the variables on their convergence towards a long-term equilibrium relationship, but allows a wide space for short-term dynamics. The VECM is so an adequate tool for the examination of the short-term deviations essential for achieving a long-term equilibrium between the two variables.

3. Results and discussion

3.1 Public funding of research and development

It should be underlined that national R&D systems are specific both in terms of the scope and forms of support, with the vast majority of countries using and combining public support for R&D in the form of direct and indirect tools. Direct support can be implemented through public contracts in the area of R&D, the provision of grants, subsidies, loans or corporate financing (OECD 2014). The most commonly used tools of indirect support include tax incentives and reliefs, accelerated depreciation of investments, reduction in social security charges, exemption from customs duties, subsidized loans, venture capital support, advantaged lease of infrastructure. Westmore (2013) argues that indirect support is usually more neutral than direct support of R&D in terms of industries, regions and targeting companies. Direct support is usually focused on long-term research; in contrast, indirect tools support short-term applied research and increase incremental innovations (OECD 2010).

Figure 1. The intensity of public expenditures on R&D (GERD in % of GDP)



Source: based on data from OECD database.

Also in the sample of observed countries, the scope and form of direct and indirect support in R&D is significantly different. Figure 1 captures the intensity of public expenditures on R&D, expressed as a percentage ratio of *GERD* to GDP. By comparing the intensity of public expenditure on R&D, it was found that the highest intensity of support was provided by Denmark during the reference period. In the long term it belongs to the countries with the greatest intensity of public expenditures on R&D in Europe, which is kept at above 2.5% of GDP. In 2014 the intensity level reached 3.05% of GDP and Denmark already meets the requirements of the 2020 Europe Strategy. The Czech Republic reported a growing trend in terms of expenditures on R&D. Even though the amount of support is in comparison with Denmark over the long term about half, the intensity of public expenditures on R&D in the Czech Republic more than doubled in the observed period (0.88% of GDP in 1995 vs. 2.0% in 2014). Slovakia has a long low intensity of public expenditures on R&D and its value is similar at the beginning and the end of the reference period (0.91% vs. 0.89% of GDP). From 1998, a steady decline in expenditures on R&D was recorded, and up to 2007, when it hit the bottom (0.45% of GDP), followed by expenditures on R&D started to grow very slowly. The reason for this was not only the different priorities of applied economic policy (*e.g.* pension and health reform), but also the economic situation of Slovakia.

The studied countries also approach differently public support for R&D in terms of the area of the implementation of the various sectors. As is apparent from the data in Table 1, in spite of the different ratios between the various sectors the common tendency to promote primarily the business sector is evident (although the difference between Denmark and Slovakia is 20 percentage points), while the private non-profit sector gets a minimum support. A significant difference is also in the case of Government, with the Czech Republic and Slovakia implementing this way for about 20% of the total public support, in contrast, only in Denmark it accounts for only 2.4% of support. The implementation of public R&D by universities is most supported by Slovakia, whereas in the Czech Republic support is about 6 percentage points lower (Úřad vlády ČR 2015).

Table 1. R&D expenditure by performing sectors as percentage of GERD in 2014

	Business	Higher education	Government	Private non-profit
Denmark	65.4	31.8	2.4	0.4
Czech Republic	54.1	27.2	18.3	0.3
Slovak Republic	46.3	33.1	20.5	0.2

Source: based on data from OECD (2014).

In terms of supporting R&D, national policies of R&D are especially key priorities, which are important not only for the total volume of resources, but also for the preferred forms of support. Moreover, a country's general tax rules can be an important attraction or deterrent to risk-taking innovators. Huňady *et al.* (2014) and Akcigit *et al.* (2015) claim that tax rates matter to the location of inventors and their patent registrationsThe Czech Republic has its priorities in the area of direct support for R&D, which carries out and finances through budgetary chapters of the individual agencies and ministries. The special-purpose support is granted through the grant projects, programming

projects, projects of a specific university research and large infrastructure projects for research, development and innovation (R&D&I).

Direct support of R&D in the Slovak Republic is carried out through the provision of financial resources from the State budget in the form of non-repayable support. In the framework of the special-purpose form, the provider, on the basis of competition, provides funding for the solution of R&D projects and the solution of the development projects. The institutional form of support secures the provision of funding for the activities of the R&D infrastructure of the Slovak Academy of Sciences, legal persons who carry out R&D and provides funding to public universities and State universities in order to support R&D.

Denmark belongs to innovatively most developed countries in the long-run, direct support includes institutional, competitive and other funding support. Institutional funding represents the Government funding of universities. The foundation of competitive funding is that the funding of R&D projects either is converted to universities directly, or is provided through independent research councils. Among other support of funding several policy instruments are ranked at this point, such as research bills for small and medium-sized businesses, subsidies for qualified employees, knowledge coupons. All these policies been introduced to support the development of small and medium-sized enterprises (Danmarks 2005, Deloitte 2015).

In all the countries studied tools of indirect support of R&D are part of R&D national policies provided to encourage the business sector to higher R&D activities. The claim is clearly defined by legislative standards – see Acts 595/2003, 586/1992 and 333/2014. Table 2 summarizes the types of incentives offered, their definition in individual countries differs greatly. In view of the scope of the article here it is not possible to introduce them in detail, the precise definition and comparison of specific conditions is brought by Žůrková (2016). The individual forms of indirect support are difficult to unambiguously compare due to the different conditions and terms even with the same types of indirect support for R&D, as well as in terms of providing completely unique incentives. Indirect support of R&D is most often provided in the form of tax exemptions, deductibles from the tax base, grants, or in the form of accelerated depreciation for R&D.

Table 2. Types of indirect support of R&D applied in the Czech Republic, Denmark and Slovakia

	Czech Republic	Denmark	Slovakia
Accelerated depreciation on R&D assets	yes	yes	
Cash grants	yes		yes
Infrastructure/land preferential price	yes		yes
Patent-related incentives			yes
Tax deduction	yes	yes	
Tax credits		yes	yes
Tax holiday	yes		yes

Source: author's compilation based on Ernst and Young (2015) and OECD (2014).

Selected countries do not provide individual tax incentives for the identical time period. While Denmark already has a long tradition in providing indirect support of R&D, the Czech Republic and Slovakia are still "newcomers" in this area. The Czech Republic began to provide the main tool of indirect support of R&D (deduction of R&D support) not until the beginning of 2005. Slovakia has introduced major tax incentives (deduction of expenditures on R&D), only as of 1.12015. The most important tax incentive in Slovakia until then was the tax relief.

3.2 Testing the relationship of public expenditures on R&D and economic growth

For the empirical verification of the existence of a long-term relationship between public expenditures on R&D and economic growth the cointegration method was chosen. All data were tested at the 5% level of significance. The Johansen cointegration test was used with cointegration, which works with the maximum probability to verify the occurrence of the cointegration vectors in non-stationary orders based on the vector autoregressive model. When estimating the cointegration relation, first the estimation of the VAR model was made to determine the optimal delay, which is necessary to eliminate the vector autocorrelation of residual components. On the basis of this procedure by using Akaike's information criteria, a delay for two years was determined as optimal. As already

mentioned, there are deviations from the long-term, equilibrium relationship corrected by a series of partial short-term adjustments, which are explored by using the VECM.

The cointegration analysis was performed first for total expenditures on R&D and GDP, then for each sector of the implementation of R&D separately. The results in Table 3 show that in this period there is one cointegration relationship, demonstrating the cointegration between expenditures on R&D and GDP in the case of Denmark and Slovakia.

Table 3. Number of cointegration relations between overall expenditures on R&D and GDP

Cointegration between	Dependent variable	Number of cointegration relations
Czech Republic		
GDP and GERD	GDP	0
	GERD	0
Denmark		
GDP and GERD	GDP	1
	GERD	1
Slovakia		
GDP and GERD	GDP	1
	GERD	1

Source: authors' calculations.

Therefore, through testing, it was found that there was a long-term relation between overall expenditures on R&D and economic growth only in the case of Slovakia and Denmark, in the Czech Republic, the existence of a long-term relationship between the variables was not confirmed. Based on these findings the error correction model (VECM) was implemented, which reveals the possibility of short-term deviations between expenditures on R&D and economic growth in countries with an established cointegration relation. The model specification was tested by several residual components tests. We used the autocorrelation LM-test based on Lagranger multipliers, the normality test, and heteroskedasticity test. The performed tests reject the existence of all three phenomena. The estimate of the VECM is contained in Table 4, standard deviations are given in in brackets.

Table 4. The error correction model

Cointegration	Dependent variable	ω_1 resp. ω_2	α_1 resp. β_1	α_2 resp. β_2	α_3 resp. β_3	α_4 resp. β_4	α_0 resp. β_0
Denmark							
GDP and GERD	GDP	0.890	-1.706	-0.45	-23.277	-10.833	29218.3
		(0.235)	(0.571)	(0.389)	(5.720)	(10.280)	(7425.5)
	GERD	0.012	0.007	0.006	0.201	0.094	113.529
		(0.032)	(0.077)	(0.053)	(0.775)	(1.393)	(1005.8)
Slovakia							
GDP a GERD	GDP	0.156	0.341	-0.365	-30.774	-17.962	4688.46
		(0.128)	(0.324)	(0.447)	(28.823)	(29.728)	(2251)
	GERD	0.005	-0.005	-0.007	-0.368	0.244	70.575
		(0.001)	(0.002)	(0.003)	(0.187)	(0.192)	(14.566)

Source: authors' calculations.

Time delay for 2 years appears as optimal for public expenditures and economic growth therefore, the following cointegration equations (3) and (4) were defined:

$$\Delta GDP_t = \alpha_0 - \omega_1(GDP_{t-1} + \gamma GERD_{t-1}) - \alpha_1\Delta GDP_{t-1} + \alpha_2\Delta GDP_{t-2} + \alpha_3\Delta GERD_{t-1} - \alpha_4\Delta(GERD_{t-2}) + u_{1t} \quad (3)$$

$$\Delta GERD_t = \beta_0 + \omega_2(GERD_{t-1} + \gamma GDP_{t-1}) + \beta_1\Delta GERD_{t-1} - \beta_2\Delta GERD_{t-2} - \beta_3\Delta GDP_{t-1} + \beta_4\Delta (GDP_{t-2}) + u_{2t} \quad (4)$$

The parameter γ is the cointegration coefficient, α_0 and β_0 are the model constants $\alpha_{1,4}$ and $\beta_{1,4}$ are indicators of the short-term relationship between quantities. The expression (GDP_{t-1}+ $GERD_{t-1}$) is the so called equilibrium

error or correction error member. u_{1t} and u_{2t} indicate the residual components of the long-term relationship. The parameters of ω_1 and ω_2 measure the speed of adaptation to the long-term equilibrium. The advantage of this model is that it allows examining at the same time the long-term and short-term dynamics in the relationship between *GDP* and GERD. Thus, the model measures the deviations of the dependent variable from the equilibrium in the preceding period. The results suggest that the correction rate of short-term deviations from the long-term equilibrium state is higher in the case of Slovakia, however also in Denmark; the long-term equilibrium is established in a period less than 1 year.

A complementary examination was made of the relationship between expenditures on R&D and economic growth with a focus on implementation, *i.e.* the partial sectors business (*BUS*), Government (*GOV*), the private non-profit sector (*NON*) and the sector of universities (*EDU*). The results and the numbers of cointegration relations are captured in Table 5.

Based on a more detailed examination, it was found that even in the Czech Republic there was a long-term relationship between expenditures on R&D and GDP, and specifically for the Government sector. Denmark has confirmed the long-term relationship between all sectors and economic growth, the strongest relation was found in the case of expenditures on R&D in the business sector. Slovakia has not confirmed the long-term relationship only in the case of the business sector.

Table 5. Number of cointegration relations for the partial sectors

		Czech Republic	Denmark	Slovakia
Cointegration between	Dependent variable	Number of cointegration relations	Number of cointegration relations	Number of cointegration relations
GDP and BUS	GDP	0	2	0
	BUS	0	2	0
GDP and GOV	GDP	1	1	1
	GOV	1	1	1
GDP and EDU	GDP	0	1	1
	EDU	0	1	1
GDP and NON	GDP	0	2	1
	NON	0	2	1

Source: authors' calculations.

From the cointegration analysis follows that there is a positive long-term relationship between examined quantities in all countries; in the case of Denmark and Slovakia it has been confirmed for total expenditures on R&D (GERD) as well as for individual sectors of the implementation of R&D; moreover, in the case of the Czech Republic only the Government sector has been evidenced. Therefore, the fact has been confirmed, which was also demonstrated in the essays by Yanyun and Mingqian (2004), Peng (2010) or Bozkurt (2015), presenting the conclusions of the authors Korkmaz, Taban and Sengur or Gulmez and Yardimcioglu, who dealt with the relationship of expenditures on R&D and economic growth and also argued that there was a long-term relationship between these variables. In the Czech Republic a long-term relationship between GERD and GDP has not been confirmed, therefore, this statement is not in accordance with the theories of the already mentioned authors, and this can be explained *e.g.* by differences in the countries examined, or by another a time range. In the long run, the reason of the absence of a long-term relationship may also be found in fragmentation and frequent changes to the method of R&D financing in the Czech Republic. In contrast, the definiteness of positive results in the case of Denmark can clarify the stable and long-term support of R&D along with the exact definition of duties and powers of the institutions active in the R&D support system.

Conclusion

The basic requirements of the development of each economy involve stable and sustainable economic growth. To ensure the sustainable growth it is necessary to improve the existing workforce, increase their productivity by

improving the technology, working practices or innovations, and thus achieve greater competitiveness. An important prerequisite for this is the application of the growth and dissemination of the results of R&D.

The aim of the article was to determine whether there was a long-term relationship between expenditures on R&D and economic growth in the Czech Republic, Denmark and Slovakia. Following the availability of data collected from OECD database, the period 1995-2014 was chosen for the empirical validation.

Individual countries show a number of differences in R&D in providing support, which is given by the diversity of national policy priorities of R&D, institutions providing support of R&D, and in the form and amount of the support. In the case of Denmark these differences, for example, consist in the provision of completely unique forms of direct support, such as research bills for small and medium-sized businesses, subsidies for qualified employees, knowledge coupons, etc., which are not provided by the Czech Republic or Slovakia. Denmark also due to a long-time provision of support of R&D has a more elaborate R&D organization system, than it is the case of the other two countries. The Czech Republic and Slovakia have a very similar organizational structure, as well as forms of direct support provided. All countries were similar e.g. in the case of tax incentives to promote R&D, which were mainly in the form of deductions from the tax bases, and tax credits or also in the opportunities for accelerated depreciation on R&D.

The empirical validation of the existence of a long-term relationship between public expenditures on R&D and economic growth was performed by the Johansen cointegration test. On the basis of the results a positive long-term relationship between examined quantities in all countries has been confirmed; and in the case of Denmark and Slovakia it has been confirmed for total expenditures on R&D (GERD) as well as for individual sectors of the implementation of R&D (in Denmark for all, in Slovakia for Government, the private sector, and the non-profit sector, universities), while in the Czech Republic only the government sector has been demonstrated. After the evaluation of the results, we can say that Slovakia and the Czech Republic will have to go through a number of changes and solve many of the shortcomings in the R&D support system. The problem in these countries is primarily fragmentation and lack of coordination of the R&D support system. A way to solve this problem should be the coherence of the R&D support system and the exact delimitation of duties and powers, for example, by following the example of Denmark, such as the Central Ministry or Commission.

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The Impact of Higher Education on National Economic and Social Development: Comparative Analysis

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Abstract:

The effect of the higher education under the conditions of knowledge-based economy and under influence of the 4th Industrial Revolution that started at the current stage of economies' development, is being experienced by each country. The purpose of this paper is to identify the economic and social aspects of obtaining higher education, the influence of higher education on the economy, the impact of higher education in the context of current changes on the necessity of the lifelong learning. Particular actuality is associated with necessity of the lifelong learning in the process of working at current economy. The study covers the relationship between the level of education and the development of social and economic potential of a country, the impact of higher education on it. As a result the basic requirements which the sector of higher education should face at modern stage, especially in the context of transformation of countries under influence of the 4th Industrial Revolution.

Keywords: higher education; lifelong learning; knowledge-based economy; 4th Industrial Revolution; economic and social development

JEL Classification: A22; A23; I23; I24; I25; I26; O1

Introduction

Education, in general, has long been viewed as an important determinant of economic well-being and the university education, in particular, as the preferred route for a professional career. The actuality of this aspect increases under the conditions of knowledge-based economy and under influence of the 4th Industrial Revolution. In today's technological and informational society, the level of intellectual development of human resources becomes a key indicator of post-industrial economy. Thus, higher education competitiveness is an indicator of sustainable development of a country's economy and human potential of its population. Higher education at modern stage is not only the factor and catalyst for further economic development of any country that ensures all areas of economic

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activity by the professional human resources, being not only as their producer, but also as a consumer to involve in project activities, the creation of new technologies and so on. Thus, the role of higher education becomes increasingly important in terms of reorienting the current development of the society at the next stage, where the higher educational is more flexible to changes in the environment, creative and result-oriented, focused on the need not only to give a knowledge for students but to learn getting it independently, and the most importantly - the educational institutions are increasingly becoming independent and self-sufficient institutions which produce not only a professional staff but also high-tech products, involving in the process of creating its graduates. So, the powerful educational institutions become technological business incubators with own resources and the possibilities to get additional financing.

But this direction of development of higher education gives new challenges. The introduction of the high technologies into the production process creates the need to improve the knowledge and skills of the employees, the implementation of the continuous lifelong learning and appropriate incentives for the professional development.

Lifelong learning is becoming more and more important for the countries that want to be competitive in the global knowledge economy. So the era of the 21st century is not only a new landmark development but, above all, a transformational shift to the intellectualization as the process of the saturation of the information environment by the intellectual assets.

1. Literature review

The scientific literature emphasizes at least three mechanisms through which education may affect economic growth. First, education can increase the human capital inherent in the labour force, which increases labour productivity and thus transitional growth toward a higher equilibrium level of output (as in augmented neoclassical growth theories (Mankiw *et al.* 1992). Second, education can increase the innovative capacity of the economy and the new knowledge on new technologies, products and processes promotes growth (as in theories of endogenous growth, Lucas (1988), Romer (1990), Aghion and Howitt (1998). Third, education can facilitate the diffusion and transmission of knowledge needed to understand and process new information and to successfully implement new technologies devised by others which again promotes economic growth (Nelson and Phelps 1966, Benhabib and Spiegel 1994). But under the influence of the current stage of rapid development the role of higher education should critically be reconsidered. There are different opportunities available that will shape the role which is able to be undertaken by higher education in the Fourth Industrial Revolution. Combining the strength of the traditional higher education with the increasing trend of Massive open online courses (MOOCs) represents necessary steps to scale quality education. On the other hand, “Global Identity” and “Education for You” embody aspects, if globally embraced that would transform global higher education (Mezied 2016). The issues of influence the higher education on the economy, the role of higher education in promoting lifelong learning, transformation role of higher education, ratings of national systems of higher education and their quality have been studied by foreign researchers, *e.g*. Kruss *et al.* (2015), Hanushek *et al*. (2010), Hanushek (2016) and Yang (2015). At the same time the question of higher education and the contribution of higher education to the lifelong learning have been a subject of domestic research. Thus the transformation of modern role of higher education under conditions of knowledge-based economy is shown in the following: higher education is constantly evolving, becoming more universal and mass, is more popular to receive not a one-time education, but its continuation throughout lifelong learning, are increasingly the process of creating the new technologies and products with attracting the talented students, the process of teaching becomes more project-oriented and by doing to get more results, applied results for economy. The purpose of the article is to identify the economic and social aspects of obtaining the higher education, influence of the higher education on the economy, the impact of higher education in the context of current changes on the necessity of the lifelong learning.

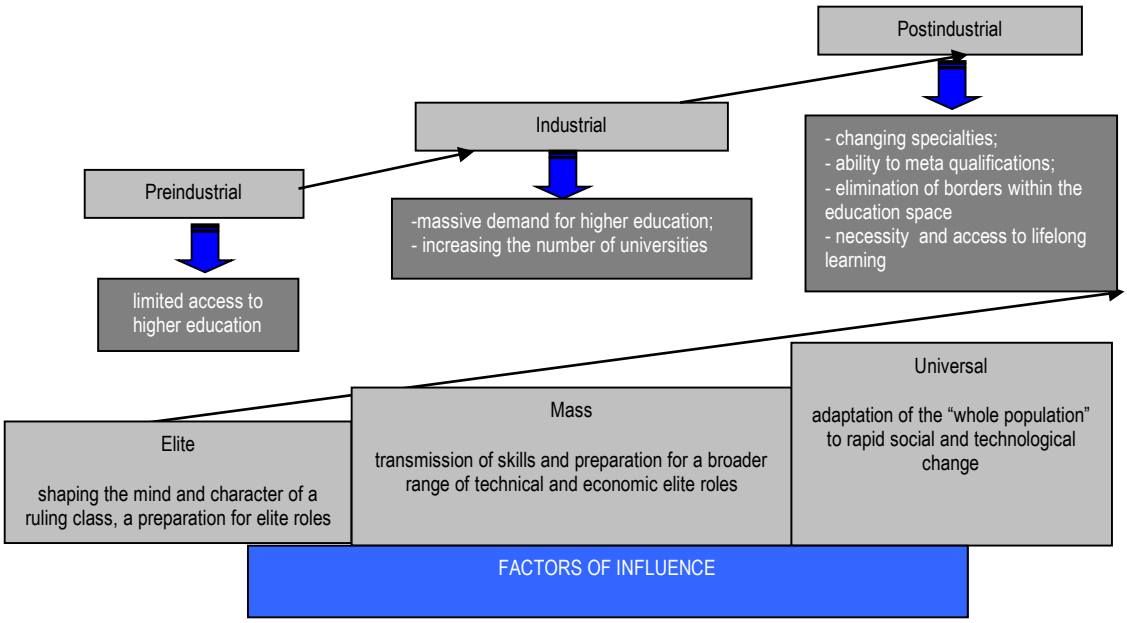
2. Methodology and results

Higher education will continue to play a key role in economic development. As we start working towards the new Sustainable Development Goals, we will need professionals across all sectors and education is central to producing those professionals (Kruss *et al.* 2015).

But the process of obtaining the higher education has an obstacle which is social stratification, inequality in access to higher education (about this J. Stiglitz emphasizes in his speeches), because the opportunity of obtaining the higher education in several countries is not free of charge, the price of which is often high.

According to the concept of the American sociologist Martin Trow, the development of higher education usually passes through three stages: the elite, mass and universal, each of which corresponds to the requirements of time (Trow 2006). Reflections on the transition from elite to mass to universal access: Forms and phases of higher education in modern societies since WWII (Forest *et al.* 2007). Thus the transformational development of higher education looks like the following Figure 1.

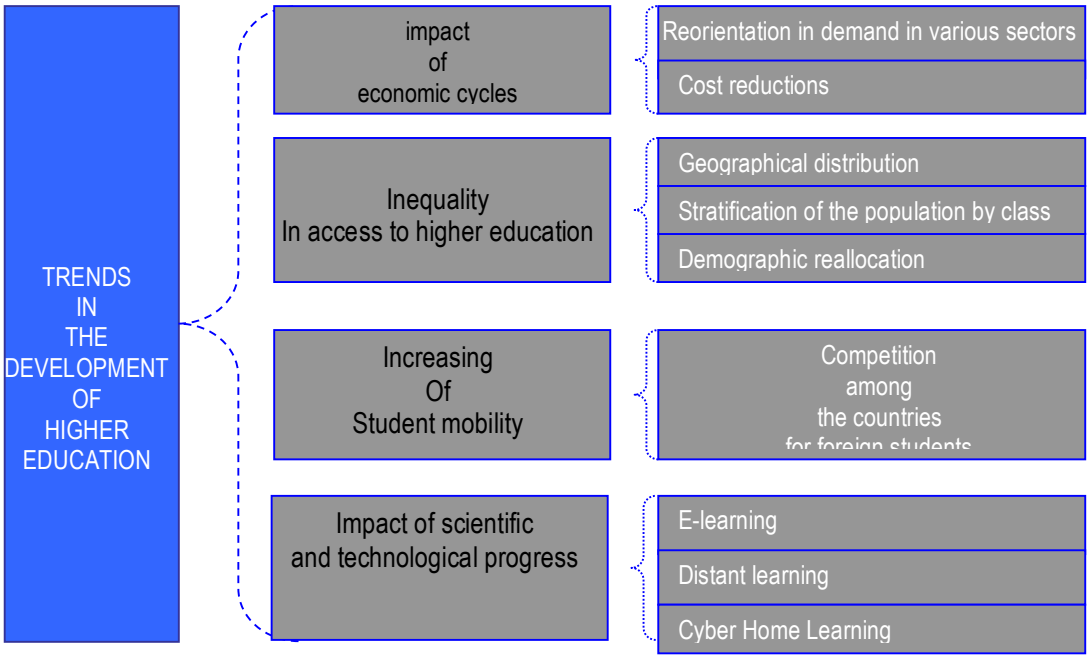
Figure 1. The transformational development of higher education



Source: by authors.

So, post-industrial stage of development of society, the transition to which is dictated by the growing role of science and technology in all spheres of public life transformed the field of higher education at a new quality level, particularly focused in need of constant development, self-improvement and the transition from the normal process of transfer knowledge between "professor-student" to teach the students to search for information in the future, self-adaptability and to teach, that lifelong learning is an integral part of modern higher education and improvement of their professional skills in the future.

Figure 2. The main trends in the development of higher education at modern stage

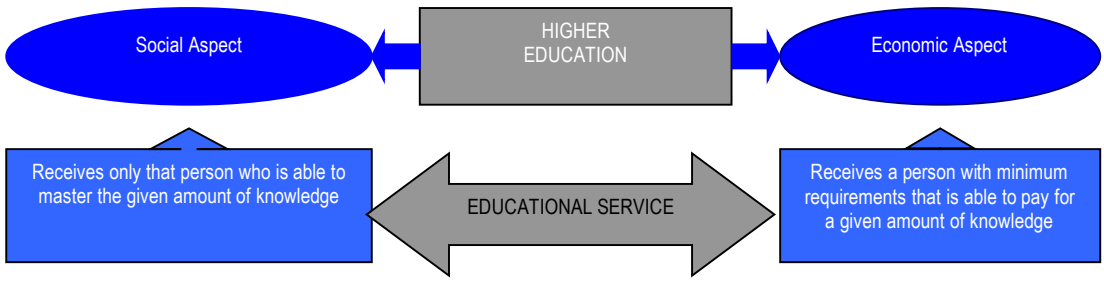


Source: by authors.

There is interdependence between the human capital and the economic development of any country, namely: if the volume of investment by any institution (public and private) will increase to the educational component of its population, the country's economy will develop more actively, in result this will stimulate any investments to the economy in general. But that presupposes that people are going to get jobs and that there's something that is actually driving the development. In this kind of argument, it is not just thinking about supplying the education, it is saying that knowing where the possibilities for the economy to specialize and develop are going to be important in thinking about how economic development takes place (Goodchild 2015).

As we can see (Figura 2), the current trends have changed the approaches to higher education, which arose the new forms of education, reorientation of educational institutions, increasing of student mobility. Overall, the current stage not only changed the form of higher education, but also its aspects Figura 3).

Figure 3. The aspects of higher education at current stage



Source: by authors.

Thus, higher education, as an independent sphere of activity that generates the added value, under the influence of knowledge economy where interest for higher education every year only increases, refocused to the economic aspect, providing higher education to all who wish, taken money. Of course, this gives an opportunity obtaining funds, but society loses the cumulative aspect of education, restricting its access to people who have a

predisposition to learning and the production the new ideas that can be used in the future for the benefit of the economy.

The economy looks at a number of different growth equation specifications and using international education data, attempts to draw out the contribution of both the number of, and the growth in, graduates since the 1960s. There are three main findings. Firstly, many growth relationships, including those estimated elsewhere in the literature, are quite sensitive to the countries included – which often depends on the variables used – and time period of analysis. We argue that, given these issues, growth equations should always be treated with caution. Secondly, remembering this caveat, neither the increase nor the initial level of higher education is found to have a statistically significant relationship with growth rates both in the OECD and worldwide. This result is robust to numerous different specifications. Thirdly, there is some evidence consistent with the existing literature that levels of technical skills at the end of compulsory education matter. The employment of higher level technical skills (proxied by the number of employed researchers in the economy) is also a strong predictor of growth. This gives a possible mechanism linking the output of (some) the higher education sector with economic growth. However, it does not imply that mass higher education necessarily leads to higher growth. This depends on the skills produced by an expanding tertiary sector and their utilisation (or underutilisation) in the jobs available to increasing numbers of graduates (Holmes 2013).

The world is changed substantially, if in the last century the amount of knowledge increased twice every thirty years, but now the knowledge is updated every year, by some estimates to 15%. In this regard, the public demands for the quality of the professional education are increased, learning technologies are constantly updated, economic conditions in which higher educational institutions operate are changed, the competition in the market of educational and research services escalates, and the attitude of the public in relation to higher education is changed. The experts observe such trend: the more person is educated, the more he needs to update his knowledge regularly. Such employees are always competitive, mobile, their knowledge and skills help them to climb the career ladder and to get a higher salary.

Overall, the role of higher education in promoting lifelong learning expands and transforms to a new era at modern stage. Firstly, increased access to universities is not enough; the higher education system should ensure retention and progression of all learners and of adult learners in particular. Especially in communities with an ageing population, universities need to facilitate learning for adults and senior citizens with support from the public and private sectors. Secondly, teaching and learning at universities can be transformed by linking learning to the wider issues of life, by recognising shared responsibilities, by creating innovative curricula and by capitalising on the diverse experiences of learners. Innovation in higher education can be crucial in terms of changing attitudes and values and helping to cultivate the necessary capacities for lifelong learning. Thirdly, the reform of higher education goes beyond mere pedagogy and didactics; it is a social process which links teaching and learning to students' personal and individual life patterns, their social and cultural context, and their chosen discipline. Given rapid changes in labour markets and societies, universities are expected to become more responsive to the work and life situation of adult learners, helping them not only acquire skills and knowledge, but also maintain and improve their position in society and ultimately enhance their quality of life (Yang *et al*. 2015).

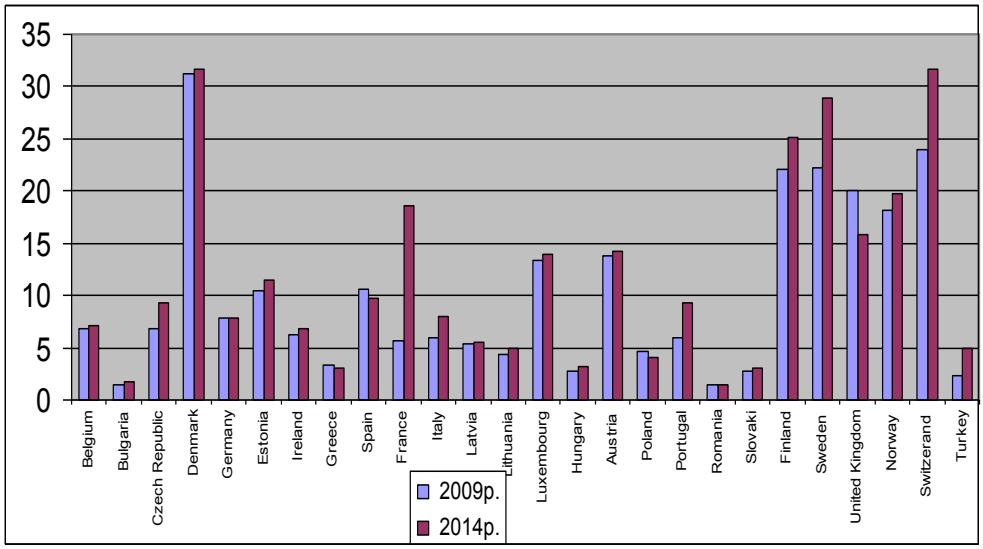
Lifelong learning encompasses all purposeful learning activity, whether formal, non-formal or informal, undertaken on an ongoing basis with the aim of improving knowledge, skills and competence. The intention or aim to learn is the critical point that distinguishes these activities from non-learning activities, such as cultural or sporting activities (Statistical books The EU in the world 2015). Taking to attention a definition ''Lifelong learning'', which is based on Delors' (1996) four 'pillars' of education for the future:

- learning to know- mastering learning tools rather than acquisition of structured knowledge;
- learning to do – equipping people for the types of work needed now and in the future including innovation and adaptation of learning to future work environments;
- learning to live together, and with others – peacefully resolving conflict, discovering other people and their cultures, fostering community capability, individual competence and capacity, economic resilience, and social inclusion;

- learning to be – education contributing to a person's complete development: mind and body, intelligence, sensitivity, aesthetic appreciation and spirituality.

Looking the Figure 4, we can see the following.

Figure 4. The level of participation in the system of lifelong learning in European countries in 2009 and 2014 years, %



Source: by authors, based on Statistical books. The EU in the world 2015 edition

The level of participation in the system of lifelong learning in European countries is dissimilar, where during the last 5 years in such countries as Denmark, Switzerland, Sweden, Finland the level has grown to 25%. Besides, we can observe, that France has rapid increasing of participation level in the system of lifelong learning (increased its position by 2.3 times), and one of the leaders of 2014 as Denmark. We can observe the slow growth for this period, in particular from 30,8% in 2009 to 31,2% in 2014. It concerns the availability of the motivation among the employees and their employers, as a result increasing the productivity of labour and production.

In developed countries, the number of people with higher education is much higher in formal and informal activities for improving their professional level than the people without higher education.

However, in Ukraine this global tendency is not widespread: most of employees with higher education are lack of involving in the process of continuous professional development. Describing Ukrainian position among other countries in the context of international comparisons, it is necessary to state that in our country yet there are no conditions for the effective using of all the advantages that could provide for its innovative direction of development. For example, by the data of the Global Competitiveness Index (GCI) in 2015-2016 Ukraine occupies 79th place out of 140 countries, compared with the previous year's position was deteriorated by 3 units.

Then, we consider it appropriate to analyse the dynamics of the given component "Higher education and training" of the Global Competitiveness Index. Analysing Table 1, we observe that for the last five years the highest index of higher education and training belongs to Finland, the score of which, in the dynamics, significantly increases. Only at the end of 2014 there was a slight decrease of the index. The position of the USA is variable: falling of the index from 5.67 in 2008 to 5.58 in 2011 and its increasing from 2012 till 2014 to 5.82. The weakening of the position is observed in Denmark, which during 2008-2010 was part of the three countries with the highest index, whereas during the recent years Singapore has strengthened its position, as it is a country of the group of newly industrialized countries – from 5.56 (8) in 2008 to 6.09 (2) in 2014.

Looking at the pillars of higher education and training in Poland, it is concluded that its value during the analysed period is dynamically changing – namely, at the end of 2014 the country took the same position as in 2008 – 34th place, while the score of the index started to restore the own positive dynamic only at the end 2014, which indicates the relative instability and deteriorating of competitiveness.

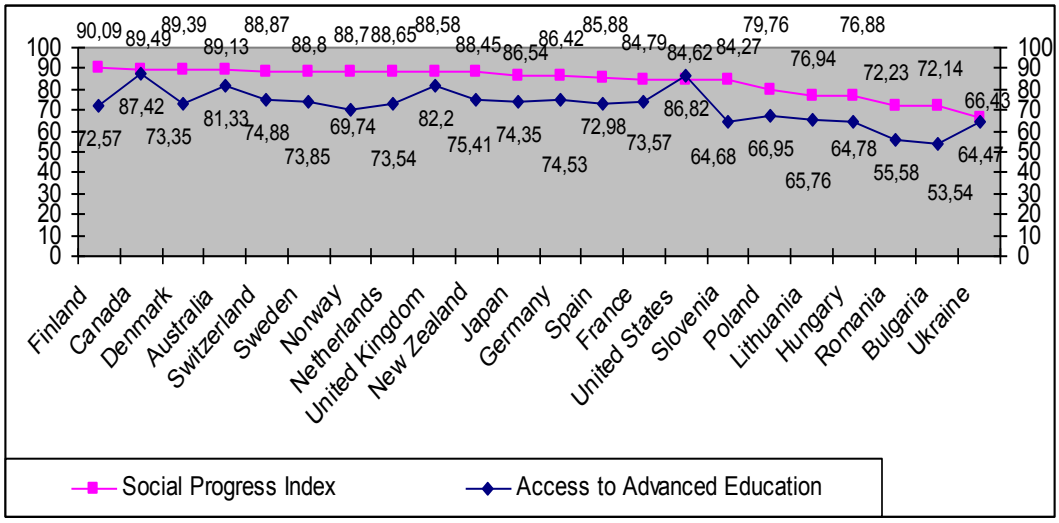
Table 1. The dynamics of pillar 'Higher education and training' of the Global Competitiveness Index

Country/ Economy	2008-2009		2009-2010		2010-2011		2011-2012		2012-2013		2013-2014		2014-2015	
	Rank	Score	Rank	Score	Rank	Score	Rank	Score	Rank	Score	Rank	Score	Rank	Score
The USA	5	5.67	7	5.57	9	5.64	13	5.58	8	5.72	7	5.75	7	5.82
Japan	23	5.08	23	5.06	20	5.28	19	5.27	21	5.28	21	5.28	21	5.44
China	64	4.05	61	4.09	60	4.24	58	4.34	30	4.64	70	4.23	65	4.42
Switzerland	7	5.60	6	5.60	4	5.79	3	5.80	3	5.90	4	5.88	4	5.98
France	16	5.37	15	5.30	17	5.36	20	5.24	27	5.14	24	5.21	28	5.26
The United Kingdom	18	5.27	18	5.17	18	5.34	16	5.47	16	5.57	17	5.45	19	5.5
Denmark	2	5.98	2	5.90	3	5.84	6	5.75	14	5.59	14	5.54	10	5.68
Poland	34	4.64	27	4.82	26	5.00	31	4.95	36	4.92	37	4.88	34	5.04
Czech Republic	25	4.98	24	5.05	24	5.11	30	4.95	38	4.87	39	4.85	35	5.02
Finland	1	6.07	1	5.97	1	6.06	1	6.09	1	6.18	1	6.27	1	6.22
Romania	52	4.29	52	4.30	54	4.47	55	4.42	59	436	59	4.41	58	4.63
Ukraine	43	4.46	46	4.38	46	4.61	51	4.58	47	4.70	43	4.75	40	4.93
Russian Federation	46	4.40	51	4.30	50	4.55	52	4.54	52	4.59	47	4.66	39	4.96
Kazakhstan	59	4.12	59	4.13	65	4.20	65	4.18	58	4.37	54	4.52	62	4.51
Azerbaijan	80	3.76	72	3.88	77	3.96	75	4.01	89	3.91	87	4.00	90	3.90
Georgia	84	3.72	84	3.70	90	3.74	88	3.87	93	3.82	92	3.79	92	3.89
Armenia	94	3.43	96	3.46	91	3.66	76	4.01	70	4.22	77	4.18	75	4.20

Source: Tsarenko (2016)

Besides, the Global Competitiveness Index there is another Social Progress Index, which gives the evaluation of current stage not only in economy but in society too because this index describes the situation in all spheres of living of population through such indicators as access to advanced education, corruption and so on (Figure 5).

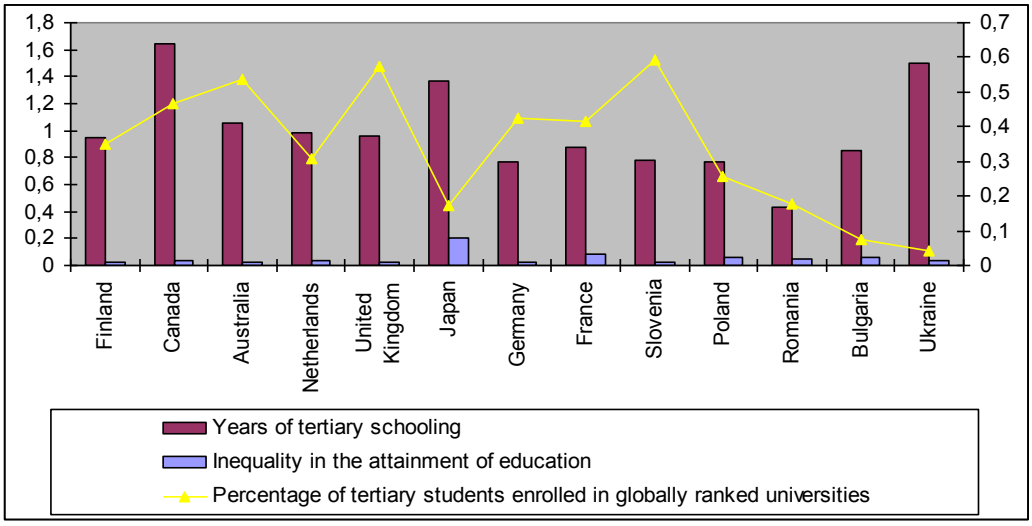
Figure 5. The analysis of Social Progress Index and its component 'Access to Advanced education' in comparing in the different countries



Source: by authors, based according to the Social Progress Index 2016

For example, by the data of 2015 we have the following situation: Finland has the highest position in this index 90,9 scores and Ukraine received only 66,43 scores. As for such pillar as 'Access to Advanced Education', which presents the components: years of tertiary schooling, inequality in the attainment of education, globally ranked universities, percentage of tertiary students enrolled in globally ranked universities.

Figure 6. The quantitative analysis of indicators of the component 'Access to Advanced education' in comparing in the different countries

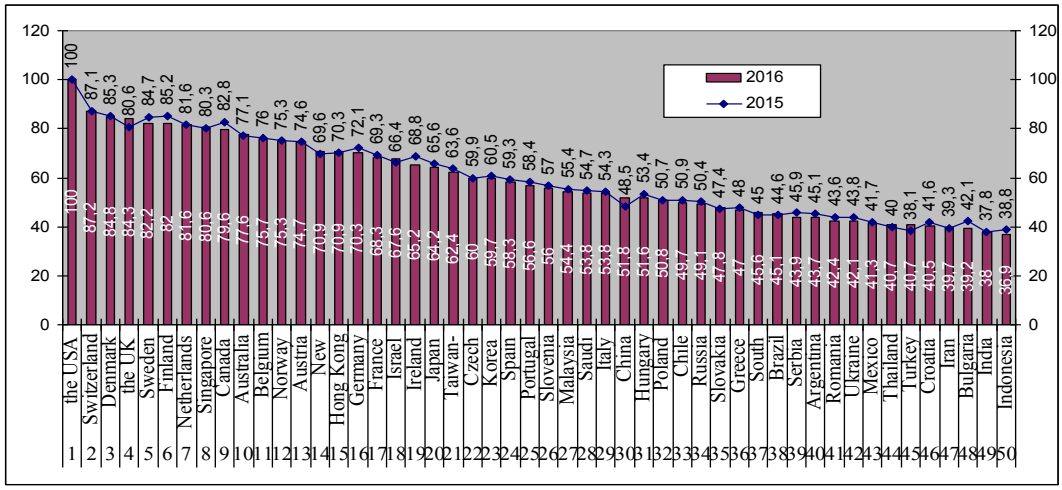


Source: by authors, based according to the Social Progress Index 2016

As seen in Figure 6, the duration of training (years of tertiary schooling) is not a guarantee of the highest quality. For example, Ukraine has one of the highest indices which is 1.49. An interesting indicator is the inequality in the attainment of education, where Japan has the highest index of 0.19. Concerning globally ranked universities and percentage of tertiary students enrolled in them the scientific community has mixed views, on the one hand, the presence the world's flagships of universities is a testament to the high recognition – quality and

competitiveness. The evidence of that is the world's popular rating systems to evaluate the competitiveness of universities (Figure 7), and systems of higher education (Figure 8).

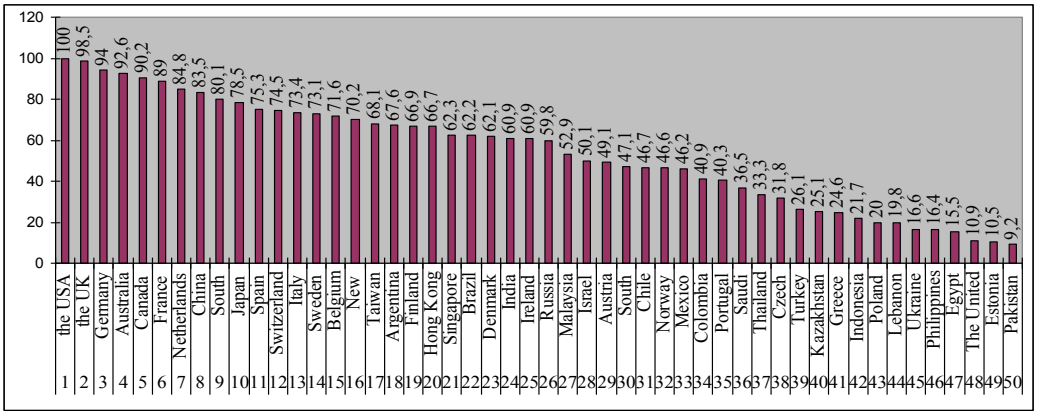
Figure 7. Ranking of higher education of the world 2015-2016 years according to the ratings Universitas21



Source: by authors, based according to the U21 Ranking of National Higher Education Systems

If we take into account the rating system Universitas21, we observe that Ukraine ranked only the 42th position in the ranking of 2016, gaining 42.1 score out of 100, which is 1.7 points less than in 2015 (43.8 points - 2015 year). Thus, in the context, Ukraine is 53rd in Resources (minimum value in 2016 was 19.1 (Indonesia), 69 – Environment (19.1 (Greece)) 27.1 – Connectivity (23, 7 (Iran)) 23.3 – Output (14.8 (Indonesia)).

Figure 8. Ranking of higher education of world 2015-2016 years according to ratings QS Higher Education System Strength



Source: by authors, based according to the QS Topuniversities source

The position of Ukrainian higher education within the rating QS Higher Education System Strength in 2016 corresponded to 45 positions with 50 positions in general, just ahead of countries such as the Philippines, Egypt, UAE, Estonia and Pakistan.

But on the other hand, as proven by the results of tests on the level of knowledge of graduates in countries around the world conducted by the OECD. By the literacy tests, the best graduates are not in the USA or Great Britain, in Japan and Finland. According to these data, obtained only by the test results without the reputation of educational institutions, the leaders became very different countries that the positions of which in rating systems are minor, namely: 1. Japan 2. Finland 3. Netherlands 4. Norway 5. Australia 6. Belgium 7. New Zealand 8. the Great Britain 9. USA 10. The Czech Republic.

For example, rating QS World University Rankings, among the 100 best universities in the world includes 32 universities from the USA and only one - of New Zealand.

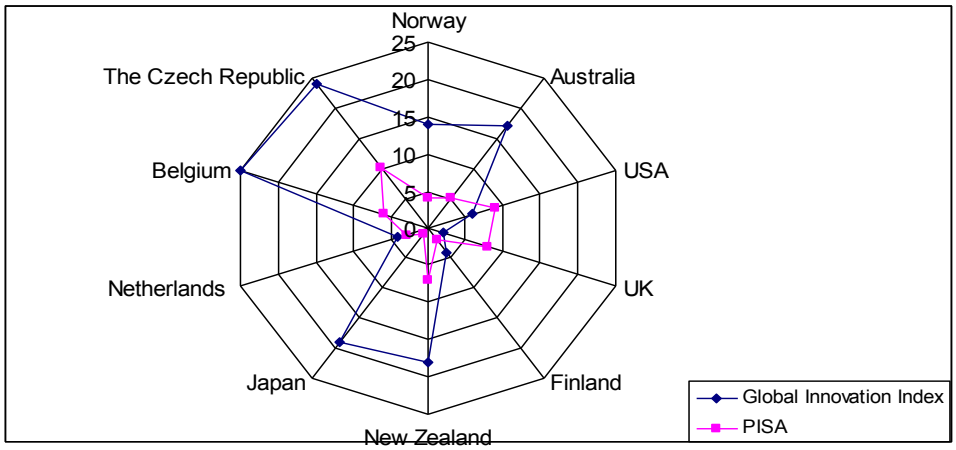
However, the New Zealand's graduates showed better results than American. The higher education system in the Netherlands with low cost training proved better than the USA and the UK, where the training is much more expensive.

As evidence of this popularity, we can use the next indicator which conducted the OECD - percentage of foreign and international tertiary students who are enrolled in each country of destination – Canada (3%), Australia (6%), the United Kingdom (10) and the United States (19%) in 2013. Another indicator - number of international students per national student abroad, which gives to us the following information: Australia has 21 international students per national student abroad (the highest number among countries in 2013), New Zealand – 8 (4th position), the United Kingdom – 14 (2nd position) and the United States – 12 (3th position). Besides such indicator as students abroad in tertiary education, by country of destination shows what proportion of students studying abroad in tertiary education in a given country of destination; where 6.2% of total citizens enrolled in tertiary education abroad study in Australia (1st position), 5.7% in France, 4.9% in Germany, 10.9% in the United Kingdom and 19.4% in the United States (Education at a Glance, 2015).

We can see, that the system of higher education in Australia is very attractive among foreign students as a country of their destination in getting a university degree. There are many similarities in the Australian higher education system with the UK's system as its colony. Besides, nowadays, the standards are very high in Australia, the Australian university degrees are recognized worldwide. The country is investing heavily in education because facilities in universities and the process of learning are at the highest level. The value of training per year: 14-35 thousand of Australian dollars, which is 40% lower than in the UK (Immigration through education, Canada, Australia, New Zealand, 2015).

In general, analysing the different indicators in this field, we can observe, that the level of development of higher education and its popularity depends on the model of the economy. Comparing the Global Innovation Index as an annual ranking of the countries by their capacity for and success in, innovation and the results of tests on the level of knowledge of graduates in countries around the world conducted by the OECD in TOP-10 of countries in the world (Figure 9).

Figure 9. The comparative characteristic of Global Innovation Index and index of PISA in TOP-10 of countries in the world



Source: by authors, based according to the Global Innovation Index 2016 and Top-10 countries where most intelligent students learn (2016)

The fact that the testing was conducted among university graduates should talk about the potential of increasing of innovation activity in the future, the presence of a reserve for the country or its absence.

In addition, we give other indicators which show the relationship between the components of education and the development of social and economic potential of each countries (Table 2).

Table 2. The characteristic of the relationship of education and the development of social and economic potential by different types of countries

Type of country	Countries	Education Index	Human Development Index	Global Competitiveness Index	Knowledge Economy Index	Knowledge Index	Global Innovation Index	International Innovation Index
Developed countries	Norway	0.888	(1) 0.944	(11) 5.33	(5) 9.11	8.99	(14) 55.59	(18) 1.14
	Australia	0.910	(2) 0.933	(21) 5.09	(9) 8.88	8,98	(17) 55.01	(22) 1.02
	The USA	0.830	(5) 0.914	(5) 5.48	(12) 8.77	8.89	(6) 60.09	(8) 1.80
	Japan	0.648	(17) 0.890	(9) 5.40	(22) 8.28	8.53	(21) 52.41	(9) 1.79
Developed countries in Europe	Germany	0.863	(6) 0.911	(4) 5.51	(8) 8.90	8,83	(13) 56.02	(19) 1.12
	France	0.745	(20) 0.884	(23) 5.05	(24) 8,21	8.36	(22) 52.18	(20) 1.12
	Italy	0.697	(26) 0.872	(49) 4.41	(30) 7.89	7,94	(31) 45.65	(38) 0.21
	The UK	0.838	(14) 0.892	(10) 5.37	(14) 8,76	8.61	(2) 62.37	(15) 1.42
Countries of the former Soviet Union	Russia	0.764	(57) 0.788	(64) 4.25	(55) 5.78	6.96	(49) 39.14	(49) -0.09
	Ukraine	0.747	(83) 0.734	(76) 4 14	(56) 5.73	6,33	(63) 36:26	(64) -0.45
	Kazakhstan	0.717	(70) 0.757	(50) 4.41	(73) 5.04	5.40	(79) 32.75	(60) -0.23
	Georgia	0.745	(77) 0.745	(69) 4.22	(68) 5.19	4.49	(74) 34.53	(77) -0.72
	Latvia	0.784	(48)0.810	(52) 4.40	(37) 7,41	7.15	(34) 44.81	(43) 0.12
Developing countries	India	0.274	(135) 0.586	(60) 4.28	(110) 3.06	2.89	(76) 33.70	(46) -0.06
	Honduras	0.356	(129) 0.617	(111) 3.7	(109) 3.08	3.00	(118) 26.73	(82) -0.79
	Nigeria	0.233	(152) 0.504	(120) 3.57	(119) 2.20	2.51	(110) 27.79	(88) -0.95
	Zimbabwe	0.411	(156) 0.492	(131) 3.44	(120) 2.17	2.85	(130) 24.31	(110) -1.63

Source: authors, based according to the Human Development Report (2014); World Bank Report (2014); The Global Innovation Index (2014).

Conclusion

Therefore, we can summarize that the impact of higher education under the conditions of knowledge-based economy is growing up with each year especially in the context of transformation of countries under the influence of the 4th Industrial Revolution. But their peculiarities are changing too. In particular:

- the changes in the requirements to the graduates: not only persons with received knowledge within academic course, but also persons with the skills and abilities on continuing the process of lifelong learning independently (learning to learn), the ability to independent searching of the necessary information from the extensive array and its analysis;
- the changes of philosophy of education: providing the interactive partnership's model the relationship between professors and students as subject with subject unlike current 'subject – object model';
- the educational environment which gives the opportunity for professors to play the role of a guide on the way of 'knowledge mining' should be created in these universities;
- the services of higher education are getting more internalized with increasing of numbers of foreign students abroad;

- universities are becoming more global, thus we should apply a new criteria of quality evaluation in global dimension, which are well-wide recognized;
- system of higher education institutions is becoming not only a producer of educational services and a new knowledge to its customers (which has the own centres, powerful scientific centres and laboratories, where able to attract students of such universities), but also as their consumers through the creation the powerful research centres in such universities that are actively involved to the introduction of innovation in different spheres of economy and innovation activities;
- the appeal of «education hubs» is broadening;
- technology is becoming increasingly central to education worldwide;
- educational cooperation through the creation of consortia is becoming more common;
- principle of regulation of higher education by the state is modified because the competition among universities is increased due to the lack of borders in the educational environment;
- the need to involve the universities to the project activities aimed at solving both national and global issues of economy of the countries.

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International Skilled-Migration and Regional Growth in Poland

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Abstract:

The paper aims to investigate the relationship between international migration and economic growth across the regions of Poland. In most studies, the potential determinants of migration have been investigated, while the impact of these flows of individuals on economic growth has received less attention. Using a panel data during the time period 1999-2005, the authors tested if different kinds of migration flows, distinguished by educational level, had an effect on economic growth. In order to control both the issue of endogeneity, due to the presence of some potentially endogenous variables among the explanatory variables, and the problem of omitted variables, the paper implements the difference-GMM of Arellano-Bond. The findings show that high-skilled in-migration flows has a strong positive impact on the growth dynamics of Polish regions. On the other hand, the outflow of skilled individuals reduces the regional skill-intensity and has a negative effect on income. The results also support the idea that skilled-migration can promote the provincial convergence.

Keywords: skilled-migration; international flows; regional convergence; Poland

JEL Classification: R10; R11; R23

Introduction

The present paper focuses on the effect of migration on destination places. In particular, by distinguishing the international flows we are interested in through investigating the role of skill-selective migration on regional growth in Poland. The economic and demographic characteristics make Poland an interesting case study in Europe. This country, indeed, represents the most populous among the new European Union members. Furthermore, the literature on the relationship between migration and regional disparities of Eastern European countries is less common than the literature on developed countries. The main findings reveal, on average, an amount of migration flows relatively less and decreasing with respect to the other developed European Union members (Kertesi 2000, Fidrmuc 2004, Bornhorst and Commander 2006, Ghatak *et al.* 2008, Ghatak and Pop Silaghi 2011). Moreover, the literature gap is accentuated by the additional scarcity of studies focused on the effect of migration on regional convergence in Eastern Europe (Kirdar and Saracoğlu 2008, Wolszczak-Derlacz 2009, Bunea 2011). This paper adds to the literature confirming that mobility of the more educated has a positive effect on the host regions and a detrimental effect on the sending regions in Poland. The remainder of the paper is organized as follow. In Section 1 is provided the literature empirical background, in section 2, the descriptive analysis and econometric model will be specified and the results will be presented. Finally, in the last section, we provide the main conclusions of the analysis.

1. Literature review

Despite the recognized importance of migration for economic development (Blanchard and Kats 1992, Borjas 1999, Rappaport 2005), scholars are still focused on the determinants of migration rather than the causal effect of migration on economic growth in the place of destination. In an important literature review, Etzo (2008) stressed the necessity of further investigation on the relationship between migration, growth and convergence. The author, indeed, argues that although the migration literature presents a huge number of empirical studies, the gap between the causes and the consequences of migration is still present and need to be reduced.

Moreover, most of the studies dealt with migration flows across regions within national borders. Conversely, by analysing the impact of international migration on economic growth, the evidence provided by the literature is still incomplete and partial. Brunow *et al.* (2015) have shown that a greater cross-border mobility can contribute to higher global long-run growth. The authors, considering a wide range of channels (such as age structure, entrepreneurship, trade, remittances etc.) through which migration can influence dynamic growth in sending countries, highlights that education and skills are among the most important factors able to influence the decision to move. Furthermore, education tends to take on a greater role if we study international mobility rather than intra-national mobility. Coulombe and Tremblay (2009), for instance, although they are not interested in the effects of migration on income disparities, analyse a sample of international and internal migrants in order to assess the role of migration on the skill disparities across Canadian provinces and highlight the positive contribution of international migration to the reduction of provincial skill intensity disparities.

According to the neo-classical growth model with diminishing returns to factor of production and homogenous labour, migration flows lead to a decrease of regional economic disparities by moving labour force from poor to rich regions (Barro and Sala-i-Martin 1992). This process would reduce the economic growth in the net in-migration regions and at the same time it boosts the economic dynamic in the emigration regions. At the end of this adjustment process, holding everything else constant, the economic disparities between the two places will disappear. For instance, Kirdar and Saracoğlu (2008) show how migration is an important source of reduction of regional economic disparities in Turkey. In this context where migration is characterized by flows of unskilled individuals, the labour mobility works as an adjustment mechanism that is able to reduce the economic differences.

Another important evidence of this equilibrating mechanism is found by Maza (2006) for the Spanish regions during the period 1995-2002. The author finds empirical support on the ability of migration in boosting regional convergence. Indeed, once migration is introduced among the regressors, the estimate of convergence decreases, indicating how mobility reduces regional disparities. Moreover, the negative coefficient associated with migration signifies that a higher level of migration slows down economic growth and reinforces the role of migration in terms of convergence.

However, some scholars argue that the simultaneous persistence of migration and economic disparities among regions do not confirm this theoretical model (Reichlin and Rustichini 1998) especially when migration "is not skill-neutral but skill-selective" (Fratesi and Percoco 2014, 1651). In particular, given the importance of migrant's characteristics, such as labour skills, many authors oppose the standard framework and suggest an investigation of the composition effect. Shioji (2001) suggests that if the human capital embodied in the migration flows is higher than the human capital that remains, then the composition effect overcomes the quantity effect due to the labour mobility. Østbye and Westerlund (2007) consider the heterogeneity of migrants and separate the flows of individuals into in-migration and out-migration in order to capture a different effect on economic growth in Norway and Sweden. The results show that the composition effect is a predominant force in Norway, whereas in Sweden migration boosts the regional convergence as the quantity effect overcomes the effect due to the composition of migration.

Another important contribution comes from Hierro and Maza (2010), where the relationship between the internal movement of foreign-born individuals and the convergence process is analysed at the provincial level in Spain. In particular, the authors have investigated if and to what extent the presence of foreign-born individuals in provinces with a higher income per capita has a consequence on economic growth and convergence. The results affirm that this kind of migration positively reduce the economic disparities. Within this strand of literature, Vidyattama (2016) analysis the effect of inter-provincial migration on regional growth during the period 1975-2005

in Indonesia. The author aims to estimate the impact of migration on economic growth in general and at the same time to find a different causal effect of in-migration and out-migration on richer and poorer regions. The results highlight a positive impact of migration on the three low-income provinces, while on the other hand, there is no significant effect of migration on high-income provinces. Furthermore, Fratesi e Percoco (2014) point out, through an analysis at the Italian regional level, the contribution of migration to the human capital accumulation in the host region. The underlying idea is that migration affects the destination place by not only increasing its labour force, but also changing the way human capital is distributed and, as a consequence, the economic performance.

Finally, Kubis and Schneider (2016) estimate a dynamic panel model to address the role of regional migration in Germany. The results confirm a skill selection process of migration and in particular, the out-migration has a negative effect on the regional dynamic of growth. Furthermore, when the authors disentangle Germany into two subsamples (East and West Germany), the estimates are different. In the East Germany subsample, the in-migration positively affects the growth, whereas in West Germany, the opposite is true since the in-migration slow down the economic growth.

In summary, these studies confirm that the heterogeneous effects of migration on regional economic growth depend on the intangible skills embodied by each migrant. The underlying assumption is that the different educational level creates a selection process able to explain the different impact of migration on the economic growth. However, there is no empirical evidence to support this claim when we study international flows. Furthermore, differently from and Kubis and Schneider (2016), another original element of the paper is the possibility to account for the skill-selectivity. In particular, the dataset provides a subdivision of migration flows which enables us to disentangle the different migrant's skills by using the level of education of migration flows.

From the methodological point, this kind of investigation arises from different identification issues. First, the endogeneity between migration and GDP per capita could lead to a simultaneous bias. In particular, the reverse causality among them could create a systematic distortion. Second, the endogeneity due to omitted variables, if not considered, could increase the error of estimation. The economic literature has approached this topic using different identification strategies and different methodologies, from the instrumental variable approach (Barro and Sala-i-Martin 1992, Kirdar and Saracoğlu 2008, Maza 2006) to the difference-GMM estimators (Niebuhr 2012, Vidyattama 2016). This work will try to study the relationship between selective migration and economic growth by implementing a dynamic panel estimation and, in particular, a *difference-GMM* of Arellano and Bond (1991).

2. Empirical analysis

2.1 Description of the data

The Poland spatial map is divided by the Eurostat into 6 macro-regions (NUTS1), 16 regions (NUTS2) and 66 provinces (NUTS3). Concerning the first level of division, the Eurostat used the geographical position as a method of identification and thus we have the centre, the south, the east, the north-west, the south-west and the north. The capital city is Warsaw placed in the centre macro-region where we find the highest population density. Also the city of Lodz, the second most populated city, is in the centre area, with an economic vocation in the textile industry. In the South of the country, we find the artistic and cultural complex placed in Cracow and in the Western side, the urban agglomeration of Poznan and Wroclaw. Finally, in the North is the city of Danzig, the centre of the shipbuilding industry and with the largest harbour in the country.

In this study, the reference economic unit analysed is the region (NUTS2). The regional territorial units express a good proxy of the territorial organization of economic activities and simultaneously allow us to capture the movements of labour force. The regions are, therefore, an appropriate instrument of analysis in investigating the socio-economic structure of Poland, according to a local development perspective.

Within studies on the economic growth, the unit of analysis has assumed an important role. There has been criticism from some scholars about the adequacy of the administrative level as a measure of territorial aspects of the economic system, and the necessity to use ad-hoc units of analysis (Boldrin and Canova 2001). As we can notice, on the one hand, this type of statistical unit, as functional urban areas (Chesire and Carbonaro 1995), can be more appropriate, and on the other hand, the dynamic specifications of these areas suggest that their dimension is not fixed during the time (Fingleton 2001). Therefore, even if the administrative level is not exactly representative

of the features of the growth process, it guarantees a satisfactory level of analysis, capable of capturing the sub-national disparities (Fischer and Stirböck 2006).

In order to carry out the empirical analysis, we use the regional value added at power purchasing standard from the Eurostat database and migration flows for the period 1999–2005, provided by the Central Statistical Office of Poland. In order to verify a different impact on economic growth due to the different educational level embedded in the flows of individuals, we have divided the international migration into three categories by using the classification adopted by Li and Mc Hale (2006). In particular, the authors divided the migration flows by educational attainment in: low-skilled individuals who are those with primary education; medium-skilled migrants who possess a secondary education and finally the high-skilled individuals with a tertiary education.

Table 1 shows the descriptive statistics referring to the variables considered in the econometric analysis of Polish regions. Starting with the economic growth (ΔY_{it}), the annual average value during the whole period is positive and equal to 4.6%. Also, the migration flows were characterized, on average, by positive growth. In particular, the high-skilled in-migration has grown at an annual average rate equal to 0.08% and was higher than the rate of out-flows of people with the same level of education (0.03%). The medium-skilled individuals show high growth rates, respectively 0.11% for the immigration and 0.20% for the emigration. Furthermore, within the low-skilled individuals is interesting insight at the high differences between the in-going flows with a growth rate equal to 0.04% and the out-going migration, which registers a growth rate of 0.30%. Finally, in order to measure the human capital, the present paper, follows the methodology of Dolado *et al*. (1994) and then exploited by Fratesi and Percoco (2014). In particular, the average level of education of migration flows is used as a proxy of the human capital embedded in this flows of individuals. The paper implements three educational level: primary, secondary and tertiary. Therefore, the in-migration and the out-migration stocks of human capital for each region *i* (HK_i) are constructed separately through the following equation:

$$HK_i = \frac{\sum_k migr_k year_k}{\sum_k migr_k} \quad (1)$$

where: k = 1, …, 3; $year_k$ is the number of year of schooling for the level of education *k* and $migr_k$ is the number of migrants of schooling level *k.*

Concerning the human capital, Table 1 shows that on average, regions were characterized by a level of human capital equal to 7.23. However, this variable ranges between a maximum value of 9.85 for the region with the highest level of human capital and a minimum value of 4.13.

Table 1. Descriptive statistics of the variables

Varible	Description	Obs.	Mean	Std. Dev.	Min.	Max.
ΔY_{it}	income growth rate	96	0.0460405	0.0302072	-0.0139862	0.1612681
Y_{it-1}	the initial level of income	96	9.0782560	0.2072436	8.7160440	9.7231640
imm_tert	high-skilled immigration	96	0.0836296	0.0356667	0.0265637	0.1907423
emig_tert	high-skilled emigration	96	0.0390130	0.0411017	0.0015599	0.2520510
imm_second	medium-skilled immigration	96	0.1106984	0.0705437	0.0295484	0.4372703
emig_second	medium-skilled emigration	96	0.2077573	0.2503858	0.0060361	1.2227620
imm_prim	low-skilled immigration	96	0.0475736	0.0399741	0.0126564	0.1966762
emig_prim	low-skilled emigration	96	0.3040746	0.4943949	0.0093276	2.4388240
Hk	human capital	96	7.2323570	1.3106370	4.1330590	9.8518520
share_tert	share tertiary educated	96	0.1883275	0.0439306	0.0968720	0.3227151

Source: own elaboration on Gus and Eurostat data

Table 2 shows that the immigration and the emigration of human capital in the initial year (1999) and the final year (2005) for each region. The central regions seem to be the more attractive regions in terms of human capital in both periods. However, they show a drastic increase in the out-migration of human capital from 1999 to 2005. Indeed, in 1999, the emigration of human capital was on average 1.5, while in 2005 the loss of human capital for Lodzkie and Mazowieckie was equal to 8.55 and 6.33, respectively. Furthermore, apart from Wielkoposkie and Pomorskie, over the years the northern regions become more attractive in terms of human capital. These results seem to confirm the study of Di Berardino and Sarra (2013) in which they point out the potential attractiveness of the northern and central regions, which represent the first and second areas in terms of economic growth dynamic.

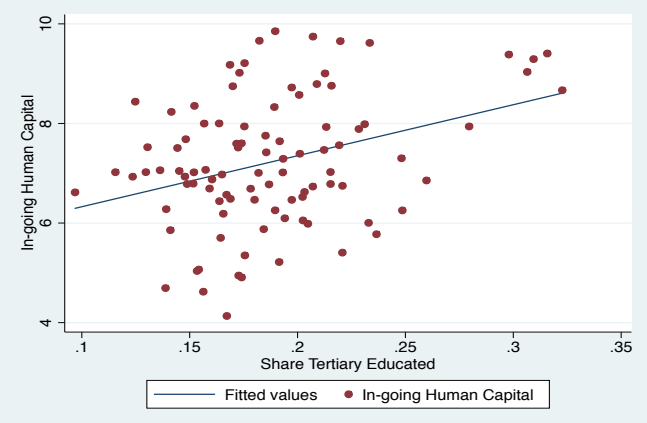
Table 2. In-migration and out-migration of human capital in 1999 and 2005

Macro-region	Region	Human capital 1999		Human capital 2005	
		In	Out	In	Out
Centre	Łódzkie	9.28	1.49	10.22	8.55
	Mazowieckie	8.01	1.61	9.76	6.33
South	Małopolskie	7.43	4.02	8.24	7.65
	Śląskie	6.76	6.97	6.96	5.01
East	Lubelskie	7.32	2.70	7.31	9.49
	Podkarpackie	7.03	6.13	6.26	7.14
	Podlaskie	6.97	6.69	7.13	6.95
	Świętokrzyskie	8.50	6.98	6.83	8.34
North-West	Lubuskie	5.37	7.47	6.51	4.67
	Wielkopolskie	9.30	4.20	9.37	7.10
	Zachodniopomorskie	7.43	7.33	8.11	5.28
South-West	Dolnośląskie	6.42	4.22	7.57	6.01
	Opolskie	5.17	5.85	5.61	4.59
North	Kujawsko-Pomorskie	6.18	4.62	7.33	5.41
	Pomorskie	7.22	4.57	7.79	6.65
	Warmińsko-Mazurskie	7.73	6.45	7.41	4.71

Source: own elaboration on Gus data

Another important question to answer is the direction of the in-migration of human capital. Figure 1 shows that skilled migration prefers to live where the share of tertiary educated individuals is high. This is in line with what Berry and Glaeser (2005) found for the American city. The authors, indeed, explain how high skilled workers tend to establish strong relationship with other highly educated people.

Figure 1. Relationship between the human capital in-migration and the share of tertiary educated



Source: own elaboration on Gus data

This result could have important economic implications. If the initial divergence, in terms of human capital, is widened by the tendency of a polarization process of the human capital, then the asymmetric increase of skilled individuals could slow down the convergence process among the regions of Poland. On the contrary, an increase of the human capital distribution in the lagged regions could lead to a convergence process among the Polish region.

2.2 Econometric issues

In this section, the relationship between international migration and economic growth is tested through an econometric model. The regression analysis focuses on the impact on the income per capita of different kinds of migration flows: high skilled, medium skilled and low skilled. We also include the initial level of income in the model, because it allows us to consider whether the difference in terms of economic growth between regions is decreasing more or less. In other words, we could verify if that among the Polish regions, a convergence process is occurring. Indeed, a value of the coefficient included in the range [0,1] indicates the presence of a convergence process (Barro and Sala-i-Martin 1992). Each specification also controls for the share of tertiary educated as a proxy of the human capital of each region (*share_tert*). This variable is in line with multiple studies, which stress the positive role of this factor on economic growth and in determining high level of growth.

Starting with the specification of interest that considers the impact of high skilled flows, the model is formulated as follows:

$$Y_{i,t}=\beta_1 Y_{i,t-1}+\beta_2 imm\_tert_{i,t-1}+\beta_3 emig\_tert_{i,t-1}+\beta_4 share\_tert_{i,t-1}+ \mu_i+\eta_t+\varepsilon_{i,t} \quad (2)$$

where: i = 1, 2, ...,16 is the region; *t =1999, 2001 ... 2005* is the time period covered by the data; $\varepsilon_{i,t}$ is the idiosyncratic error term; $Y_{i,t}$ represents the income per capita while $Y_{i,t-1}$ is initial level of income per capita.

The migration rate is measured through the number of migrants with different educational levels over the total population in the same year. The paper also estimates two other different specifications by substituting the high-skilled migration with the other two skill levels based on educational attainment (medium-skilled and low-skilled). Therefore, we estimated three different equations necessary to measure the relationship between migration and economic growth.

The model also includes all the time effects (η_t) and the regional time-invariant characteristics (μ_i). All the variables are expressed as logarithms and lagged one year. We must also consider that the economic growth is influenced by other variables, such as the level of human capital presents in each region measured through the share of tertiary educated.

In order to verify this relationship, the choice of a fixed effects or random effects estimator is discarded, despite its generalised use in panel data models, as the presence of the lagged levels of income per capita creates a distortion that could bias the estimation results. Moreover, although the static models (fixed-effects or random-effects) are able to control for the time-invariant, different regional characteristics, which represent the unobservable heterogeneity[16], they do not allow us to capture the endogeneity issue due to the presence of some potentially endogenous variables among the explanatory variables. In particular, the reverse causality between migration and economic growth could create a systematic distortion. As a result, the estimated coefficients through a static panel approach, such as fixed-effects or random-effects, are biased. Anderson and Hsiao (1982) proposed a solution to this simultaneity bias by transforming the equation in first differences and then by searching for instrumental variables (IV). However, when the lagged dependent variable is present among the regressors, in order to catch some convergence process, it is necessary to instrument both the lagged dependent variable and the other endogenous variables. Arellano and Bond (1991) proposed a generalization of the method suggested by Anderson and Hsiao. In this context, the first-differences of the endogenous explanatory variables are instrumented by a set

[16] In the random-effects model the time-invariant regional characteristics are treated as stochastic and as such, are uncorrelated with the other explanatory variables while in the fixed-effects model the unobserved heterogeneity is treated as deterministic.

of lagged levels of the same explanatory variables. In line with these considerations, some studies have adopted a dynamic panel approach through a difference-GMM (Niebuhr 2012; Vidyattama 2016).

The present paper aims to estimate a dynamic panel data and it intends to treat the immigration and emigration flows as well as the lagged dependent variable ($Y_{i,t-1}$) as potentially endogenous variables. For this reason, we try to handle these errors due to simultaneous causation and to the presence of the lagged dependent variable by implementing a difference-GMM of Arellano-Bond (1991).

The additional advantages related to the GMM estimator, among the dynamic panel data, are the flexibility, and the few assumptions regarding the process of data generating. The Arellano-Bond estimator implies that the model is taken in first difference and therefore, we are also able to remove the unobserved time-invariant regional characteristics[17]. Furthermore, the presence of lags of each endogenous variable represents a set of instruments that can be used to account for the endogeneity problem. If the error term is not serially correlated and some explanatory variables are predetermined or sequentially exogenous (like the lagged dependent variable), *i.e.* correlated with past realisations of the error term, but uncorrelated with present and future shocks, the moment conditions applied for the first difference equation is as follows:

$$E[W_{it-s}.(\Delta\varepsilon_{it})]=0 \text{ for } s \geq t;\ t=3,\ldots,T \quad (3)$$

where: W_{it-s} is the lagged dependent variable and all of the predetermined regressors in the model.

The validity of moment conditions is tested by implementing the Hansen J test of over-identifying restrictions and by testing if the error term is not second order serially correlated.

In order to verify the presence of integrated dependent variable and integrated regressors, we have also tested the stationarity of each variable included in the model. Table 3 shows the statistical significance of the two Panel unit root tests applied in this study: Levin-Lin-Chu-test (LLC) and the Im-Pesaran-Shin-test (IPS). Whereas the LLC does not consider the heterogeneity across regions, the IPS allows having a different autocorrelation coefficient for each region and for this reason it is more reliable. Once we have transformed all the original variables through the application of the logarithm, the panel unit root tests exhibit the stationarity of both the dependent variable and the regressors with a high significance level.

Table 3. Panel unit root tests

Variable	Levin-Lin-Chu unit-root test	Im-Pesaran-Shin unit-root test
Y_{it-1}	**	**
imm_tert	**	*
emig_tert	**	**
imm_second	**	**
emig_second	**	**
imm_prim	**	*
emig_prim	**	**
share_tert	**	**

Source: own elaboration on Gus data. ** significance at 1%, * significance at 5%.

2.3. Results

Table 4 shows the result of the model estimated with the difference-GMM estimator. In the first step we investigate the growth differentials and, in particular, by following the neo-classical traditional framework, in a dynamic panel setting, when the coefficient of the initial income level takes a value included in the range [0.1], there is evidence

[17] The first difference transformation in the difference-GMM implies that the fixed provincial characteristics are deterministic and potentially correlate with the other regressors.

of a convergence process among the Polish regions[18]. Indeed, column 1 shows the presence of convergence, a process under which the backward areas have shown better performance than the richer areas. In order to evaluate the impact of migration on the regional disparities it is necessary to measure the coefficient associated to the initial income level once we control for our variable of interest. When we introduce high-skilled migration, the estimated coefficient of convergence decreases ($\rho_1 = \beta_1 - 1$) from -0.511 to -0.466. This confirms that high-skilled migration is a force able to reduce the differentials in terms of economic growth. Moreover, this result is also confirmed when the medium and low-skilled migrations are introduced.

By focusing on the variable of interest, column 2 displays the role of high-skilled migration on economic growth. The greater the in-migration of tertiary educated people, the greater the growth dynamic is. On the contrary, if the higher-educated people are also those who leave the region, the effect on regional income per capita will be negative. Moreover, the slight difference between the coefficient associated with migration indicates an asymmetry between in-migration and out-migration that seems to confirm the idea of separating this flows (Østbye and Westerlund 2007). Nowadays, the consolidated migration literature suggests the necessity of analyses that controls for gross migration instead of net migration in order to observe the heterogeneity effects between in- and out-migration and thus to observe the effects of asymmetric in- and out-migrant's skills.

When medium-skilled migration takes the place of high-skilled migration, the effects are different, and in particular, both in-migration and the out-migration of individuals with a secondary education have a negative impact on economic growth. However, only the emigration is statistically significant at 1% and could be used to make inference. Finally, the low-skilled migrations do not seem to have a significant effect on economic growth. This corroborates the assumption of a heterogeneous effect of migration when the skill content is taken into consideration (Fratesi and Percoco 2014).

In regards to the control variable, a high share of tertiary educated individuals in the region is able to explain the positive performance in terms of economic growth. Indeed, the coefficient associated with human capital is always positive and statistically significant at 1% with a coefficient that ranges between the value of 0.82 and 1.28. This result also contributes to support the relevance of the human capital when analysing the impact of migration on economic growth.

The estimates are robust. Since the model is over-identified, we use the Hansen J-test in order to verify the validity of the instruments. Moreover, the test on serial autocorrelation is also performed. The former indicates that the null hypothesis cannot be rejected at the 10%, while the latter shows that although first-order autocorrelation is expected, the test of second-order autocorrelation presents an absence of a higher-order autocorrelation in the GMM model.

Definitively, the estimates suggest the importance of the skill-intensity of migration flows as a key factor able to promote the regional economic performance. However, if the results display a prevalence of the mechanisms generated by the high-skilled in-migration, which positively affect the economic growth, it is also true that these mechanisms do not explain a divergence process but on the contrary a decrease of the disparities. This most likely means that poor regions have primarily benefited from the high-skilled foreign in-flows. The estimates confirm the picture drawn through the above discussed descriptive analyses. Indeed, the existence of a slight process of convergence could be explained by the fact that during the period of analysis, the richer regions (centre) were characterized by an increase of the average years of schooling of out-migration with respect to the other regions.

It could be argued that these analyses do not seem to go along with previous studies focused on the relationship between internal migration and economic growth. Some studies (Di Berardino and Sarra 2013), for instance, despite the different time period of analysis, displayed that high-income regions are more attractive in terms of interregional migration flows and this appears to be an important element able to explain the positive economic performance of these regions, which contributes to increasing the economic disparities.

[18] In order to test the regional convergence, a general dynamic panel data model has the following structure: $logy_{i,T} - logy_{i,0} = a + \rho_1 logy_{i,0}$ with $\rho_1 = e^{-bT} - 1$ that can be analogously expressed in the following manner $logy_{i,t} = a + \beta_1 logy_{i,t-1}$ where $\beta_1 = e^{-bt}$. For this reason, if $0 < \beta_1 < 1$ there is evidence of a convergence process since the value of ρ_1 is negative ($\rho_1 = \beta_1 - 1$).

Therefore, within the framework of the effect of migration on economic disparities, it could be carefully argued that internal and international migration acts in different ways. However, the lack of updated international data and the difficulties that arise to comparing the levels of education among countries, prevents us from evaluating the net effects on economic growth. Nonetheless, the significance of this topic could encourage further empirical analysis in the future. In particular, an analysis could be performed on whether or not the entrance of Poland in the European Union has determined a structural change of the migration dynamics and on the regional disparities.

Table 4. International migration and economic growth

Dependent Variable	Gdp per capita (1)	Gdp per capita (2)	Gdp per capita (3)	Gdp per capita (4)
Y_{it-1}	0.4883323	0.5340678	0.5793209	0.5464261
	(0.0944342)***	(0.1022388)***	(0.1017844)***	(0.0954965)***
imm_tert		0.9636143		
		(0,3368077)***		
emig_tert		-0.9091564		
		(0.4358181)**		
imm_second			-0.0109463	
			(0.1832089)	
emig_second			-0.120923	
			(0.0417669)***	
imm_prim				-0.4979909
				(0.6568761)
emig_prim				0.0010844
				(0.026521)
share_tert	1.176236	1.287209	0.827172	1.234735
	(0.2215597)***	(0.2282946)***	(0.2404862)***	(0.2716216)***
Test-statistics				
Hansen test (p-value)	(0.849)	(0.850)	(0.366)	(0.523)
First-order serial correlation (p-value)	(0.003)	(0.042)	(0.023)	(0.068)
Second-order serial correlation (p-value)	(0.541)	(0.975)	(0.123)	(0.152)

Source: own elaboration on Gus and Eurostat data. *** significance at 1%, ** significance at 5%, * significance at 10%.

The estimation procedure is the GMM difference approach based on the two-step estimator. The estimation includes time fixed-effects, time dummies and control variables. The lagged dependent variable, the high-skilled, medium-skilled and low-skilled migration are treated as endogenous variables and instrumented with suitable lags. All the other variables are assumed to be exogenous. The authors instrument first difference of the lagged dependent variable with the second lag of its level in order to ensure sparse instrumentation. The dependent variable in the Arellano-Bond model is the income per capita. Standard errors clustered by region (NUTS2) are in parentheses. The Hansen test is run to verify the validity of over-identifying restrictions when the standard errors are robust to heteroskedasticity. We also report the p-values for first- and second-order autocorrelation in the first-differenced residuals.

Conclusions

The aim of the present paper is to analyse the consequences of the relationship between international mobility and economic growth in an emerging country like Poland during the period 1999-2005 and to extend the results to other national contexts through innovative features.

The study indicates the presence of a decreasing process in terms of economic disparities and finds that the characteristics of migration flows contribute to explaining this phenomenon. The results attest to how heterogeneous the effects of migration are when the skill content is considered. In particular, in line with other many studies, focused on the consequences of internal selective migration (Fratesi and Percoco 2014, for the Italian

regional context and Kubis and Schneider 2016, in Germany), the estimates highlight that regions mostly capable of attracting high-skilled individuals experienced a positive path of growth in terms of income per capita. This paper, indeed, shows how the other two kinds of flows with lower skill contents do not exert a significant effect on economic growth. Therefore, the analyses confirmed that the attractiveness of tertiary educated individuals represents a key factor able to create a regional competitive advantage.

If a consolidated literature has shown the existence of the link between interregional flows and economic growth, analogous consequences are also found when international mobility is taken into consideration. However, when attention is paid to the convergence process, the analyses suggest a different picture with respect to the literature. The final effects due to the mobility depend, indeed, on the regional composition of the migration flows. The higher human capital emigration in the centre regions has surely contributed to the convergence process. However, the peripheral areas, especially those located in the Eastern part, continue to register high human capital emigration rates that are, at times, higher than the in-migration. The situation could lead to a trend reversal with different consequences on the economic disparities. In other words, a divergence process could take the place of the previous slight convergence. These considerations are also interesting if we consider the entrance of Poland in the European Union. In this direction, future researches are necessary in order to verify if and to what extent this phenomenon represents a structural break and if it has had an effect on the evolution of both internal and international migration.

In summary, the present paper suggests paying attention to both on strategies able to attract human capital and policy oriented to promoting growth and to reducing the economic disparities. The policy maker should be focused on several actions able to sustain the ability of a territorial system to attract human capital in order to create virtuous mechanisms for the economic development. We strongly believe that the entrance of the Poland in European Union has reinforced the role of Polish regions in terms of attractiveness of migration flows.

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Innovative Entrepreneurship Financing in the Republic of Kazakhstan

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Abstract:

The topicality of the study is determined by the need to find optimal ways of innovative entrepreneurship financing as an important factor of economic growth of the country's economy. The article is aimed at developing conceptual, organizational and methodical bases of innovative development financing in the context of macroeconomic reforms in Kazakhstan, identifying the role of state development institutions and financial instruments applied in the implementation of the state program of industrial-innovative development. The research substantiates the specific proposals to improve the state policy in innovation financing, shows the role of financial and credit instruments in the economic and innovative development of the country as the fundamental factors affecting the dynamic development of innovation, studies the basic forms and methods of the country's innovative development stimulation, examines international experience and analyzes the level of innovative activity financing. The research findings are of practical value for improving the process of state regulation of the innovative entrepreneurship financing, the rational allocation of available public and private (commercial) resources; streamlining methods of providing state support for innovative entrepreneurship; raising the level of investment attractiveness of innovative entrepreneurship through the organization of effective interaction of this institute with innovative infrastructure facilities.

Keywords: entrepreneurship financing; innovations; budget financing; state institutions; credit instruments; investment projects

JEL Classification: O310; O320; O380; G320; G380

Introduction

Financing of innovative activity of entrepreneurship is allocation and use of funds for the design, Financing of innovative activity of entrepreneurship is allocation and use of funds for the design, development and organization of manufacture of new products, services, for the creation and introduction of new equipment, new technologies, development and introduction of new organizational forms and methods of management. Access to financing remains a major constraint to innovation.

The financial system of Kazakhstan is based, primarily on the banking segment, as the stock market is playing a minor role in the financing of companies so far. The banking system favors industries which are mostly based on incremental innovations. And the banks, as a rule, are not willing to bear the risks associated with the (radical) innovation projects and SMEs, particularly start-ups and service companies that are unable to provide collateral. At the same time, financing of radical innovation is closely connected with the development of equity instruments, and in particular those relating to funding at the initial stage of the company's work. Focus on equity financing is likely to increase in the medium and long term, as the economy develops and becomes more complex.

1. Research Background

The relevance of developing the methods, mechanisms and management tools for innovative activity financing at various levels of the economy management, in general, as well as government regulation and support of innovative entrepreneurship, in particular, is disclosed in a number of studies of foreign and domestic scientists and practitioners. The following Western scholars are occupied in investigating these issues: Fagerberg and Srholec (2013), Kurnyshev (2014), Barysheva (2012), Akmaeva (2012) and a number of others. Some analytical materials are presented in foreign ratings and reviews (European Innovation Scoreboard 2013, The Global Competitiveness Report 2013–2014, Emerging Global Trends in Advanced Manufacturing 2012, OECD Science, Technology and Industry Scoreboard 2012, OECD Factbook 2013). Certain aspects of the chosen topic are widely covered in the academic textbooks and periodicals. In Kazakhstan, the issues of development and implementation of innovation and science and technology policy are widely considered in the works by Nurlanova (2013), Kazybaev (2004) and in the previous studies by the authors as Teal *et al*. (2011), Toxanova and Paimkulova (2011), Toxanova and Baizakov (2012), Toxanova (2013, 2015), Abdymanapov and Toxanova (2016a, 2016b), as well as analytical reviews and reports as Smailov (2013), RK NCSTI and US NAS (2006), RK Committee on Statistics (2016), RK MRD (2014), ERI (2015).

Financial support for innovation is currently allocated between equity capital which produces a small number of actively supported projects and grants for R & D which distribute relatively small amounts between a large number of companies. Most of the supported projects and activities are investment projects with limited content of 'pure' innovation. This situation reflects the possibilities of successful applicants, rather than bias on the part of financial institutions that are strongly pointing to a deficit of genuine innovation projects in need of funding. Considering that Kazakhstan will continue to modernize the economy and gradually increase the content of innovation in this process (for example, some incremental product and process innovations), the number of firms taking an active part in innovation will increase in the medium term.

Kazakhstan is implementing initiatives for the development of the venture capital industry by investing in private funds (SPAIID 2010, SPIID, 2014). This is a valuable experience that will contribute to the creation of national competence in the field of venture capital investment and the implementation of some of the existing opportunities. Nevertheless, this is a slow organic process which, being complicated by the existing flow of transactions and volume of financing through the created specialized intermediaries, can provide only limited results. Already existing companies can be an additional source of funding and knowledge.

The analysis of the implemented innovation policy should be based on a regular assessment of all parameters, procedures and results. However, until now the support programs were evaluated incompletely. Without reliable information based on the analysis of the return on effort, it will be difficult for the politicians to develop effective and efficient policy tools. Moreover, it is important that the evaluation and monitoring mechanisms correctly reflect the characteristics of innovation processes. The existing evaluation procedures assume that each

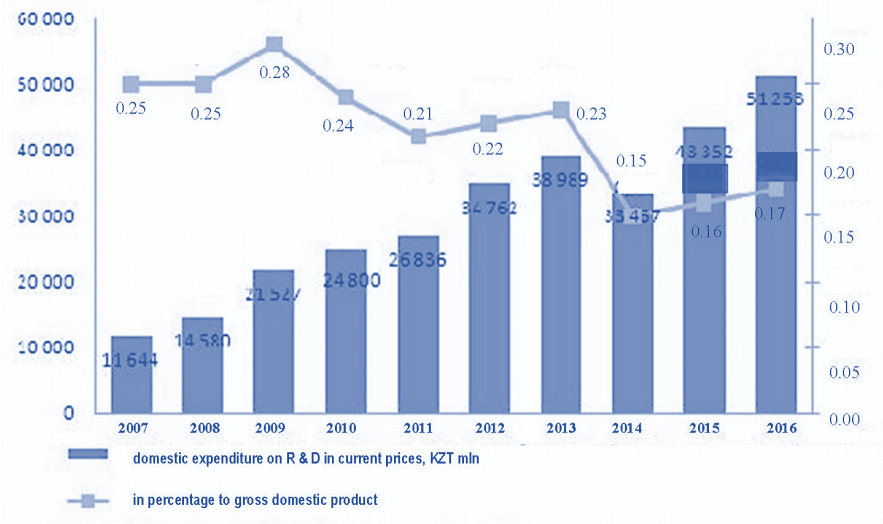
investment project should be successful, rather than the portfolio of supported projects, while often they neglect the indirect positive effects of innovative activities, which ultimately leads to the rejection of excessively risky projects. The integration of financial measures with other forms of support increases the positive effect of government intervention. In some cases, attempts were made to integrate a tool package into the comprehensive support programs, such as "Productivity 2020" or "Business Road Map 2020". Combined with the 'one window' approach, this approach is effective for preventing the system fragmentation and at the same time allows using individual packages for business support.

Innovations are increasingly prioritized in Kazakhstan, the country is seeking to develop scientific and technological capabilities and provide tight integration of science and entrepreneurship.

2. Analysis of the current situation in innovation process financing in Kazakhstan

Carrying out innovative research, developing own innovative products and processes by the entrepreneurial sector are one of the main conditions of innovative development. Currently innovative activities of Kazakhstan's enterprises do not exceed 6.4%. However, in recent years, gross domestic expenditure on R & D (research and development activities) did not grow as fast as GDP. They decreased in absolute terms in 2014 due to the financial crisis and reached the level of 0.16% in relation to the GDP, although the ratio was 0.22% during three previous years (Figure 1). In the developed countries, this figure is considerably higher: in the US expenditure on R & D accounts for 2.6% of GDP, making 2.4% in Germany, 3.0% in Japan and 3.7% in Sweden. The share of investment in R & D of the total volume of Kazakhstan's investments decreased from 0.47% in 2010 to 0.33% in 2012 but in 2013 it increased to 0.36% and has further positive growth trend.

Figure 1. Time history of domestic expenditure on research and development from 2007 to 2016



Generally, R&D developed at the expense of budget financing, which in recent years has increased its share in the total volume of R&D funding. In contrast, private expenditure on domestic R&D decreased in 2013-2014, both in absolute terms and as a % of GDP, though starting since 2014 the rise of this indicator has been observed. Despite the legal and institutional reforms, innovation indicators showed only limited progress. R&D intensity remains very low, while domestic expenditure on R&D made up to 0.23% of GDP in 2016. (Humanitarian Encyclopedia, 2016).

Such low level of expenditure does not allow upgrading research equipment, taking into account that in the past investments in this area were insufficient. This situation contradicts to the goal presented in the State program for the innovation development and technological upgrading promotion, which provides for an increase in government spending on science and innovations by 1% in 2015.

Low level of innovation activities and R&D expenditures in Kazakhstan follows from the structure of industrial production with its raw-material orientation and direct foreign investments. Despite the fact that in recent years the development of oil and gas industry has served the cause of the country's economic development, the demand of businesses for R&D has not increased, and the growth of production has not been observed. Major extractive enterprises often use imported technologies that national research institutes do not produce. Domestic expenditure on R&D accounted for 38% of total R&D expenditures in 2015.

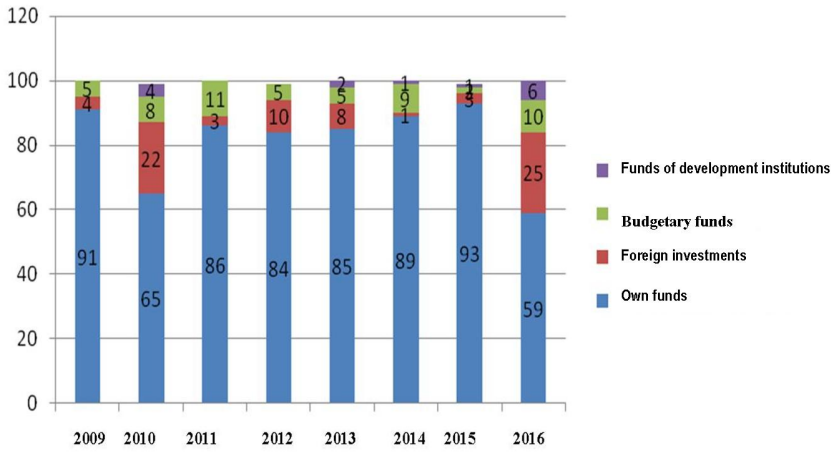
As a whole, until recently, the innovative activity of the enterprises developed at their own expense. Only in 2016, there was an increase of budgetary funds, funds of development institutions, and the share of foreign investment in the development of innovations. Current government initiatives are aimed both at the higher budget financing of R&D, and at the provision of financial and tax incentives to encourage private sector for R&D spending.

Recent reforms include new rules for subsoil user companies which will be obliged to allocate 1% of their revenues on R&D. All branches of the "Samruk-Kazyna" JSC will allocate 10% of their net income on innovative projects in accordance with the new section on innovation which is now part of their corporate strategy. In addition, the new Law on state support of industrial-innovative activity has increased opportunities for grant funding and expanded framework for the co-financing.

Program financing is an important instrument to promote strategic objectives of the state policy enshrined in national programs and other political documents. The provisions of the new Law "On Science" are intended to stimulate competition among the applicants for grants, which corresponds to the political goals and helps identify opportunities for the commercialization of research results. The Law "On state support of Industrial Innovation", adopted in early 2012, as well as the amendments to the law are also aimed to facilitate the financing of scientific and innovation projects (RK Law 534-IV 2012).

The main instruments of financial and fiscal policies used to promote business investment in R&D include measures, comprising direct transfer of funds from the public sector to the private and indirect fiscal measures, implying the refusal of the state from the taxable income of the private sector in exchange for a certain investment behavior. Figure 2 shows the expenditures for technological innovations of enterprises by source of funding. In addition, such measures as the involvement of venture capital and loan and equity guarantees can be used to extend access to foreign private sources of financing and encouraging the flow of investment funds for innovative projects in general, and for research and development, in particular.

Figure 2. Expenditures for technological innovations of enterprises by source of funding



According to Table 1, it can be noted that in comparison with the countries participating in the Customs Union, in Kazakhstan expenditures on R&D are incurred primarily only at the expense of budgetary funds, there are no private investments, while in Russia and Belarus clients' funds account for a larger R&D rate (29% and 16%, respectively). The amount of public funding totaled 81% of the R&D spending in 2015. A high proportion of public financing for R&D over a long period of time indicates such a drawback as underutilization of other sources of

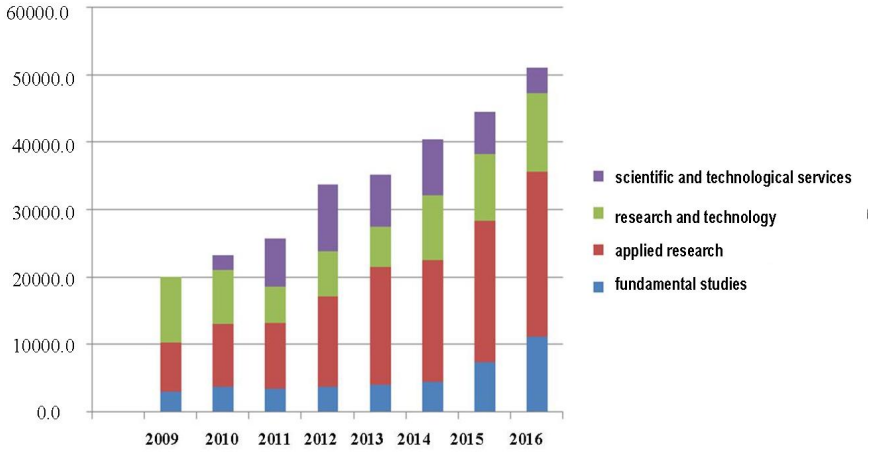
funding. To a large extent the scope of R&D in the trade and industrial sector of Kazakhstan is provided by direct state financing, which is explained by state-ownership for R&D institutes. Lack of demand for innovations also explains the low level of spending on investment goods.

Table 1. Distribution of expenditures on R&D by sources of funding, in percentage as broken down by member-countries of the Customs Union

Country	Budgetary sources	Extra-budgetary sources	Equity capital	Clients' funds	Foreign investment
Kazakhstan (2015)	81	1	17	-	1
Belarus	62	1	13	16	8.2
Russia	55	2	7	29	7

In recent years, state system of R&D focuses more on the applied research than on the fundamental studies (Figure 3). As in other transition countries, commercial pressure leads to changes in the structure of R&D. This is justified for a short period of time, but the balance between different types of scientific investigations requires ongoing analysis in order to prevent the neglect of fundamental studies. In Kazakhstan the share of development (engineering design, engineering works, modeling and full-scale production) is about half their number in Belarus and Russia. This low rate is one of the obstacles to the commercialization of research.

Figure 3. Domestic current costs of scientific and technical work by types of work



Expenditure pattern shows a relatively high level of spending on applied sciences, with much lower levels of funding for the final stage of development. For example, in 2015 about 45% of spending on science and technology focused on applied research in Kazakhstan, while in the developed countries these figures are at the level of 25-30%, with about 55-60% of all funds allocated to the latest stage of development and commercialization (OECD Factbook 2013).

Major part of the activities of research institutions accounted for engineering sciences and R&D costs amounted to 50.8% in 2015. For comparison, the share of total spending on research in the natural sciences accounted for 29.9%, making 9.4% in agricultural sciences, 4.4% in medical sciences, 2.5% in social sciences and 3.0% in humanities.

Separation of different types of studies deepened because of the distribution of authorities between various organizations. The Ministry of Education and Science, for example, is mainly responsible for conducting fundamental studies and the Ministry for Investments and Development occupied primarily in applied research. This strict separation can be smoothed by means of introducing new coordination mechanisms.

There are several government organizations involved in financing of R&D and other innovation projects in accordance with national priorities. Science Committee of the Ministry of Education and Science determines the

national priorities for the development of theoretical and applied sciences, for preparation of recommendations on the formation and improvement of scientific, technological and innovation policy of the state. RK MES finances both theoretical studies and applied research, and Science Foundation considers applications for financing of risky scientific applied research in accordance with the priorities established by the Science Committee.

The provided financing is open to private companies which can co-finance research projects and choose a scientific organization that will carry out research on the basis of public funding. Financing is provided on a competitive basis, and can be in the form of a grant and a loan.

The state program for science development (Science and Innovative activities 2015) has identified financing of technological development and co-operation with investors as the main tasks of the Science Foundation. Increase in the share of expenditure on applied research and development in the amount of total expenditures on R&D was intended to increase the commercial value of research by means of close ties with the private investors. The program also highlights the importance of cooperation with the institutions of financial development. There are opportunities for improvement in this area, but further progress is possible only with the help of new coordinating institutions which appear at the moment.

The beneficiaries of financing are mostly research institutes, payments to which account for 80%. Science Foundation also carries out market research, provides advisory service on legal, financial and economic aspects relating to its activities, organizes seminars, workshops and conferences on research and development projects touching upon the subject of financing and commercialization.

State institutions of financial development subsidize a limited number of research and innovation projects, which made only 1.3% of the total amount of expenditure on innovative projects in 2010 t the same time innovative grants to these institutions made 27% of the total amount in 2010 as compared with 2.7% in 2008. If we talk about the regional structure of the resource allocation of these institutions, the capital accounts for 66% of the resources, while the scientific potential in Astana is lower than in Almaty (52% of research fellows of Kazakhstan work in Almaty and 7.2% in Astana) (ECE/CECI/14. 2012).

The law “On Science” introduced important changes in research financing. Financing is now allocated in three areas: grants, basic financing and program funding. Grants are provided in accordance with international practice. The main innovation in this system is that the grants will be conferred not only to research organizations and universities, but also to independent scientists and their teams. The National Center for State scientific and technical expertise was established which will submit its results to the National Research Council. The new monitoring system will make the scheme for consideration of scientific projects and programs much easier. Scientific issues are no longer covered by the Law on Public Procurement (RK Law 534-IV 2012).

Basic financing serves to provide public research organizations and universities with major cash resources for infrastructure, engineering facilities, administrative costs, staff costs and other elements necessary for functioning of the organization. Program financing is intended to promote strategic objectives of state policy stipulated by national programs and other political documents.

Fiscal measures require relatively low administrative costs compared to direct financial incentives. The private sector can thus select the most productive way to invest, and the risk of national bankruptcy is reduced. As a rule, fiscal measures are simple and accessible. There are actually more ways to support the innovation process than just R & D. Firms can acquire new products and technologies that do not require or require very little further refinement from external sources. Changes can be introduced in the purchased goods and technologies, and in the technologies developed by the firm itself. Such actions are the most powerful driving force of the innovation process.

3. The role of state development institutions and financial instruments used in the implementation of state program for industrial-innovative development of Kazakhstan

Currently, the state of Kazakhstan’s innovation sphere is such that even under the most favorable macroeconomic conditions without the concerted efforts of the state it will be impossible to achieve breakthrough in the technological and structural adjustment. The innovation process cannot be the subject of activity of only individual economic entities – it is largely of a macroeconomic character and, therefore, the state’s participation in the investment

process is not only possible, but necessary. Development institutions that exist primarily as specialized financial institutions are one of the mechanisms for the implementation of these functions; they have become catalysts for rapid socio-economic development of many countries.

Development institutions are specialized governmental or quasi-governmental organizations established to promote economic growth and socio-economic development. Their activities are aimed at eliminating or mitigating the 'market failures' – situations when the market mechanisms are unable to provide the most effective solution to the economic and social problems (Melnikov 2016).

The following can be considered as criteria used to refer an organization to the development institutions:

- the availability of strategic goals (a mission), entrenched in the legislative or statutory instruments;
- focus on the development of the economy as a whole, or certain industries, sectors, regions;
- the availability of a specific regulatory framework and regulatory requirements;
- the use of public-private partnership in the activity.

The general theory of state development institutions has not yet been built. In different countries, there is considerable diversity of development institutions and methods of their operation. Division to financial and non-financial development institutions is their most common classification.

State financial development institutions include organizations that provide business entities with directly or indirectly financing in various forms (loans, borrowings, guarantees, leasing, acquisition of securities, participation in equity) for the implementation of investment projects in the priority areas (NATD 2016).

Experience shows that certain investment projects or areas of activity may be insufficiently attractive for the private sector because of an unfavorable risk-reward ratio, including by virtue of excessive risk assessment of these projects due to lack of information. However, such projects can be successfully implemented in condition of applying principles of public-private partnership. To this end, the state must, on the one hand, assume part of the risks, and on the other hand, give a certain 'sign' to private businesses by its participation in financing of such projects and thereby increase their credibility. Therefore, financial development institutions occupy a specific niche in the economy between the actual commercial sector and direct budget financing. They should not be limited by irrevocable subsidizing of socially important, but obviously unprofitable industries and projects. At the same time, they should not replace private business and engage in such activities which it can successfully carry out on its own. In performing their functions financial institutions must act as a catalyst for private investment in priority sectors and industries, as well as facilitate the creation and innovation, and improve the institutional environment.

Non-financial development institutions provide economic entities with neither direct nor indirect financing: their task is to form infrastructure for entrepreneurial activities in the broadest sense, including the provision of specialized information, advisory and intermediary services in the areas where such services are absent or poorly developed.

The strategic task of transition to a balanced economic structure that ensures sustainable economic growth can be solved only through active structural adjustment of the industry and by giving a new quality to industrial-innovative development.

State Program for Accelerated Industrial and Innovative Development of Kazakhstan for 2010-2014 became a mechanism for implementation of the state policy of transition to a balanced economic structure, ensuring steady economic growth; this program is aimed at the priority development of the processing sector, gradually overcoming one-sided raw material orientation on this basis (SPAIID 2010). Currently, phase 2 of the program for 2015-2019 is being implemented (SPIID 2014).

A number of institutions operate in Kazakhstan that are involved in financing and managing of the modernization process, which includes investment financing, involvement in infrastructure projects and resources for innovation. The most important institutions in this area are:

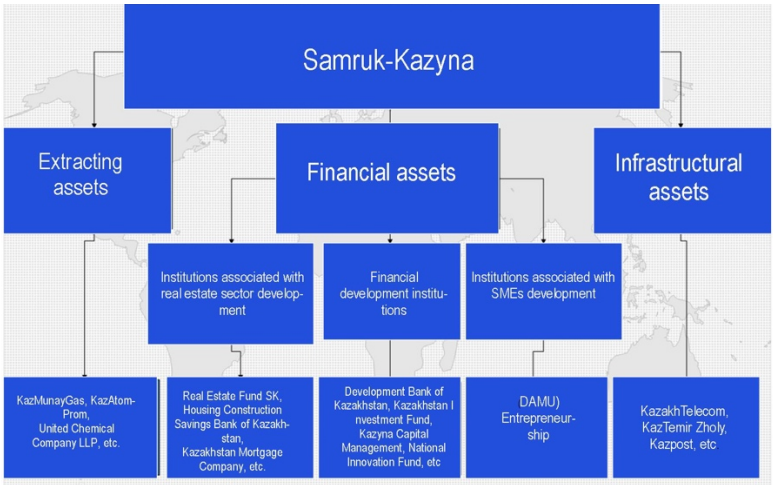
- the Development Bank of Kazakhstan JSC (DBK) which provides financial support to the private sector and government organizations through the provision of medium- and long-term loans at low interest rates. The bank focuses on infrastructure projects and crediting industrial enterprises, and is the property of "Samruk-Kazyna". DBK was founded in 2001;

- entrepreneurship Development Fund (DAMU) JSC which was established in 1997 to ensure financial and non-financial support to small and medium-sized enterprises, and stimulate demand for products and services of these businesses. DAMU operates at the regional and national levels. "Baiterek" National Managing Holding JSC is the only shareholder of "DAMU" Entrepreneurship Development Fund". Precisely DAMU Fund is the operator of the "Business Road Map – 2020" Program. Thus, only in the city of Astana among the measures to stimulate the development of innovative entrepreneurship 480 projects for a total amount of KZT 84,507 million have been approved since the launch of the "Business Road Map 2020". Sector-wise, processing industry projects make up 27.5%, those in service industry total to 72.8%, in particular, transport sphere – 35.7%, hotel business – 10.7%, education – 7.7%, health care – 9% and other sectors – 9.7% (RK Committee on Statistics 2016);
- national Innovation Fund is takes an active part in the promotion of innovations through investment in the equity, capitalization of domestic and foreign venture capital funds, grants for R & D, support for industrial parks and stimulation of the innovation culture development. The Fund was established in 2003 under the Ministry of Industry and New Technologies. In 2012 the Fund was reorganized into "National Agency for Technological Development" (NATD) JSC;
- science Foundation was established in 2006. It actively operates in the field of ICT and space technologies, nanotechnologies and new materials, biotechnology, renewable energy and nuclear technology. The Foundation provides loans to scientists who plan to set up a company or to commercialize the results of their research during the next 3-5 years. Financing ranges from USD 50 thous. Up to USD 2 mln.

This institutional structure, with the exception of DAMU, was created in the last decade. Financial instruments used for the modernization of the economic structure and innovation support focus on equity, soft loans and grants. In addition, "Development Bank of Kazakhstan-Leasing", a DBK subsidiary, provides leasing for investment projects. All institutions are currently considering new opportunities of replenishing their portfolios of instruments.

In accordance with the Decree of the Head of State dated October 13, 2008 No. 669 "Sovereign Wealth Fund Samruk-Kazyna" JSC was established by the merger of JSC "Sustainable Development Fund Kazyna" JSC and "Kazakh Holding for Management of State Assets "Samruk", which allowed concentrating state-owned assets of the country in the Fund and adjust a rapid and transparent mechanism for providing financial assistance to the economy.

Figure 4. Asset structure of the National Welfare Fund "Samruk-Kazyna" JSC



The "Samruk-Kazyna" Fund is entrusted with the task to consolidate and manage effectively the key assets of the country. Figure 4 shows the Fund's asset structure. To perform the mission entrusted the activities of "Samruk-Kazyna" JSC are focused on the implementation of the three main strategic lines: promoting diversification

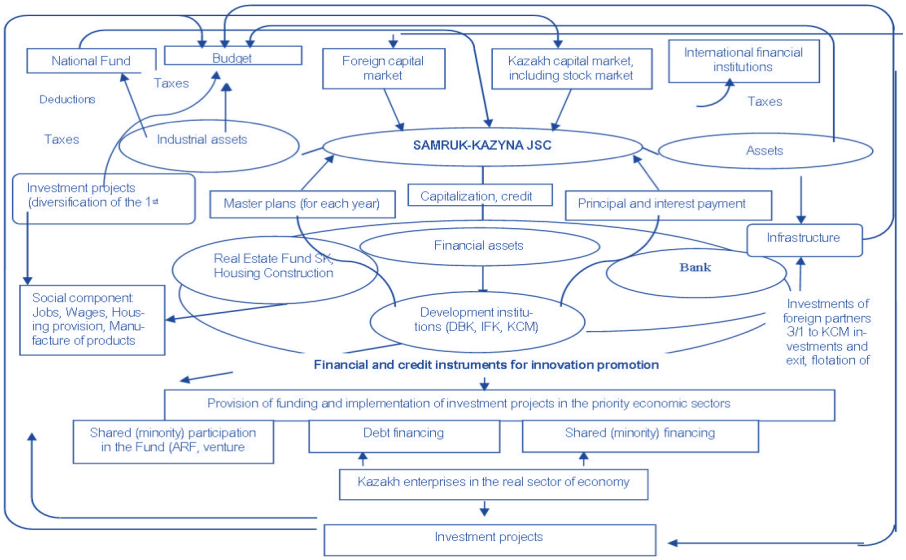
and modernization of the national economy; improving the efficiency of "Samruk-Kazyna" JSC and subsidiary companies; acting as the operator of state programs for stabilization of the banking and financial sector (fulfilling functions in this area is temporary, related to the need to address the crisis manifestations in the economy). Within the task of promoting the economy modernization and diversification "Samruk-Kazyna" JSC shall carry out:

- financing and assisting in the implementation of projects providing an increase in value added in industry;
- financing and assisting in the implementation of projects providing the infrastructure development;
- creating new non-resource enterprises;
- assisting in development of small and medium-sized businesses.

The assigned mission of JSC "Samruk-Kazyna" JSC is carried out by industrial, infrastructural and financial companies, whose activities are aimed at the maintenance and development of the mining sector of Kazakhstan's economy and at the transition of extractive enterprises to a higher redistribution by stimulating development of refining and associated processing sector. This task is performed by using capacities of Kazakhstan's large industries with large actual volumes of consumption and output through investments in related industries, *i.e.* processing of products of the industry to manufacture higher value added products.

Figure 5 shows a financing mechanism for funds attraction and use of financial instruments to carry out economic diversification of "Sovereign Wealth Fund Samruk-Kazyna" JSC. Infrastructure group of companies is aimed at creating a high-performance infrastructure enabling to ensure the dynamic growth and development of industries and technologies in Kazakhstan. The Financial Group promotes increased sustainability, diversification and modernization of the economy through the provision of financing and implementation of investment projects in priority sectors of the economy, including projects in the sector of small and medium-sized businesses, if the volume or conditions of financing on part of private investors do not allow implementing these projects, as well as support for the implementation of housing programs. In the crisis period, the main effort of the "Samruk-Kazyna" Fund were focused on the implementation of the stabilization program, including support for small and medium enterprises, the financial sector, mortgage loan refinancing, the real estate market stabilization, and financing of investment and infrastructure projects.

Figure 5. Mechanism for funds attraction and use of financial and credit instruments to promote innovative development of the economy



Note: compiled on the basis of OECD Factbook 2013: 25.

The Development Bank provides long-term crediting with a minimum rate of at least USD 5 million, "DBK-Leasing" JSC finances leasing transactions for projects with a minimum amount of USD 1 million, Kazakhstan

Investment Fund JSC provides financial support at the rate of USD 30 million to the private sector initiatives in non-resource sector of the economy by shared and minority participation in the authorized capital of enterprises. "National Agency for Technological Development" (NATD) JSC is responsible for creating the innovative infrastructure, innovation introduction and development of venture capital funds, it also provides direct financing through the participation in the authorized capital of the created and existing enterprises to produce high-tech and science-intensive products. The main objective of the development institutions is not to assume all the risk, but to share it with a particular investor. Table 2 presents the financial and credit instruments of the development institutions.

Table 2. Financial and credit instruments of the development institutions

Financial instruments for investment	Development institutions						
	DBK	DBK-leasing	KIF	KCM	NATD	DAMU	ECIC
Crediting:							
- long-term investment projects (10-20 years)	+						
- medium-term investment projects (5-10 years)	+						
- short-term for SME entities						+	
- conditional (placement) in the second-tier bank						+	
- for export transactions	+						
- for current operations	+						
- inter-bank	+						
Guaranteeing:	+				+	+	
Shared (minority) participation							
- in the companies' capital	+		+	+	+	+	
- in the fund				+	+		
Refinancing:	+						
Mezannine financing	+						
Interest rate subsidizing	+					+	
Financial leasing (3-20 years)		+				+	
Project financing	+					+	
Agent servicing	+						
Export credit insurance							+
Investment insurance abroad, in the RK							+
Trade financing							+
Agent servicing of projects	+						
Grants					+		

Note: compiled on the basis of the development institutions, where: DBK – Development Bank of Kazakhstan, KIF – Kazakhstan Investment Fund, ECIC – Export Credit Insurance Corporation, KCM - Kazyna Capital Management, NATD JSC - "National Agency for Technological Development" (NATD) JSC, DAMU – Entrepreneurship Development Fund JSC

Development Bank of Kazakhstan JSC was established the first of the development institutions. In many countries, development banks contribute to the promotion of public investment in the real economy. As evidenced by the experience of foreign countries, the implementation of ambitious targets of economy modernization and increase the pace of its growth requires creating appropriate infrastructure in the formation of which the most important role is assigned to the state development banks. Thus, there is a Bank for Reconstruction and Development (KFW) in Germany, National Financial Corporation (NAFIN) in Mexico, State Development Bank (CDB) in China, the National Bank for Economic and Social Development (BNDES) in Brazil, Production Development Corporation (CORFO) in Chile, Financial Development Corporation (COFIDE) in Peru, Institute of Industrial Development in Colombia, Bank for Development and Foreign Economic Affairs in Russia. Such banks are available almost in all countries.

The development banks support and finance of capital-intensive infrastructure projects with a long payback period, contribute to the creation of large import-substituting enterprises, provide a qualitative breakthrough in the area of business investment. The most important conditions for achieving these goals are the availability of sufficient capital, solid state guarantees, the clear arrangement of investment and strict control over the targeted use of funds.

The international experience of the developed countries indicates that state-owned development banks should not be created by increasing the capital of a commercial bank, because due to commercial bank status it will not be able to fully perform the functions of a development bank. Development banks should not compete with commercial banks whose task is providing short-term loans, for which purpose they use funds owned by their clients, yet they are responsible for this and bear the risks. Therefore, in all countries with market economies state support mechanisms are formed for long-term crediting to the economy through the development banks.

Currently, Development Bank of Kazakhstan carries out the execution of the assigned mission by satisfying investment needs of accelerated development on a commercial basis that are not provided by second-tier banks in the competitive non-resource sector of the country's economy for lending resources to finance projects in the processing industry, production and transport infrastructure that are worth more than USD 5 million and have long payback periods, and also the Bank promotes the export of products manufactured by Kazakhstani producers (Nurlanova 2013).

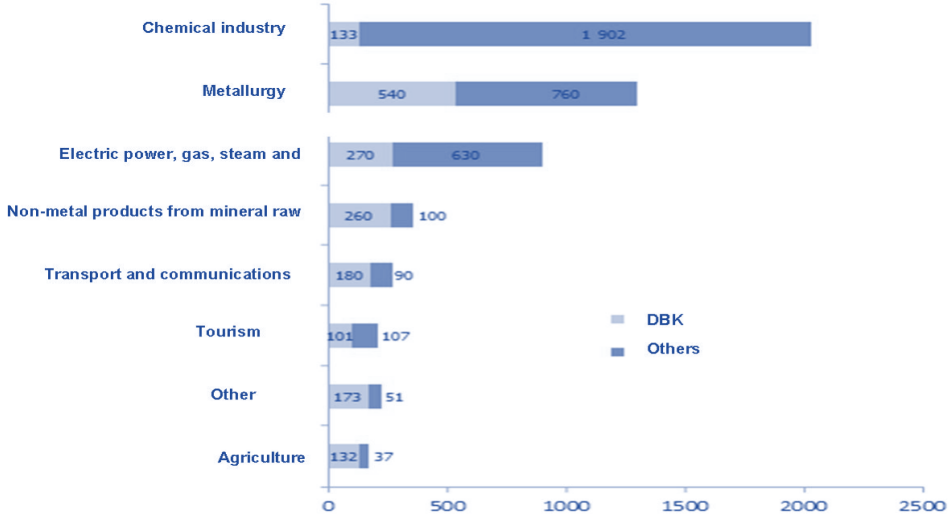
Development Bank, being a development institution, on the one hand, solves the problems of the state investment policy determined by the Government of the Republic of Kazakhstan, and a shareholder in the face of "Samruk-Kazyna" State Holding. At the same time, being a financial undertaking, the Development Bank carries out all the requirements necessary for banks and operates on commercial principles.

Memorandum of credit policy determines that a credit instrument is a way to finance investment projects implemented by the Bank and export transactions through:

- granting loans and credits in cash on conditions of serviceability, maturity, and refundability;
- leasing;
- interim financing in order to ensure the preparation and implementation of investment projects;
- mezzanine financing, providing a subordinated loan with the right to convert into shares or a stake in the borrower's equity;
- financing of the borrowers' current activities within implementation of investment projects financed by the Bank;
- project financing – financing of the investment project, where cash flows and proceeds from the investment project implementation are the main source of loan redemption;
- interbank lending – financing of the second-tier banks and non-resident banks of the Republic of Kazakhstan.

Since the beginning of the Bank operation 1,711 investment projects and export transactions to the amount of USD 10 billion with the Bank's participation at the rate of USD 4.9 billion have been approved and at various stages of implementation. In total drawdown of funds under the investment projects and export transactions has amounted to USD 3.86 billion since the beginning of DBK operation, including USD 239.4 million in 2015 (see Figure 6).

Figure 6. DBK participation in the investment projects

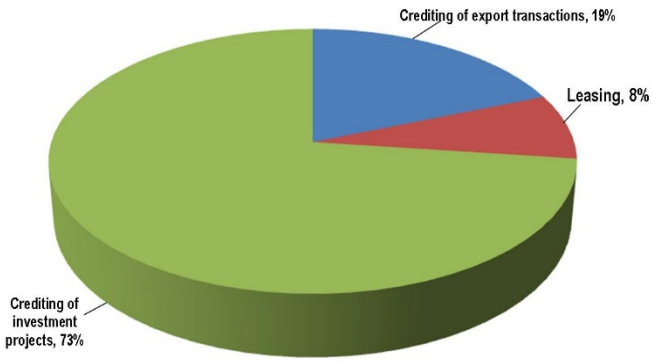


The priority line of the DBK activities is financing of large industrial and infrastructure projects of innovative character, especially in such sectors as power generation, transport, communication and tourism infrastructure, metallurgy, chemistry, and petrochemistry.

In the long-term investment lending to a number of processing industries the DBK share reaches 75-80%: in the textile and clothing industry – 91.3%, chemical industry – 84.5%, in the pulp and paper industry – 76.9%, in manufacture of construction materials – 71.7%, in manufacture of machinery and equipment – 70.6%, in generation of electric power, gas and water – 70.1%, in manufacture of leather and leather products – 68.2%.

As of January 1, 2014 the loan portfolio of the Bank amounted to USD 2.7 billion, and with regard to the investment in development projects of national companies it made USD 3.9 billion. The share of loans for implementation of investment projects (81%) prevails in the loan portfolio structure, of which 8% account for leasing operations, which is indicative of the Bank's investment activities. Financing of export transactions amounted to 19% of the loan portfolio. Shares of financial instruments are shown in Figure 7.

Figure 7. Shares of financial and credit instruments by types in the DBK loan portfolio structure over 2014



The direct impact on the economy of Kazakhstan due to implementation of the investment projects with participation of "Development Bank of Kazakhstan" JSC is expressed in the figures given below.

Production effect. In 2014 with the participation of the Bank's investments investment projects that are included in the Republican map of industrialization and worth a total of USD 175 million were put into operation, the Bank participation making USD 99 million. About 400 permanent jobs were created at the launched enterprises. Table 3 gives some strategic investment projects of the DBK.

Table 3. Strategic investment projects of the DBK

Company	Project
Kaustic JSC	The production of chlorine and caustic soda in the Pavlodar Region
Aktau International Sea Trading Port	Expansion of the Northern section of Aktau International Sea Trading Port in the Mangystau Region
Shymbulak Ski Resort	Comprehensive development of the ski resort in the Almaty Region
Akshabulak GTPP	Construction of gas turbine power plant Akshabulak oil-and-gas field in the Kyzylorda Region
Kazakhstan Electrolysis Plant	Construction of the 2nd phase of the Electrolysis Plant
KEGOC	Construction of the power transmission line

In addition, as part of the ongoing work to support the commercial banks under the anti-crisis program of the Government of Kazakhstan the Development Bank refinanced 19 projects of the second-tier banks (Alliance, ATF, CenterCredit Bank, BTA, Eurasian Bank, Kazkommertsbank, Halyk Savings Bank of Kazakhstan, Eximbank), totaling USD 345 million. Implementation of the anti-crisis program measures by the Development Bank enabled to save jobs, maintain the liquidity of the manufacturing and financial sectors, as well as eliminate the possibility to shut down enterprises - the Bank's borrowers. During the reporting period the enterprises exported products and rendered services to non-residents to the total amount of KZT 10.2 bln (USD 68.9 million).

Budget revenues: By means of putting into operation of new production facilities additional payments to the budget are provided. Tax and other deductions to the budget of these enterprises amounted to KZT 5.3345 billion in 2015.

Social effect: As of 1 January 2015 about 5.5 thousand new jobs were created at the facilities that were commissioned by the Development Bank's funding, totaling more than 15.7 thousand new employment opportunities (IPSTDC 2010).

The highest rates of the average monthly wages of the main staff were observed at the enterprises engaged in the maritime transport sector ("Tengiz Transport Company" LLP, "Kazmortransflot" National Maritime Shipping Company JSC and "Aktau International Sea Commercial Port" Republican State Enterprise). At the enterprises-borrowers of the Development Bank the average capacity utilization, considering attainment of projected capacity, ranges from 15% to 100%, that is, there is a potential for further growth.

Implementation of the projects financed with the participation of the Development Bank to create new competitive production facilities not only increases the industrial potential of the regions and the export potential of the country, but also directly contributes to the strengthening of the country's infrastructure provision, access to new foreign markets, the establishment of cluster manufacturing plants and development of the stock market in the country.

Stock market entry: 8 borrowers issued securities in the amount of approximately USD 440 million (at the end of 2015).

1) To calculate the cost-effectiveness of the implementation of the Development Bank's projects the following formula was used:

$$N = П - Z, \quad (1)$$

where: П – total revenues from sales of goods and services obtained from the implemented projects making USD 47.7 bln; Z - total expenses from the implemented projects making USD 39.4 bln.

Thus, the net economic effect of the implementation of projects financed by the Development Bank of Kazakhstan JSC is USD 8.3 bln (47.7- 39.4)

2) The effect Nx from the funds invested by the Development Bank is calculated by the following formula:

$$Nx = N/D, \quad (2)$$

where: (D) – participation share of the Development Bank of Kazakhstan JSC in the implemented projects as of 1.01.2015 making USD 2.4 bln.

Thus, 8.3 bln/2.4 bln = 3.5 dollars, i.e. every dollar provided by the Development Bank of Kazakhstan JSC to finance investment projects brings USD 3.5 of net income to the economy.

3) Multiplication of the DBK investment in the projects is calculated by the following formula:

$$F/D \quad (3)$$

where: F – total amount of the approved projects of Development Bank of Kazakhstan JSC making USD 5.9 bln.

Thus, 5.9/2.4 = 2.5 dollars. Accordingly, every dollar allocated by the Development Bank of Kazakhstan JSC to finance investment projects creates a total investment of USD 2.5.

In addition to the direct impact factors of the projects (volumes of production and exports, creation of new jobs, payments to the budget), their indirect impact factors are considered with regard to the industrial and investment activities in the economy, such as the development of related industries, emergence of new products, attraction of additional private investment, increase in the quality level of industry development, and so on.

4. Recommendations for improvement of the state policy in field of innovative activity financing in Republic of Kazakhstan

The conducted analysis of the innovative activity financing revealed the following problems:

1) the state policy in the field of innovative business financing is fragmented and insufficient to create the broad mass of innovative companies, and also there are the systemic problems in financing of science and research activities, the lack of clear guidelines for scientific studies and applied research, the lack of specific support mechanisms in numerous programs for the development of innovation activities which are often declarative in nature;
2) the lack of an adequate system of financing innovative projects at all stages of the project, especially at the initial stage, including: lack of basic mechanisms of investment in venture projects that are ready to assume the high risks of start-up projects, business sale and purchase market, developed stock market, etc.;
3) insufficient service support for innovative entrepreneurship in obtaining financial resources, including a high level of bureaucratism when obtaining grants and loans;
4) insufficiently effective financing mechanisms to enter the international market of Kazakhstani high-tech goods (services): no provision is made for benefits while exporting manufactured high-tech products from the Republic of Kazakhstan; high administrative barriers in foreign economic activities of innovative companies; a considerable document flow and long-terms for the declaration and release of goods;
5) insufficient financing of researchers' activities resulting in a 'staff scarcity' in research and innovation spheres, including: low salaries of scientists, which leads to lack of staff supply in the area of innovations; 'brain drain' in the countries that provide more opportunities.

Based on the international experience, it is necessary to elaborate a highly effective scientific and innovative system that allows uniting all participants in this process through a ramified network of horizontal links: the scientific potential of universities and research institutions, innovative entrepreneurship at the enterprises and in organizations, innovation and financial infrastructure. It is possible to solve the set out problems successfully only given the effective functioning of the entire national innovation system (NIS) and, above all, its financing system.

In the international practice, a wide range of mechanisms for financing innovation has been developed, including:

- direct and indirect (through government agencies) allocation of budgetary funds to research organizations and universities in the form of budgeted financing of operating expenses as well as provision of grants and placement of state orders for the execution of research and development;
- provision of enterprises engaged in research and development with various tax incentives;
- investment of budgetary funds in the capital of venture funds and other specialized financial institutions involved in the implementation of innovative projects;

- allocation of preferential government loans and loan guarantees (insurance) to the subjects of innovation activities;
- implementation of targeted public procurement of innovative products and services;
- financing the creation of business incubators, technological parks and other facilities of innovation infrastructure.

One of the priority tasks of innovation policy is to promote the development of venture funds that provide small and medium innovative enterprises with capital at the stage of their formation. Currently, support for the venture sector is mainly carried out through the mechanism of public-private partnership, stipulating joint participation of government and business in the creation and financing of venture capital funds.

Provision of loans and credit guarantees are the traditional tools of the state support for small and medium-sized innovative companies that are widely used in many countries around the world.

State loans and guarantees to the innovative companies are usually small in size (on average amounting to USD 100-500 thousand); they cover 50-75% of the cost of projects undertaken by them. They are allocated on preferential terms.

Recently in many foreign countries public grant financing is increasingly used as a tool to support small innovative companies at the earliest stages ('pre-sowing' and 'sowing') of their development. The grants perform an important economic function, contributing to the successful commercialization and increasing the pay-off from the expenses incurred by the community to receive them. The US program to support small business innovation research is an example of a successful initiative to promote innovation and R & D. It served as a model for similar programs in countries such as Australia, the United Kingdom and the Kingdom of the Netherlands. The program supports small innovative companies in three areas: R & D feasibility, the total volume of R & D activities and industrial introduction. The program funds are intended to support the first steps in the scheme of funds receiving. Grants depend on the wishes of the state customer; the program details are published on the Internet.

A number of measures have been developed in the international practice to help improve the efficiency of the grant support to innovations, and among them:

- involving leading national research organizations to the examination of applications for grants;
- gradual clarifying the prospects for funded projects in accordance with the implementation of research and development, providing grants;
- partial (up to 70-80%) financing of project budget given the remainder of costs is covered by the grantee's funds to promote improving its interest in the final result.

In general, as the international experience shows, forms and tools of state support for research and development in the leading countries of the world are constantly updated and optimized. At the same time an increasing number of countries give priority to the formation of financial mechanisms enabling to facilitate the commercialization of the obtained scientific knowledge. The number of grant-making programs for carrying out the initial project research and development is increased; the practice of creating targeted public-private venture capital funds investing in startup-companies is expanded.

Based on the conducted analysis and study of foreign experience in financing the following can be offered as recommendations for improvement of the state policy in the field of innovative activity financing in the Republic of Kazakhstan:

a) to implement priority research financing through the system of government contracts and grants, and create markets of scientific and technical products;
b) stimulate the activities of banks in providing investment loans, as well as the activities of the funds (insurance companies, leasing companies, consulting and information organizations, *etc*.) which support innovative enterprises;
c) stimulate the activities of enterprises of all forms of property to continually carry out technical re-equipment through the introduction of new and high technologies, by means of tax incentives;
d) reduce the taxable income (profit) by the value that was used for technical re-equipment, reconstruction and construction of regional facilities of industrial and social infrastructure;

e) stipulate an income tax (profit) exemption within 12 months from the date of registration for newly established enterprises engaged in priority innovative development of the region; in case of the company closing earlier than in 24 months to make the payment of taxes in full;
f) use the potential of local authorities, by encouraging the region's priority activities through the initiation of reduction or exemption from the payment of earmarked levies for these enterprises; through the complete land tax and real estate tax exemption (or by reducing tax rate) for small innovative enterprises.

Conclusion

Summarizing, it can be stated that in the course the research, the following tasks have been solved:

1) the role of financial and credit instruments in the economic and innovative development of the country is shown as the fundamental factors influencing the dynamic development of innovations;
2) the main forms and methods of stimulating the country's innovative development have been studied. Stimulation of innovation concerns all business entities. The low level of interest rates in the country positively influences the development of innovative processes, and a high level of inflation reduces this indicator. The level of competition in the market exerts an ambiguous impact on the innovation activities. The product patent system stimulates innovation, acting as a mechanism for reducing risks. Preferential taxation is an incentive for the search for innovations and their commercialization. The creation of technological parks where incentives are provided for participants in the innovation process also contributes to the development of innovative activities;
3) the foreign experience has been studied, which shows that the formation of the competitiveness of the national economy is based on the development of the innovation sphere, while financial and credit instruments play a key role as levers of influence. In recent years, to correct market and systemic 'failures' in the areas where acute social needs exist, OECD countries and emerging economies have used targeted tools to stimulate the demand for innovations. These tools include public procurement, regulation, standards, consumer policy, consumer innovation initiatives, and the leading market initiatives;
4) the analysis of economic and innovative development of the Republic of Kazakhstan has been carried out. In Kazakhstan an increasingly important emphasis is put on innovations, the country strives to develop scientific and technological capabilities and to implement close integration of science and business. Nevertheless, in recent years, gross domestic expenditure on R & D has not grown as fast as GDP. Innovative activity in the country does not have a stable growth trend yet, which is connected with post-crisis phenomena in Kazakhstan's economy;
5) the progress of implementation of state programs for the innovative development promotion has been considered. Activation of innovation activities gains key importance for the sustainable economic growth of the country. At the same time, without a purposeful participation of the state, it is impossible to achieve a breakthrough in technological and structural reorganization. The state needs to fulfill its strategic and coordinating functions in economic processes. The Government of Kazakhstan has extensive programs aimed at diversifying the economy, including programs to stimulate innovation activities: Strategy 2020, the State Program for Accelerated Industrial and Innovative Development of Kazakhstan for 2010-2014 (Stage 1); State Program for Innovative and Industrial Development of the Republic of Kazakhstan for 2015-2019 (Stage 2), Program for Innovation Development and Assistance to Technological Modernization, R & D Strategy and Programs, Comprehensive Business Support Programs such as the "Business Road Map 2020" and "Productivity 2020" programs. The focus of these programs is on creating a favorable business environment and encouraging the private sector; introduction of incentives for the creation of knowledge-intensive, high technology export-oriented enterprises, introduction of new means and tasks to address a number of problems that limit innovative development;
6) the level of innovation funding has been analyzed and problems encountered by the system of financial support for innovation have been identified: the fragmented nature of the state policy in the field of financing and its insufficiency to create a broad mass of innovative enterprises, the lack of a sufficient

system for financing innovative projects at all stages of the project, especially at the initial stage; inadequate provision of service support in forwarding of innovative entrepreneurship when obtaining financial resources; insufficiently effective financing mechanisms for entering the international market; insufficient financing of researchers' scientific activities leading to 'staff scarcity' in the scientific and innovation spheres.

The proposed measures in the field of grant and bank financing, as well as tax incentives will not only increase the number of firms actively participating in innovation activities, but also will create an appropriate investment climate in the country for active implementation of innovations.

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Cross-Cultural Adaptability in a Sample of International University Students in Prague – Gender and Culture Effect

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Abstract:

The Cross-Cultural Adaptability Inventory (CCAI) was administered to a sample (n= 152) of international and domestic students studying at the University of Economics in Prague to assess their cross-cultural adaptability. Adaptation to non-native cultural environments is essential for study or work related sojourns. The results indicate that as far as cross-cultural adaptability of students is concerned, there are significant differences between gender and country of origin groups as measured by Flexibility and openness dimension of the CCAI (FO scale). Among the main findings: female students scored higher than male students, Anglo-Saxon and French students scored higher and the Czech and Slovak students lower on the FO scale than the other culture groups. Possible reasons for these differences are discussed. To our knowledge, this is the first study of this kind conducted in Czechia.

Keywords: adaptability; culture; CCAI; university students

JEL Classification: M14; Z10

Introduction

In our globalised world, people move from one country to another to pursue their personal or professional interests. Such relocations demand considerable level of innate abilities and skills. Intercultural awareness and knowledge of different cultures is becoming a necessary aspect of life for international students and workers. One of the main advantages of moving across international borders is learning how to live in the globalised world. Indeed, businesses and universities use various training methods to facilitate the transition from one culture to another which can be a demanding process. According to the Czech Ministry of Education, Youth and Sport, there were over 42 000 foreign students studying at public and private universities in 2015 and there were about 12 500 Czech students studying at foreign universities (CMEYS 2016). The number of foreign students in Czechia is growing every year (www.czech.cz/en/104255).

Culture has been defined in many ways across many academic disciplines. Parsons, a sociologist, defines culture as the management unit of the social system (Jandourek 2001). Trompenaars an international management guru, defines culture as the means by which people communicate, perpetuate and develop their knowledge about attitudes towards life (Trompenaars *at al*. 1998). Hofstede (1997), a social psychologist, defines culture as collective

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programming of the mind. Berry, whose field of research is culturology, proposed that culture is a sum of ways of living of a group of people within a society which is culturally passed from one generation to another (Berry *et al.* 2002).

Cross-cultural adaptation, in literature often referred as acculturation, is a process of psychological adaptation of an individual to a new culture. According to Bennett, acculturation is a process in which intercultural sensitivity of an individual changes from an ethnocentric to an ethnorelativist stage. This change is the key to successful acculturation (Bennett 1998). According to Bennett, acculturation skill development is achieved at two levels: culture-specific and culture-general. At the culture-specific level, the relocating individuals need to be aware of the "emic" grid of their original culture in order to adopt effective communication in any new cultural environment with a different "emic" grid. At culture-general level, skills that would be useful in any cross-cultural situation are adopted by relocating individuals. This approach, based on more generalizable skills, is the intercultural equivalent of "etic" cultural analysis. According to Berry (2002), the cross-cultural adaptability varies considerably between individuals and is affected by a range of factors such as ethno-cultural background, gender, age, education level, *etc*.

According to Berry (2002), changes occur during the acculturation process in an individual due to his or her contact with individuals from another culture. During this process individuals may choose to abandon behavioural patterns common in the original culture and accept new patterns of behaviour (Berry *at al.* 2002). This process is commonly accompanied by feelings of uncertainty, frustration and depression. Such experiences are referred to in literature Oberg (1960), Hofstede (1997) as "Culture shock" (Hofstede 1997).

On the other hand, individuals from highly ethnocentric cultures may choose to retain behavioural patterns common in the original culture. In this case acculturation to a new culture may be extremely difficult or impossible (Berry *at al.* 2002). According to Berry (2002), personality traits are influential during acculturation of an individual. These include traits which make adaptation easier as well as those which make it more difficult. The author mentions, for example, extraversion and introversion. Others have used personality scales to reflect differences between individuals in their ability to adapt to new cultures (Eysenck Personality Inventory – EPI-1975), (Berry *et al.* 2002, 89)

Several instruments for measuring intercultural sensitivity have been developed and used extensively, such as The Intercultural Development Inventory (IDI) by Hammer and Bennett (2002), Development Model of Intercultural Sensitivity (DMIS) by Bennett (1998), Intercultural Sensitivity Scale (ISS) by Guo-Ming Chen and Starosta (2000), and the Cross-Cultural Adaptability Inventory (CCAI) by Kelly and Meyers (1995).

Kelly and Meyers (1995) suggest that there are four dimensions influencing the level of cross-cultural adaptability: openness and flexibility, personal autonomy, perceptual acuity and emotional resilience. Scales were created for each dimension. Flexibility and openness scale (FO scale) reflects individual´s tendency to be broad-minded and open toward others. The ability to be flexible and non-judgemental is often associated with cross-cultural effectiveness. Personal autonomy scale was created to assess how well one will be able to appreciate cultural differences while maintaining his or her personal sense of self. Perceptual acuity dimension focuses on one´s ability to identify both verbal and nonverbal cues from individuals from another culture. Finally, emotional resilience is defined as being able to maintain positive emotions while being surrounded by unfamiliar environment with respect to cultural cues. Individuals immersed in a new culture often experience negative emotional reactions (*i.e.,* culture shock). The emotional resilience scale was created to represent an individual´s ability to cope with these feelings. The CCAI is considered to be a reliable and valid instrument for assessing personality, behaviour and skills required for cross-cultural adaptation (Ward *et al.* 2000). According to Hoffman, the CCAI is the most reliable indicator of an individual´s cross-cultural adaptability (Hoffman 2002).

Focussing on groups involved in cross-cultural adaptation, previous studies indicate that cultural distance determined particularly by linguistic or religious differences may be an important factor influencing cultural adaptation (Berry *et al*. 2002). According to Berry, the greater the cultural difference between the original and the host culture, the greater the problems experienced by individuals (Berry *et al*. 2002). These results indicate that the greater the cultural difference between the original and the host culture, the greater the adaptation difficulties. Moreover, participants from countries with a long tradition of international travel, student exchange programs and

international professional sojourns could be expected to possess higher level of adaptation skills than those from inward looking ethnocentric cultures. It could therefore be expected that the scores on the CCAI scales will be different according to the culture of origin.

Previous research also indicates that women tend to be less adaptable to new local conditions than men, particularly in masculine oriented cultures. According to previous research, focussing on business sojourners, women seem to depend more on social support (Ward *et al*. 2001). Because of this finding, it is likely that women, particularly women sojourners, for example students, could be less adaptable to new local conditions than men. Consequently, it could be expected that the scores on the CCAI scales will be lower in women than in men (Ward *et al*. 2001, 93, 186).

In this study, the focus is on comparing gender and culture of origin of participants with respect to individual CCAI dimensions. Previous research is considered in the formulation of the research hypotheses. The dependent variables in this study are the levels of the CCAI dimensions. The independent variables which may influence the levels of CCAI dimensions are gender and cultural differences as defined by country of origin.

1. Methodology

The survey sample consisted of 152 students of the intercultural communication seminar at the University of Economics, Prague. The students were both males and females aged 18 to 25 years. The research instrument was CCAI printed questionnaire, developed by Colleen Kelley and Judith Meyers and published by Vangent Inc. The questionnaires were purchased by the University of Economics, Prague.

The CCAI instrument was developed to provide a tool for self-assessment of cross-cultural adaptability (Kelley and Meyers 1995). The survey was conducted in English. All respondents were competent in the English language. Respondents answered a set of 50 multiple choice questions with a 6 response option scale: Definitely True, True, Tends to Be True, Tends to Be Not True, Not True and Definitely Not True. From the total number of 50 questions, 20 questions related to Emotional Resilience (ER) dimension, 15 questions covered Flexibility and Openness (FO) dimension, 10 questions covered Perceptual Acuity (PAC) dimension and 7 questions related to Personal Autonomy (PA) dimension. As the results of the overall analysis indicated that the differences between independent variables were found particularly in the FO (Flexibility and Openness) dimension and not in the remaining three dimensions, we have focused on the analysis of the FO scale. Questions administered as part of the FO scale included: “I can enjoy relating to all kinds of people”, “I like being with all kind of people” or “I believe that I could live a fulfilling life in another culture”. The authors state that the FO scale measures the extent to which a person enjoys the different ways of thinking and behaving that are typically encountered in the cross-cultural experience and that the open and flexible people have a positive attitude towards the unfamiliar (Kelley and Meyers 1995).

A majority of the international students attending the Intercultural Communication seminar at the University of Economics in Prague in 2014 and 2015 were included in the sample. For the most numerous country/ culture group the Czechs and the Slovaks, a random selection was used to select respondents. Over two thirds of respondents were females, which corresponds with the share of women students at University of Economics, Prague, and almost one third of respondents were students from Czechia and Slovakia. Based on further work with data, respondents were divided into seven groups, based on closeness of their cultures. The following groups were created: Czechoslovak culture (Czechs and Slovaks), Scandinavian culture (respondents from Finland, Sweden and Norway), Germanic culture (Germans and Austrians), French culture (respondents from France and Belgium, Hispanic culture (respondents from Spain and Portugal), Russian culture and Anglo–Saxon culture (respondents from United Kingdom, Canada, New Zealand and USA).

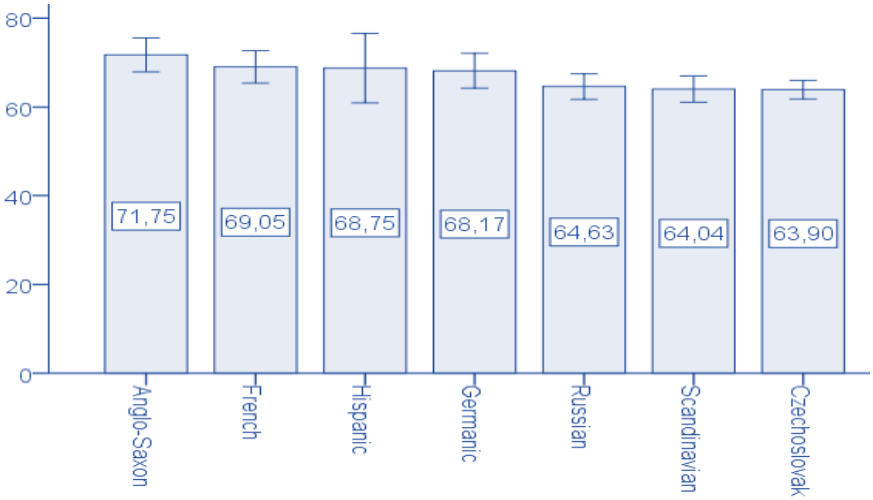
Table 1. Statistics for the whole population – Independent samples t-test for Flexibility and Openness (FO) dimension

Independent variables	N	Mean	SD	Independent samples t-test value	p > 0.05
Gender	152				
Female	104	66.70	8.023	8.478	0.05*
Male	48	65.42	8.029	5.640	0.05*

Independent variables	N	Mean	SD	Independent samples t-test value	p > 0.05
Culture Groups	152				
Czechoslovak (CZ. SK)	52	63.90	7.593	6.068	0.05*
Scandinavian (FIN. SWE. NOR)	28	64.04	7.662	4.422	0.05*
Germanic (GER. AUS)	18	68.17	7.913	3.654	0.05*
French (FRA. BEL)	22	69.05	8.289	3.906	0.05*
Hispanic (ESP. POR)	8	68.75	3.462	5.280	0.05*
Russian (RUS)	8	64.63	9.347	2.080	0.05*
Anglo –Saxon (UK. CAN. NZ. USA)	16	71.75	7.160	4.008	0.05*

Note: *= statistically significant at 5% level

Figure 1. Average value of Flexibility and Openness (FO) dimension by culture groups



The data were analysed by the table processor and statistical software SPSS 22.0. Descriptive statistics, independent samples t-test and paired samples t-tests were used to find relationships between independent variables for each of the four CCAI dimensions. Fifteen working hypotheses were proposed and these are set out below.

Based on previous research, authors have proposed 15 working hypotheses in order to confirm differences between gender and culture groups for each of the four CCAI dimensions. As the results of the overall analysis indicated that the differences between independent variables were found particularly in the FO (Flexibility and Openness) dimension and not in the remaining three dimensions, 9 hypotheses were proposed for the FO (Flexibility and Openness) dimension, and 2 hypotheses for each of the remaining CCAI dimensions: PA (Personal Autonomy), PAC (Perceptual Acuity) and ER (Emotional Resilience). As the research was conducted in the Czech Republic for which this kind of information, to our knowledge, is so far not available, the research emphasis was on the Czech and Slovak individuals and their cultures. While some differences between Czech and Slovak cultures do exist, for the purpose of this research they were considered marginal. We therefore utilize the concept of the Czechoslovak culture group.

The proposed null hypotheses

H01: Flexibility and Openness (FO): no difference between females and males is expected.

H02: Flexibility and Openness (FO): no difference between Czechoslovak and other culture groups is expected.

H03: Flexibility and Openness (FO): no difference between Czechoslovak females and all other females is expected.

H04: Flexibility and Openness (FO): no difference between Czechoslovak males and all other males is expected.

H05: Flexibility and Openness (FO): no difference between Czechoslovak females and Czechoslovak males is expected.

H06: Flexibility and Openness (FO): no difference between Czechoslovak group and French group is expected.

H07: Flexibility and Openness (FO): no difference between Czechoslovak females and French females is expected.

H08: Flexibility and Openness (FO): no difference between Czechoslovak group and Anglo-Saxon group is expected.

H09: Flexibility and Openness (FO): no difference between Czechoslovak females and Anglo-Saxon females is expected.

H010: Personal Autonomy (PA): no difference between females and males is expected.

H011: Personal Autonomy (PA): no difference between Czechoslovak group and other culture groups is expected.

H012: Perceptual Acuity (PAC): no difference between females and males is expected.

H013: Perceptual Acuity (PAC): no difference between Czechoslovak group and other culture groups is expected.

H014: Emotional Resilience (ER): no difference between females and males is expected.

H015: Emotional Resilience (ER): no difference between Czechoslovak group and other culture groups is expected.

2. Results

Table 2 shows overall results for Flexibility and Openness by gender and culture. The differences are significant at 5% level. Data analysis was undertaken in order to support or reject individual hypotheses. As we have discovered significant differences between independent variables in the case of the Flexibility and Openness (FO) dimension, nine hypotheses were proposed for this dimension and most analyses are therefore dedicated to this dimension. For the remaining dimensions, Personal Autonomy (PA), Perceptual Acuity (PAC) and Emotional Resilience (ER), the average values of the independent variables of gender and culture showed no significant differences and the analyses were limited to two hypotheses concerning overall gender and culture effect each.

Table 2. Flexibility and Openness by gender and culture group

Independent variables	Females				Males				Total			
	N	Mean	SD	p > 0.05	N	Mean	SD	p > 0.05	N	Mean	SD	p > 0.05
Culture group												
Czechoslovak	39	63.28	7.924	0.05*	13	65.77	6.418	0.05*	52	63.90	7.593	0.05*
Scandinavian	16	66.75	6.648	0.05*	12	61.75	8.593	0.05*	28	64.04	7.662	0.05*
Germanic	8	66.38	6.653	0.05*	10	69.60	8.872	0.05*	18	68.17	7.913	0.05*
French	17	70.88	8.115	0.05*	5	62.80	5.848	0.05*	22	69.05	8.289	0.05*
Hispanic	2	75.50	3.536	0.05*	6	66.50	9.772	0.05*	8	68.75	3.462	0.05*
Russian	8	64.63	3.462	0.05*	0			0.05*	8	64.63	9.347	0.05*
Anglo-Saxon	14	72.36	7.417	0.05*	2	67.50	3.536	0.05*	16	71.75	7.160	0.05*

Note: *= statistically significant at 5% level

Table 3. H01: Flexibility and Openness: no difference between females and males is expected.

Independent variables	N	Mean	SD	Paired samples t-test value	p > 0.05
Gender					
Female	104	66.70	8.023		
Male	48	65.42	8.029	3.522	0.05*

Note: *= statistically significant at 5% level

The hypothesis H01 is rejected, because there was a statistically significant difference between females and males (t = 3.522, p = 0.05).

Figure 2. Means of Flexibility and Openness (FO) by gender for all culture groups

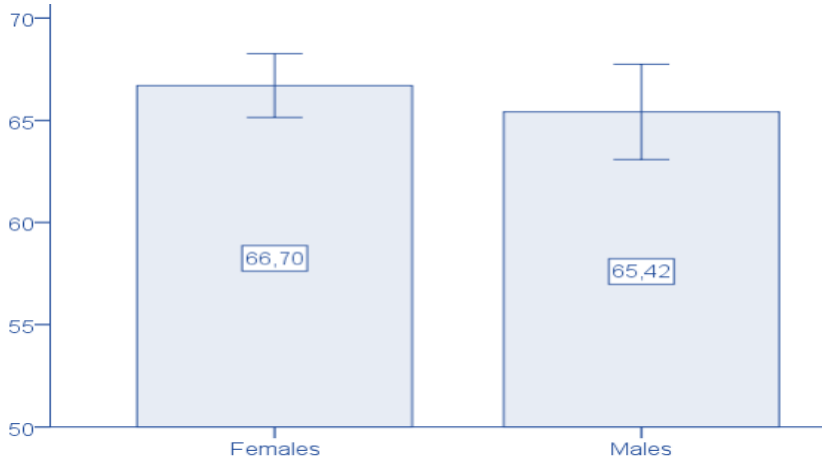


Table 3 and Figure 2 show significantly higher flexibility and openness for females than for males when all cultures are included. What evidently influences flexibility and openness in females is their culture of origin. In our research, highest values of flexibility and openness was associated with females from Anglo-Saxon (mean = 72.36) and French (mean = 70.88) groups. By comparison, the Russian (mean = 64.63) and Czechoslovak (mean = 63.28) culture groups were associated with lowest values of flexibility and openness for females. It appears that the Anglo-Saxon and French women tend to be more open to foreign cultures and are more experienced in coexisting with individuals from other cultures than, for instance, Russians or Czechs women (see Figure 3). In this figure Hispanic group was excluded because there were only 2 respondents in the sample. Differences between culture groups are statistically significant at 5% level (p = 0.05). This will be discussed later.

Figure 3. Average value of Flexibility and Openness for females

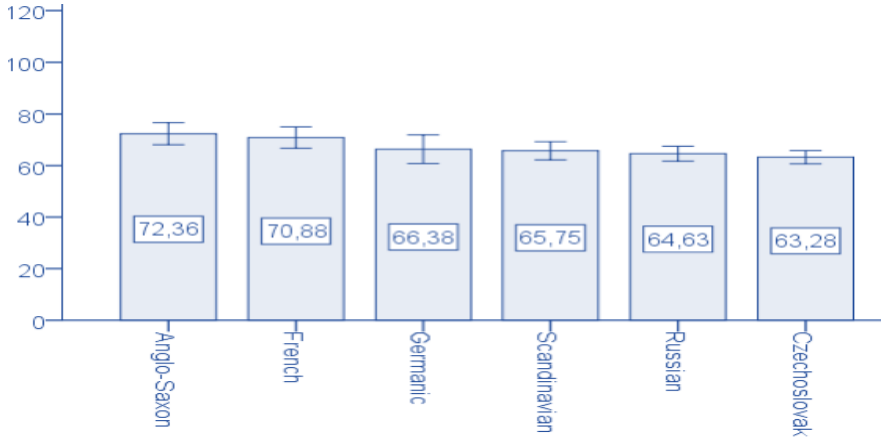


Table 3 and Figure 2 show significantly lower scores on flexibility and openness for males than for females when all cultures are included. Again, as was the case with females, what influences flexibility and openness in males is their culture of origin. In our research, highest values of flexibility and openness was associated with males from the Germanic (mean = 69.60) and Hispanic (mean = 66.50) groups. By comparison, the French (mean = 62.80) and Scandinavian (mean = 61.75) culture groups were associated with lowest values of flexibility and

openness for males (see Figure 4). In this figure Anglo-Saxon and Russian groups were excluded because there were only 2 or no respondents in the sample.

Figure 4. Average value of Flexibility and Openness for males

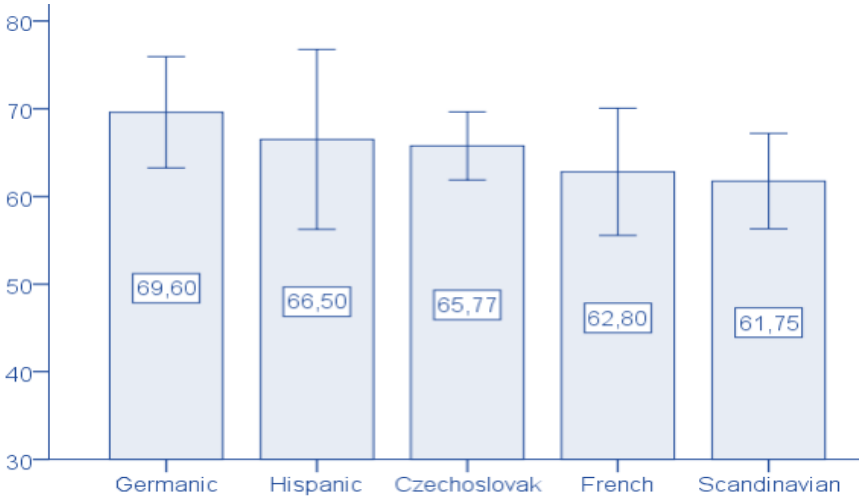


Table 4. H02: Flexibility and Openness: no difference between Czechoslovak group and other culture groups is expected

Independent variables	N	Mean	SD	Paired samples t-test value	p > 0.05
Culture group					
Czechoslovak	52	63.90	7.593		
Other cultures	100	67.54	7.990	3.406	0.05*

Note: *= statistically significant at 5% level

Table 4 shows that the Czechoslovak respondents had significantly lower average values of flexibility and openness than the combination of all other respondents. Hypothesis H02 is therefore rejected. There is a statistically significant difference between the Czechoslovak culture group and the combination of other culture groups (t = 3.406, p = 0.05).

Table 5. H03: Flexibility and Openness: no difference between Czechoslovak females and other females is expected

Independent variables	N	Mean	SD	Paired samples t-test value	p > 0.05
Culture group					
Czechoslovak	39	63.28	7.923		
Other cultures	65	68.75	7.409	2.978	0.05*

Table 5 shows that Czechoslovak female respondents had, in comparison to the combination of all other female respondents, significantly lower average values of flexibility and openness. The hypothesis H03 is therefore rejected. There is a statistically significant difference between the Czechoslovak females and females from other culture groups (t = 2.978, p = 0.05).

Table 6. H04: Flexibility and Openness: no difference between Czechoslovak males and other males is expected

Independent variables	N	Mean	SD	Paired samples t-test value	p > 0.05
Culture group					
Czechoslovak	13	65.77	6.418		
Other cultures	35	65.28	8.631	0.714	.214 n.s.

Table 6 shows that there was no significant difference between the Czechoslovak male respondents and the combination of all other male respondents in average values of flexibility and openness. The hypothesis H04 is

therefore supported. There is no statistically significant difference between Czechoslovak males and males from the combination of all other culture groups (t = 0.714, p = 0.214).

Table 7. H05: Flexibility and Openness: no difference between Czechoslovak females and Czechoslovak males is expected

Independent variables	N	Mean	SD	Paired samples t-test value	p > 0.05
Culture group					
Czechoslovak females	39	63.28	7.92		
Czechoslovak males	13	65.77	6.418	0.547	.364 n.s.

Table 7 shows that there was no significant difference between Czechoslovak female respondents and Czechoslovak male respondents in average values of flexibility and openness. The hypothesis H05 is therefore supported. There is no statistically significant difference between Czechoslovak females and Czechoslovak males (t = 0.547, p = 0.364). The average values of flexibility and openness for Czechoslovak females and Czechoslovak males are very similar, with slight difference of 0.04 in the mean and the difference in standard deviation is 0.4.

Table 8. H06 Flexibility and Openness: no difference between Czechoslovak culture group and the French culture group is expected

Independent variables	N	Mean	SD	Paired samples t-test value	p > 0.05
Culture group					
Czechoslovak	52	63.90	8.015		
French	22	69.05	8.289	2.041	0.05*

Note: *= statistically significant at 5% level

Table 8 shows that there was a significant difference between the Czechoslovak and French culture groups. The Czechoslovak culture group had significantly lower average values of flexibility and openness than the French culture group. The hypothesis H06 is therefore rejected. There is a statistically significant difference between the Czechoslovak culture group and the French culture group (t = 2.041, p = 0.05).

Table 9. H07: Flexibility and Openness: no difference between Czechoslovak females and French females is expected

Independent variables	N	Mean	SD	Paired samples t-test value	p > 0.05
Culture group					
Czechoslovak	39	63.28	7.923		
French	17	70.88	8.115	3.315	0.05*

Note: *= statistically significant at 5% level

Table 9 and Figure 5 show that there was a significant difference between the Czechoslovak females and French females. The Czechoslovak females had significantly lower average values of flexibility and openness than the French females. The hypothesis H07 is therefore rejected. There is a statistically significant difference between Czechoslovak females and French females (t = 3.315, p = 0.05).

Figure 5. Average value of Flexibility and Openness for the Czechoslovak and French females

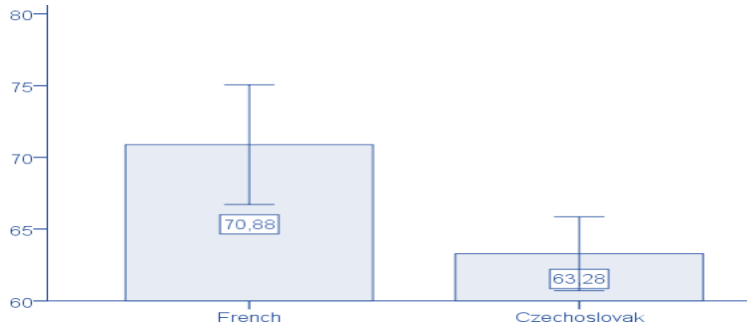


Table 10. H08: Flexibility and Openness: no difference between Czechoslovak and Anglo-Saxon culture groups is expected

Independent variables	N	Mean	SD	Paired samples t-test value	p > 0.05
Culture group					
Czechoslovak	52	63.90	8.015		
Anglo-Saxon	16	71.75	7.160	3.018	. 0.05*

Note: *= statistically significant at 5% level

Table 10 and Figure 6 show that there was a significant difference between the Czechoslovak and Anglo-Saxon culture groups. The Czechoslovak culture group had significantly lower average values of flexibility and openness than the Anglo-Saxon culture group. The hypothesis H08 is therefore rejected. There is a statistically significant difference between the Czechoslovak (63.90) and the Anglo-Saxon (71.75) culture groups (t = 3.018, p = 0.05).

Figure 6. Average value of Flexibility and Openness for the Czechoslovaks and Anglo-Saxons

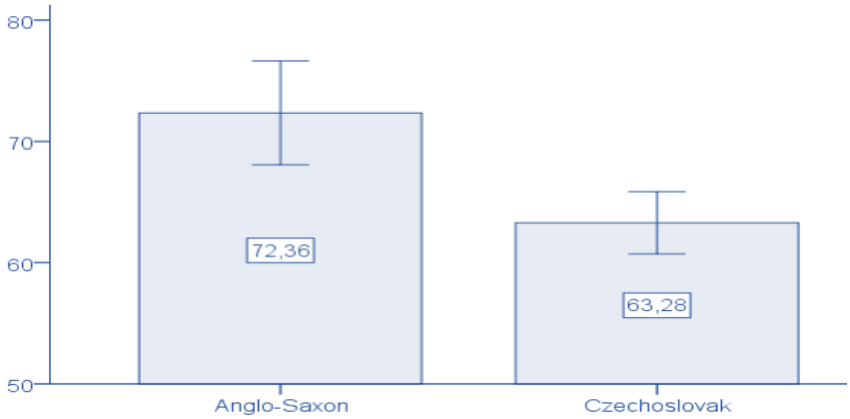


Table 11. H09: Flexibility and Openness: no difference between Czechoslovak females and Anglo-Saxon females is expected

Independent variables	N	Mean	SD	Paired samples t-test value	p > 0.05
Culture group					
Czechoslovak females	39	63.28	7.923		
Anglo-Saxon females	14	72.36	7.417	3.244	0.05*

Table 11 shows that there was a significant difference between the Czechoslovak females and Anglo-Saxon females. The Czechoslovak females had significantly lower (63.28) average values of flexibility and openness than the Anglo-Saxon females (72.36). The hypothesis H09 is therefore rejected. There was a statistically significant difference between Czechoslovak females and Anglo-Saxon females (t = 3.244, p = 0.05).

Table 12. H010: Personal Autonomy: no difference between females and males is expected

Independent variables	N	Mean	SD	Paired samples t-test value	p > 0.05
Culture group					
Females	104	33.43	3.36		
Males	48	32.91	2.79	0.415	.412 n.s.

Table 12 shows that there was no significant difference between female and male respondents in the average values of personal autonomy. The hypothesis H010 is therefore supported (t = 0.415, p = 0.412).

Overall, in the case of Personal Autonomy (PA) dimension, there were no significant differences between either gender or culture groups. Table 12 shows only slight differences between females (mean = 33.43, s.d. = 3.36) and males (mean = 32.91, s.d. = 2.79). Similarly, only small differences were found between Czechoslovak group (mean = 33.32, s.d. = 3.29) and other culture groups (mean = 33.24, s.d. = 3.16). See Table 13.

Table 13. H011: Personal Autonomy: no difference between Czechoslovak group and other country groups is expected

Independent variables	N	Mean	SD	Paired samples t-test value	p > 0.05
Culture group					
Czechoslovak	52	33.32	3.29		
Other cultures	100	33.24	3.16	2.346	.279 n.s.

Table 13 shows that there was no significant difference between Czechoslovak and other culture group respondents in the average values of personal autonomy. The hypothesis H011 is therefore supported (t = 2.346, p = 0.279).

Table 14. H012: Perceptual Acuity: no difference between females and males is expected

Independent variables	N	Mean	SD	Paired samples t-test value	p > 0.05
Culture group					
Female	104	47.25	4.76		
Male	48	45.87	5.78	1.255	.125 n.s.

Table 14 shows that there was no significant difference between female and male respondents in the average values of perceptual acuity. The hypothesis H012 is therefore supported (t = 1.255, p = 0.125). Overall, in the case of Perceptual Acuity (PAC) dimension, there were no significant differences between either gender or culture groups. Table 14 shows only slight differences between females (mean = 47.25 s.d. = 4.76) and males (mean = 45.87, s.d. = 5.78). Similarly, only small differences were found between Czechoslovak group (mean = 46.44, s.d. = 5.20) and other culture groups (mean = 47.01, s.d. = 5.10). See table 15.

Table 15. H013: Perceptual Acuity: no difference between Czechoslovak group and other culture groups is expected

Independent variables	N	Mean	SD	Paired samples t-test value	p > 0.05
Culture group					
Czechoslovak	52	46.44	5.20		
Other cultures	100	47.01	5.10	2.956	.145 n.s.

Table 15 shows that there was no significant difference between Czechoslovak and other culture group respondents in the average values of perceptual acuity. The hypothesis H013 is therefore supported (t = 2.956, p = 0.145).

Table 16. H014: Emotional Resilience: no difference between females and males is expected

Independent variables	N	Mean	SD	Paired samples t-test value	p > 0.05
Culture group					
Female	104	80.34	10.03		
Male	48	83.29	8.77	3.487	.096 n.s.

Table 16 shows that there was no significant difference between female and male respondents in the average values of emotional resilience. The hypothesis H014 is therefore supported (t = 3.487, p = 0.096). Overall, in the case of Emotional Resilience (ER) dimension, there were no significant differences between either gender or culture groups. Table 16 shows only slight differences between females (mean = 80.34, s.d. = 10.03) and males (mean = 83.29, s.d. = 8.77). Similarly, only small differences were found between Czechoslovak group (mean = 80.82, s.d. = 9.28) and other culture groups (mean = 81.51, s.d. = 9.97). See Table 17.

Table 17. H015: Emotional Resilience: no difference between Czechoslovak and other culture groups is expected

Independent variables	N	Mean	SD	Paired samples t-test value	p > 0.05
Culture group					
Czechoslovak	52	80.82	9.28		
Other cultures	100	81.51	9.97	0.325	.301 n.s.

Table 17 shows that there was no significant difference between Czechoslovak and other culture group respondents in the average values of emotional resilience. The hypothesis H015 is therefore supported (t = 0.325, p = 0.301).

3. Discussion

This study assesses the cross-cultural adaptability of domestic and international students at the University of Economics, Prague. The sample consisted of 152 students from different cultures whom responded to 50 questions with a six response option scale. The study is particularly concerned with the adaptability of Czech and Slovak university students, vis-a-vis students from other cultures. The instrument used was the Cross-Cultural Adaptability Inventory (CCAI).

The CCAI is considered to be a reliable and valid instrument in assessing the intercultural adaptability of individual sojourners (Hoffman 2002), in our case university students. The question is why is it that, in our case, only one dimension of the CCAI instrument, namely the FO scale, is showing significant impact on two independent variables of gender and culture. To consider this, we need to ask what specific questions are being asked within this dimension. Questions such as "I believe that I could live a fulfilling life in another culture, "I can enjoy relating to all kinds of people" or "I like being with all kinds of people" declare most clearly respondents desire and resolution to relate effectively to individuals from other cultures and live in these different cultures without prejudice.

Overall, the results of this study indicate that as far as cross-cultural adaptability of students is concerned, there are differences between gender and culture of origin as measured by the FO dimension of the CCAI. Based on previous research, authors have proposed 15 working hypotheses in order to confirm differences between gender and culture groups for each of the four CCAI dimensions. For the purpose of analysis, we designated similar culture groups (Czechoslovak, Scandinavian, Germanic, French, Hispanic, Russian and Anglo –Saxon), which were compared on the basis of achieved scores.

The gender of respondents had a significant influence on the FO values (HO1). According to literature, males tend to be more adaptive than females (Ward *et al.* 2001). However, in this study the opposite was found. Female respondents showed higher flexibility and openness values than males. This could be partly the result of the fact that female university students, particularly those studying subjects in which good intercultural communication is essential, are already pre-selected for adaptive abilities to other cultures. In addition, a high number of females (31) comparing to males (7) in the sum of French and Anglo-Saxon culture groups, which scored highest on the FO scale, could have contributed to this result. It is possible that women from these two culture groups scored higher than men because of the prevalence of egalitarian and possibly feminist attitudes in their home cultures. In the light of previous research, focusing on business sojourners rather than students (Ward *et al.* 2001), this is unexpected and may be indicative of an ongoing positive change in female student acculturation.

Comparing the Czechoslovak culture to all other cultures combined on the FO scale (HO2), the null hypothesis was rejected. The Czech and Slovak respondents had significantly lower average value of flexibility and openness than students from other cultures. Given a high number of respondents (52 Czechoslovaks and 100 others), this result is plausible. Possible explanations may include earlier suggestion that the foreign university students, particularly those studying subjects in which competent intercultural communication is essential, were pre-selected for adaptive abilities to other cultures and were required to use these skills. After all, the foreign students included in this study were in a foreign country while the Czechoslovak students were at home. It is also possible that given the relative isolation of Czech and Slovak cultures during communism the tendency to stay isolated from other cultures is subject to cultural inertia and may have an impact for a long period of time. This may negatively influence the FO values of Czechoslovak students. Furthermore, it was in the interest of the communist regime not to encourage people to learn foreign languages. Indeed, even now the Czechs are one of the nations where dubbing of foreign films and TV programs is extremely prolific and taken to the state of the art. This aspect of Czech culture may hinder experiencing foreign cultures through visual media because it is not just the words which are important but it is also the way they are spoken, including intonation, emotional vocalization and pitch (Kautsky 1970). Such ethnocentric attitudes could hinder the acculturation process (Berry *et al.* 2002).

Similar explanations may also be valid for the results in comparison between Czechoslovak females and other females combined. The null hypothesis HO3 was rejected. The Czech and Slovak females had significantly lower average value of flexibility and openness than the female students from other cultures. It is possible that women from other cultures scored higher on the FO scale than Czechoslovak females because of the prevalence of long lasting democratic tradition and ethno-relativist attitudes in their home countries, while the Czech women may still suffer from the legacy and inertia of the inward looking totalitarian regime together with a prevalent male dominant culture.

Czechoslovak male students did not score differently on the FO scale than all other male students combined (HO4). The null hypothesis HO4 was therefore supported. Given also that Czechoslovak males did not score differently on the FO scale than Czechoslovak females, the null hypothesis HO5 was also supported, it is possible that the relatively low FO scale scores for male students from other cultures were responsible for the support of the null hypothesis HO4. The foreign male students did not reach the high level on openness and flexibility as did their female counterparts.

Comparing the Czechoslovak females with French females (HO7) and Czech females with Anglo-Saxon females (HO9), large significant differences between the mean scores are evident. The difference between mean scores is 8 (63 and 71) for the Czechoslovak and French females and 9 (63 and 72) for the Czechoslovak and Anglo-Saxon females.

These differences are also reflected in the comparison between the Czechoslovak culture and French and Anglo-Saxon cultures as a whole. On the FO scale both HO6 and HO8 hypotheses were rejected. The Czechoslovak respondents had significantly lower average value of flexibility and openness than students from the French and Anglo-Saxon cultures. These results reflect two extremes on the FO scale, the lowest and the highest. It is therefore feasible to conclude that the significant differences in the FO values between all females and males (HO1), Czechoslovak and other culture groups (HO2) and Czechoslovak females and other females (HO3) are due to the exceptionally high FO scores for Anglo-Saxon and French female students. Again, as stated above, this result could be due to the possibility that Czech women may still suffer from the legacy and inertia of the inward looking totalitarian regime together with a prevalent male dominant culture while the Anglo-Saxon and French female student come from openly egalitarian, ethno-relativist and feminist cultures.

In the cases of Personal Autonomy (PA), Perceptual Acuity (PAC) and Emotional Resilience (ER) dimension, no significant differences between either gender or culture groups were found. This confirms our expectations about Flexibility and Openness (FO) dimension as the most significant dimension of the CCAI, for comparing gender and culture differences between Czech and Slovak students and students from other cultures included in this study.

Data analysis was undertaken in order to support or reject individual hypotheses. As we have discovered significant differences between independent variables in the case of the Flexibility and Openness (FO) dimension, nine hypotheses were proposed for this dimension and most analyses are therefore dedicated to this dimension. For the remaining dimensions, Personal Autonomy (PA), Perceptual Acuity (PAC) and Emotional Resilience (ER), the average values of the independent variables of gender and culture showed no significant differences and the analyses were limited to two hypotheses concerning overall gender and culture effect each.

Conclusion

In conclusion, the most important finding of this study concerns the effect of gender and culture on adaptability to other cultures as measured by flexibility and openness (FO) dimension of the CCAI instrument. All females scored significantly higher than all males on this dimension. This finding could indicate a new positive development in the ability of women to relate to cultures other than their own, which is contrary to previous research. Czechs and Slovaks as a group scored significantly lower than all other culture groups combined and Czech and Slovak females scored significantly lower than the combination of all other females. It is evident that the significant differences in the flexibility and openness (FO) values between all females and males, Czechoslovak and other culture groups and Czechoslovak females and other females are due to the exceptionally high flexibility and openness scores for Anglo-Saxon and French female students. The reasons for high flexibility and openness scores for these students

could be due to prevalence of long lasting democratic tradition, ethno-relativist and possibly also feminist attitudes in their home cultures. On the other hand, the Czech and Slovak students may still be under the influence of the past relative isolation of their cultures during communism. The tendency to stay isolated from other cultures is subject to cultural inertia and may have an impact for a long period of time. To our knowledge, this is the first study of this kind conducted in Czechia. For further similar studies, it could be advantageous to work with a bigger sample and larger spectrum of culture groups. Such research could be useful in formulating EU policies including improvement in intercultural understanding, university exchange programs and company professional sojourns.

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Participation of Universities in Building Innovative Economy of the Regions

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Abstract:

The article seeks to classify the innovative structure of universities, which allows identifying particular facilities of the universities' infrastructure based on definite criteria. It is focused on the development of comprehensive measures for incorporating the results of innovative, scientific and technological activities of higher education institutions into the economic activities of the subjects of the Russian Federation. The practical significance of the study lies in the possibility of using the results obtained by the state authorities during the implementation of the anti-crisis plan of the Russian Government, while forming and adjusting the strategy for the development of subjects of the Russian Federation and educational organizations to improve universities' cooperation with enterprises, develop the universities' innovative infrastructure, attract leading scientists to the universities, provide the universities' participation in the implementation of innovative development programs for publicly owned companies, create and develop university-based engineering centers, etc. The article contains the original outcomes of studying full functional infrastructure of the universities having a set of properties that would facilitate implementation of innovative processes on a regional and nationwide scale to ensure their effective functioning. The necessity of creating an organizational and functional model of the Russian universities' innovative development is substantiated.

Keywords: economy; management; region; university; innovative activities; innovative infrastructure

JEL Classification: O32

Introduction

The experience of developed countries confirms that in the conditions of global competition in the world market, one who has developed infrastructure for creating and implementing innovations is guaranteed to win (Guadix *et al.* 2016, Kasim *et al.* 2016, Kalnins and Jarohnovich 2016). Therefore, for the effective functioning of the country's innovative economy, the innovative infrastructure of the universities should have a set of such properties that facilitate the implementation of technologies for creation and dissemination of innovations on a regional and nationwide scale, which implies the active participation of the university's community in this process and the creation of business entities, small innovative enterprises by budgetary scientific and educational institutions for the practical application of the results of intellectual activity and implementation of innovative projects (ASI 2014).

At present, there are quite a few innovative infrastructure facilities in the world aimed at supporting and developing innovative projects, start-ups and innovative business: business incubators, technology parks, technopolises, innovation and technology centers, etc. All of them perform certain functions, provide various services, place certain demands on their residents and users. However, in most cases the boundaries between these elements are very blurred or even erased: they have the same goals, they provide the same services, but often there is no clear understanding of the differences between existing elements, their features and capabilities.

1. Concept headings

The development of the normative legislative base of the Russian Federation (RF Government Regulation No. 219. 2010) confirms the intention of the state to take an active part and provide assistance in the creation and development of innovative infrastructure in higher schools with insignificant amounts of financing for this process from the state budget. Thus, the analysis of the data of the Federal Law "On the Federal Budget for 2013 and for the Planning Period of 2014 and 2015" and the Federal Law "On the Federal Budget for 2016" showed that the state expenditures on civilian research and development totaled RUB 342.07 billion in 2013 (0.51% of GDP), RUB 370.35 billion (0.52% of GDP) in 2014; RUB 384.78 billion rubles (0.51% of GDP) in 2015; RUB 306.3 billion in 2016. In 2017 it is planned to spend RUB 302.04 billion for this purpose (Masyuk and Petrishchev 2015). At the same time, the conditions for allocating state funds to support the universities' infrastructure elements are clearly defined, and it is stipulated that only those universities whose innovative infrastructure development projects have passed the competitive selection can obtain the state support" (Pukhova *et al.* 2016).

Federal spending for the period from 2014 to 2016 for the implementation of particularly significant educational events (RF MES 2016) did not change with regard to most indicators, such as federal university development programs, subsidies for educational crediting, subsidies for the Government granting allocated for scientific research, except for the expenses on increasing the competitiveness of leading universities, the value of which would slightly increase, and amounted to RUB 28.3 billion in 2014 as compared to RUB 29.7 billion in 2016.

Many Russian and foreign scholars pay special attention in their studies to the increase in innovative processes taking place in the universities, to the principles and rules for building an innovative infrastructure therein (Agamirzyan 2010). However, in our opinion, it is expedient to investigate the innovation infrastructure as a set of all subsystems that provide access to various resources (assets) and/or render services to the participants in innovative activities.

The following types (subsystems) of the innovative infrastructure can be distinguished (Agamirzyan 2010):

- financial – various types of funds (budget, venture, insurance, investment), other financial institutions, including the stock market which plays a special role in the activities of high-tech companies;
- industrial-technological (or material) – technology parks, innovation and technology centers, business incubators, technology transfer centers, etc.;
- information - the bases of data and knowledge, access centers, as well as analytical, statistical, information and similar centers (*i.e.* organizations providing services);
- personnel – educational institutions for personnel training and retraining in the field of scientific and innovative management, technological audit, marketing, *etc*.;
- expert and consulting – organizations engaged in providing services on intellectual property, standardization, certification, as well as general and specialized consulting centers (finance, investment, marketing, management, *etc*.).

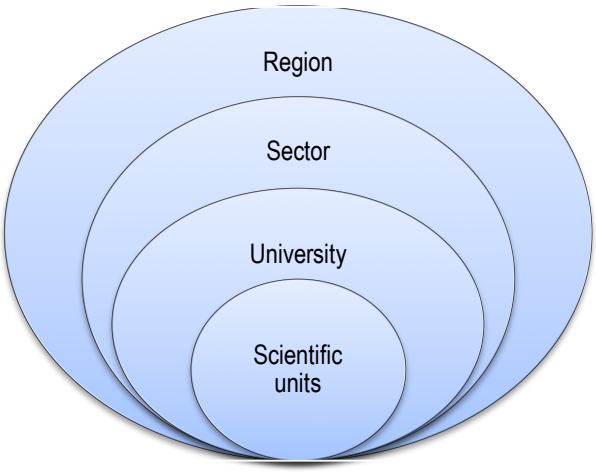
The experience of the developed countries of the world indicates the need to create a complete functional infrastructure (Elliott *et al.* 2017, Villasalero 2014). The authors tried to do this in this work, starting with the possibility of describing and classifying elements and ending with building a model of a complete functional infrastructure that can directly influence the development of innovative activity of the regions.

To achieve the goal set in the research and to classify the universities' innovative infrastructure, it is advisable to apply the system approach, according to which it is required to study the innovative infrastructure as a system on a stage-by-stage basis, to consider the elements comprising it and to analyze their content, functions, properties, interrelations, interdependencies, their interaction mechanism, therefore:

- at the first stage, on the basis of the analyzed monographs, collections of scientific papers, articles and other scientific publications, the concept of innovative activities of the university, their composition and structure was characterized; the principles, factors, conditions influencing the university's innovative structure and innovative environment were defined; problems and factors of the university's innovative structure development were revealed; the influence of the university's innovative activities on the economic processes of the subjects of the Russian Federation was investigated;

- at the second stage, the innovative infrastructure of 42 innovative universities of the country was explored, where the substantiation for the concept of innovative infrastructure was given; the functions, properties and elements of the innovative infrastructure were disclosed; a model of the university's innovative infrastructure was developed. The analysis and comparison of the universities' innovative structures allowed substantiating approaches and evaluating the efficiency and effectiveness of the universities' innovative infrastructure elements functioning;
- at the third stage, the needs of the regions of the Russian Federation in the introduction of the universities' scientific and technical developments in the innovative industries were evaluated;
- at the next stage, the process of interaction between the universities, enterprises and regions of the Russian Federation was justified, measures were proposed to support innovative development of the universities and integration of the universities and regional industry; a mechanism for the development of entrepreneurial universities applying the public-private partnership mechanism to create innovative developments for the regional industry (Figure 1).

Figure 1. Integration and interaction of a number of the innovation system elements



The proposed measures were developed taking into account the priority areas of industrial development of the Russian Federation regions.

2. Methods and materials

To identify the differences between the elements of the innovative infrastructure from each other, the following actions were performed:

- the main functions performed by the innovative infrastructure were identified;
- a list of the innovative infrastructure elements was made;
- for each element one basic function distinguishing this element from the others and several minor functions were determined.

The following properties of the university's innovative infrastructure are singled out (Development of innovative infrastructure 2014-2017, Ismailov and Gamidov 2003):

- dispersion of infrastructure elements;
- generality;
- high qualification of employees engaged in innovative activities;
- striving for a high result.

All functions of the innovative infrastructure can be divided into three main groups: allocation and servicing of residents, business promotion and development, commercialization of innovative products (Table 1).

Table 1. Innovative infrastructure functions

Allocation and servicing of residents	Business promotion and development	Commercialization of innovative products
▪ Provision of office rental; ▪ provision of manufacturing area rental; ▪ provision of laboratory premises and equipment rental; ▪ provision of premises and multiuser equipment; ▪ maintenance of the provided premises and territories.	▪ Organization of meetings with potential customers and investors; ▪ organization of participation in conferences, exhibitions, forums, congresses; ▪ coverage of the residents' activities in the media; ▪ promotion of information on subjects of SMES abroad; ▪ increase in the educational level within the entrepreneurial activity; ▪ provision of legal services; ▪ provision of accounting services; ▪ provision of advisory services within support and development of SMES; ▪ advancement of scientific research and development; ▪ adoption of the results of scientific activity; ▪ development of new technologies and their implementation; ▪ ensuring cooperation with universities, research institutes, scientific organizations; ▪ manufacture of innovative products; ▪ integration and coordination of efforts of participants in the innovation process	▪ Determination of market capacity; ▪ analysis of the enterprise position in the market; ▪ provision of services for determining sales channels; ▪ assistance in production planning; ▪ provision of services for setting up the sales process and sales management; ▪ provision of marketing services; ▪ PR and advertising.

In recent years, Russian universities have been actively working to identify the most necessary and significant structural elements of their innovative infrastructure. Researchers describe the elements of the innovative infrastructure of higher school as follows (Mosconi *et al.* 2014):

- an infrastructure of innovative activities is created, *i.e*. its structural and functional elements: centers, departments and institutes of innovative technologies, technology parks, engineering centers, business incubators, innovation and technology centers, centers for commercialization and transfer of innovative developments, *etc*.;
- scientific-methodological and normative support of innovative activities is developed;
- innovative educational programs are developed for participation in competitions;
- personnel training is provided for innovative activities enabling them to make decisions effectively in an innovative society;
- elements of distance learning, Internet education, multimedia training courses and electronic textbooks, etc. are used in the academic activities;
- new opportunities of modern information and communication technologies are applied in all directions of universities' activity.

The production and engineering subsystem of the innovative infrastructure includes a wide range of various elements that perform the services listed above: business incubators, technology parks, technopolises, innovation and technology centers, multiuser centers, etc.

There is no consensus in the academic literature on how to define, measure and implement innovations (Sawhney and Chen 2010, Sood and Tellis 2005), taking into account the existing different models of corporate governance and models of corporate innovative systems in education, industry, agriculture, medicine, etc.

According to the results obtained within the study on the topic: "Research and analysis of strategic programs for the economic and industrial development of the regions for the purposes of working out a set of measures to integrate the results of innovative, scientific and technological activities universities into the economic activities of

subjects of the Russian Federation", it was noted that innovative infrastructure performs a large number of functions aimed at the development of innovative business at different stages of its life cycle. Its elements provide successful growth and functioning of the companies that create innovative products with the subsequent market launch by solving a set of tasks for the innovative infrastructure formation, including the main ones: the increase in the competitiveness of enterprises and their products, the preservation and development of scientific and technological potential. The functions of innovative infrastructure entities are also different; they depend on the business profile, the properties of a particular innovation, the stage of the innovation process, and the goals of the state innovation policy.

The innovative infrastructure is also aimed primarily at the development of innovative enterprises whose activities are based on the creation of an absolutely new product that meets the long-existing or a specially created need. However, to date, not all companies - customers of innovative infrastructure elements are innovative enough.

Using the actual data of the Federal State Statistics Service, the Ministry of Education and Science of the Russian Federation, university reporting data, an analysis of indicators of Russian universities' innovative activities was conducted. In the course of the study, 42 largest universities, carrying out innovative activities, having or creating an extensive infrastructure to support these activities, were analyzed, as a result of which the elements of innovative infrastructure were divided into five groups, among which:

- *centers*: multiuser centers for high-tech equipment; intellectual property management centers; technology transfer centers; scientific and educational centers; innovation consulting centers; innovation and technology centers; centers for innovative activities; marketing centers; business centers; engineering centers, scientific centers; R&D commercialization centers; centers for innovation and youth entrepreneurship; centers for supercomputer technologies;
- *departments*: Postgraduate and Master study departments; innovative development departments;
- *institutes*: research institutes; institutes of innovative technologies; innovative institutions;
- *research and manufacturing complexes*: laboratories; technology parks; business incubators; design offices; experimental sites and pilot production facilities; special economic zones; support sectors for small innovative enterprises;
- *other elements*: research activity management agencies; innovative and educational structures; scientific schools; temporary creative teams; offices for interaction with industry; IT-structures; business companies; certification bodies; TV and radio channels; scientific and technical libraries; support funds for innovative projects; associations of small and medium-sized innovative enterprises.

Further within the framework of this study, an analysis of innovative infrastructures of the studied universities was carried out according to the following grouping criteria (Gruzina 2015a):

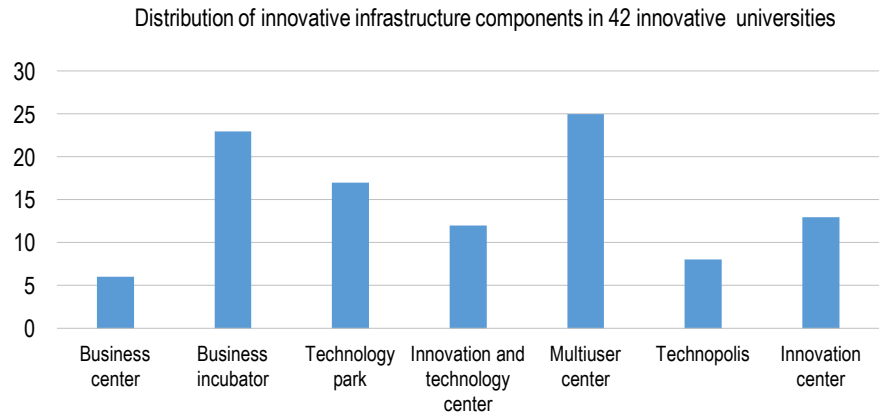
- By types of higher educational institutions: federal university, research university, university. For 85 subjects of the Russian Federation, the conducted analysis showed that 42 universities actively engaged in innovation activities include: 20 research universities, 7 federal universities, 15 universities. The analysis of each element of the innovative infrastructure separately by types of higher education institutions was the second stage of the research. During the research, the following elements of the universities' innovative structure were identified: technology park; technopolis; business incubator; business center; innovation and technology center; multiuser center; innovation center; engineering center; small innovation enterprise; laboratory; science park; and others.
- Structures promoting the development of innovative activities were presented in the studied universities by: marketing center; certification center; patent department; research support center; academic personal accounting and financing department; information department; intellectual property accounting department; and others.
- The analysis made it possible to identify the eight most frequently occurring types of innovative infrastructure components in the universities: business center; business incubator; technology park; innovation and technology center; multiuser center; technopolis; innovation center; special economic zone (Gruzina 2015b).

Further, each element of the innovative infrastructure was studied separately by types of higher educational institutions located in the territory of 10 special economic zones. The results of the study are given in Table 2, (Figure 2).

Table 2. Distribution of innovative infrastructure components (Gruzina 2015b).

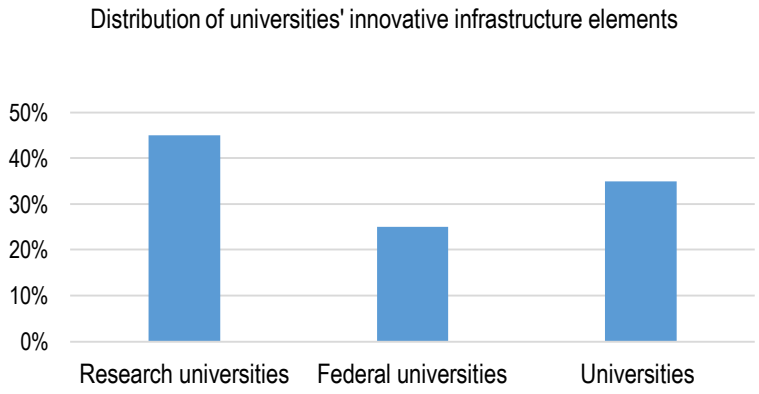
Component	Types of higher education establishments			Total
	Research University	Federal university	University	
Business center	1	2	3	6
Business incubator	11	2	10	23
Technology park	8	3	6	17
Innovation and technology center	5	3	4	12
Multiuser center	12	6	7	25
Technopolis	2	2	4	8
Innovation center	8	3	2	13
TOTAL	47	21	36	104

Figure 2. Distribution of innovative infrastructure components



The data analysis showed that the distribution of the innovative infrastructure elements in each group of universities is uneven, *i.e.* in one university all elements of the innovative infrastructure or most of them can be concentrated, as compared to other universities. Research universities occupy leading positions in virtually all indicators of innovative infrastructure, being more innovative-active than federal and state universities (Figure 3).

Figure 3. Distribution of innovative infrastructure elements according to university types



Subsequent to the results of the systematization and classification of innovative infrastructure components in 42 universities, based on the collected data on the existing elements of universities' infrastructure, the following findings were obtained:

- the universities under study are located in 22 subjects of the Russian Federation: Moscow, St. Petersburg, Moscow Region, Arkhangelsk Region, Kaliningrad Region, Rostov Region, Nizhny Novgorod Region, Samara Region, Saratov Region, Sverdlovsk Region, Chelyabinsk Region, Irkutsk Region, Novosibirsk Region, Tomsk Region, Krasnoyarsk Territory, Perm Territory, Primorsky Krai, the Kabardino-Balkar Republic, the Republic of Bashkortostan, the Republic of Mordovia, the Republic of Tatarstan, and the Republic of Sakha (Yakutia);
- the following elements of universities' innovative structure have been identified: technology park, technopolis, business incubator, business center, innovation and technology center, multiuser center, innovation center, engineering center, small innovation enterprise, laboratory, science park, *etc*.
- the structures promoting the development of innovative activities have been identified in the universities under study: marketing center, certification center, patent department, research support center, academic personal accounting and financing department, information department, intellectual property accounting department, *etc*.
- eight types of innovative infrastructure components most frequently occurring in universities have been identified: business center, business incubator, technology park, innovation and technology center, multiuser center, technopolis, innovation center, special economic zone;
- it has been revealed that operation of 22 business incubators of 23 investigated ones is recognized as effective, operation of 9 technology parks and 5 technopolises is recognized as highly efficient, operation of 4 technology parks and 3 technopolises is medium-efficient, operation of 2 technology parks is low-efficient and that of another 2 technology parks is inefficient;
- it has been revealed that research and scientific multiuser centers are assessed as operating in a highly efficient and medium- efficient manner;
- comparison of the obtained quality assessments of the functioning of innovation centers, business centers and innovation and technology centers in the research area and educational activities has showed that the majority of innovative centers, business centers and innovation and technology centers are assessed as operating in a highly efficient and medium- efficient manner.

Thus, it can be concluded that the university's innovative infrastructure creates conditions for effective operation and provides the university's structural units with the resources necessary for the implementation of strategic and operational (current) processes, namely: financial, material, information, personnel, *etc*.

3. Results

The conducted research has shown that in the modern world the state and community put hopes on the higher school in terms of solving problems that hamper the development of the education system and the entire economy of the country. First of all, this is the low intensity of updating the most important sectors of the country's economy by means of introducing innovative solutions and developments, the low level of competitiveness not only of an individual organization, but also of a certain branch of the economy, insufficiently high production efficiency, preference for imported innovative developments, *etc*. Undoubtedly, only one university and the whole sphere of higher education are unable to change the current situation of a significant lag of Russia in the innovative development. But the higher school, being a closed system, where new knowledge, scientific and innovative developments, high-tech and science-intensive products are generated and produced, can set the course and act as a kind of 'navigator' on the way to building an efficient and competitive economy of our state.

It is interesting that the universities' innovative infrastructure elements, being key elements of small business development and support, are also an instrument of innovation and socio-economic policy. Accordingly, the further development of the processes taking place in the innovative infrastructure of universities promotes the development

and strengthening of the national innovation system of Russia, which is an essential factor in the development of the innovative economy.

It is important to analyze the results obtained by the university from the functioning of its innovative infrastructure in order to identify problem zones and to form an innovative strategy that is adequate to today's situation. Such a practice will allow the universities to carry out 'error correction', intensify innovative activity and make timely and competent decisions in the allocation of priorities for innovative development. All these factors, undoubtedly, will promote easier and more effective search for ways to develop and implement the innovative developments created in the university.

Analysis of the innovative infrastructure models of 42 universities enabled to conclude that the presence of an effectively functioning innovative infrastructure oriented to the needs of the region where it is located contributes to the enhancement and intensification of the university's innovative activities, strengthening the innovative potential of university and region, and to more efficient and effective progress of innovative processes in the region. Therefore, in our opinion, it is necessary to develop innovative infrastructure elements in the Russian regions in the framework of scientific and technological priorities and innovative plans for the universities' development.

The study showed that the factors hampering the innovation activity of Russia include a lack of qualified personnel; slow pace of modernization of infrastructure sectors of the economy; low level of support for inventive and rationalization activities; acute lack of information about sales markets and new technologies. At the same time, human capital is one of the most important competitive advantages retained by Russia from the viewpoint of innovative development. In terms of the share of the population with higher and additional vocational education (22.8% of the population aged 25-64), Russia is at the level of such leading foreign countries as Great Britain, Sweden and Japan, and also ahead of Germany, Italy and France. The maintained high level of higher education in natural science and engineering and technology is especially important from the standpoint of creating an effective innovation system (Lerner and Tag 2014).

The research revealed that the formation of the innovative structures themselves, equipped with modern scientific laboratories, testing centers, pilot and industrial production facilities in the territories of the regions is the main characteristic of the innovative infrastructure development in the Russian regions.

In our opinion, within the framework of forming an innovative plan for the universities' development with the current demands of the economy and industry, it is expedient to single out the following component elements:

- the production and technological component is aimed at creating favorable conditions for enterprises to access production resources, which include engineering centers at the universities, business incubators, technology parks;
- expert-consulting component may include: innovation-consulting centers, coaching centers, intellectual property centers at the universities, *etc*.;
- personnel component implies training of highly qualified specialists in the field of innovations: higher educational institutions;
- informational support of innovative activities in the region is focused on the formation of information and analytical material that is necessary to make informed and effective decisions in the field of innovative development of the region;
- financial component includes institutes of investment activity infrastructure of the regions (municipal, venture, insurance, guarantee, innovation, funds, *etc*.);
- marketing component in the infrastructure of innovative activities of the region is directly related to the commercial attractiveness of innovations. This element contributes to the establishment of a relationship between scientific organizations, universities and consumers of innovation, which, in turn, creates the conditions for the transition from an idea to a final innovative product. The main discussion results of the study are presented in the next section.

4. Discussion

The conducted research, as well as the opinion of leading domestic and foreign scholars, confirms the fact that the creation of an innovative infrastructure of higher education is a prerequisite for achieving not only current but also

strategic goals. In our opinion, to develop the university's innovative infrastructure, the following recommendations should be adhered to.

1. When creating an innovative infrastructure in the Russian universities, it is necessary to take into account a number of factors: the profile orientation of the university, the features and level of its development, the composition and qualifications of the personnel, the provision with financial and other resources necessary to create an effective model of the university's infrastructure. It is also necessary to take into account the regional aspect: one cannot compare and equalize the capabilities of the Moscow or Siberian university, even if it is the leading one in its region. The models of innovative infrastructures that are applicable in the mentioned universities will be fundamentally different, since innovative activities in the capital of our country have been developing for a long time, and in the regional universities innovative processes have been launched since the activation of the state innovation policy, *i.e.* within the last ten years.

In our opinion, significant changes in the sphere of higher education of Russia were caused by the conviction not only of the country's leadership, but also of the society as a whole, in the reality and the possibility of creating internationally competitive, practically applicable and strategically important research and development and science-intensive and high-tech products in the Russian higher education institutions. This will allow the university not only to create tools for economic growth, but also to facilitate the transition of our country to an innovative economy based on knowledge and new technologies. But the lack of a generally accepted system for forming the models of the university's innovative infrastructure greatly complicates this much-needed and important process. In today's difficult economic and political environment, the creation of our own efficient production facilities based on new technologies and the abandonment of the dependency on raw materials is especially urgent. The majority of scholars are unanimous that the construction of own innovative strategy and performance of innovative activities should be associated with the functioning of the innovative infrastructure. At the same time, it is important to correctly form the innovative infrastructure model to take into account all the individual features of the university.

Analysis of the world and national experience in the formation of the university's innovative infrastructure led to the conclusion that linear models are not enough to take into account all innovative processes. Foreign experience of development points to the main drawbacks of linear models of building an innovative infrastructure (Engovatova 2013):

- unjustified enthusiasm for commercially ineffective scientific and innovative developments;
- lack of the possibility of forecasting the appearance of new developments of competitors;
- disunity and lack of stable relationships, focus on the overall result between research and other units of the organization;
- complexity in the organization and low effectiveness of commercialization of innovations.

The need to find possible ways of eliminating the above-mentioned imperfections of the linear model of innovative development was obvious. Scholars with world names conducted research and development aimed at creating a perfect model, which resulted in the formation of a nonlinear model of innovative development and innovative activities, which was called the 'coupling model of innovations'. Its uniqueness consisted in the determination of consecutive, logically substantiated and isolated in functional terms stages which at the same time are closely interrelated and interdependent. Positioning of innovation as a result of technological advantages and of public expectations claimed to the organization, as well as the application of an extended method of describing innovative activities and innovative processes are undeniable advantages of this model (Mirolyubova and Sukhanova 2013).

It should be noted that not all scholars unanimously adopted the nonlinear model as a standard. The lack of unity in the opinions of scholars initiated the search for a model that would take into account the shortcomings of the existing two models. Engovatova (2013) argues that today new knowledge is the most important source of economic growth, which is the basis for assigning a key role to the university in solving the most important problems of the economy.

In the scientific environment, the models of organizing innovative activities and building the university's innovative infrastructure are treated not strictly chronologically, but as reference ones, *i.e.* there are ideal distinctive

features that do not deviate from the basic principles within the same epoch. Also, the boundaries between the epochs are not clear; therefore, some principles of the 'pre-classical' university were reflected in the practice of the 'classical' university and vice versa. The post-classical period is marked by the transition from the corporate model to the state model (Sood, and Tellis 2005). The State University was established to meet public interests and expectations, promote the country's economic development. The causes of the crisis of the classical university concept and the transition to the postclassical model are (Gladwell 2010):

- the growth of the importance of scientific discoveries for the social spheres of public life;
- complicated educational process;
- complexity of entering university;
- formation of new values in the student environment;
- reorientation of society towards universities;
- formation of a new model of public thinking;
- emergence of 'sponsorship' and the growth of its value;
- close cooperation of universities with the real sector of the economy.

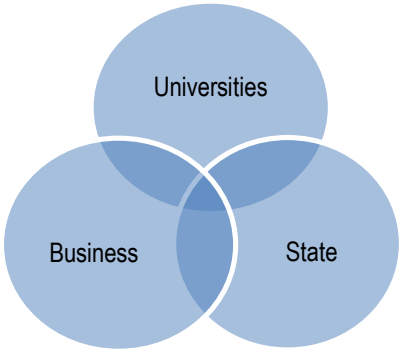
To increase the effectiveness of the innovative infrastructure of Russian universities, foreign experience was studied.

Thus, the basic principles of the Anglo-American model are (Florida *et al.* 2011): the rights to created innovative products and/or innovative development are transferred to an external company under a licensing agreement. The most important element of the university's innovative infrastructure model is the center of commercialization and transfer of innovative developments, whose competence includes the functions of safeguarding and protecting research and innovative developments and transferring exclusive rights or licenses to it to external counterparts. Basic principles of the continental model are (Florida *et al.* 2011): the university's innovative infrastructure model includes also facilities supporting basic infrastructural elements, designed to support innovative processes for the purposes of obtaining the final result. It is common to create 'ready businesses' and bring them to real economic conditions.

However, it should be added that the achievement of the maximum performance of the university depends largely on the internal and external management style of the university authorities. It seems that the university authorities should pursue the goals of establishing effective contacts with state bodies both at the regional and federal levels; cooperation and exchange of experience with other universities; establishment of long-term relations with the real sector of the economy, etc.

It is important to note that not all perceive innovative function of university from the position of the model of interaction between university, state and business (the 'triple helix' model). Thus, the Triple Helix model includes the state, science and business, as well as education and civil society, which give it signs of universality (Figure 4).

Figure 4. Triple Helix model



While the Penta Helix model relies on such a category as an 'innovative person', where his consciousness, interests and needs are linked by all the components of this model (Fedorov *et al. 2012,* Zhou *et al.* 2016).

2. There is a widespread viewpoint that structural changes in the economy require a 'critical mass' of persons interested in these changes (Florida *et al.* 2011). In this regard, the universities' innovative infrastructure, as one of the mechanisms of state innovation policy, can pursue such goals. It should be noted that a number of existing indicators assess the size and capacity of the social layer of innovators in the country at a sufficiently high level. For example, according to a study by the Martin Prosperity Institute, Russia occupies a high position in terms of the creative class ratio: according to this indicator, the country ranked 13th out of 82 countries ranked by the global creativity index, i.e. it reached a sufficiently high level (MPI 2015).

However, there are other estimates pointing to the fact that the 'critical mass' of innovators, as a sufficient number of individuals and legal entities focused on innovative behavior, is not formed in Russia (Shadrin *et al.* 2015):

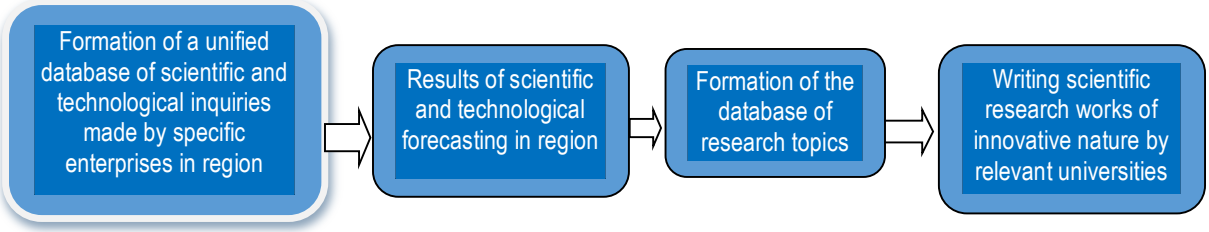
- the Russian economy is characterized by a high level of monopolization – 801 companies concentrate 30% of the country's GDP. At the same time, among small and medium-sized businesses only 4.8% of enterprises implement technological innovations;
- the level of early entrepreneurial activity makes 5.8%, the level of the established entrepreneurial activity is 3.4%, which is much lower than in many developed countries of the world. At the same time, about 90% of entrepreneurs stated that they do not use the advanced or new technologies at their enterprise;
- in 2012 in Russia the share of self-employed people (entrepreneurs) was 5.3%, making on average 11.2% in the European countries.

Thus, in the Russian Federation, the formation of a 'critical mass' of innovators who are capable of exerting a significant influence and acting as the main driver of structural changes in the Russian economy is proceeding at a low rate. Implemented measures to develop innovative infrastructure also do not contribute to accelerating this process.

In these conditions, the implementation of the functions of the university's innovative infrastructure is possible only after the establishment of close mutually beneficial relations with state authorities and the real sector of the economy. At the same time, the university promotes the state in analyzing, assessing, forecasting the scientific, technological and social development of the region and the country as a whole, implementing strategic tasks set by the state within the competence of the university, training highly qualified specialists for the national economy, etc. In turn, the state contributes to the provision of state orders for training specialists, funding innovative projects, stimulating the priority activities of the university, *etc*.

And the real sector of the economy, being the final consumer of innovative developments, provides private investments, ensures market demand for scientific, innovative and high-tech developments; it is also expedient to form the analyzed system process of interaction between the universities and specific enterprises of the regions at the micro level according to the following scheme (Figure 5):

Figure 5. The process of interaction between the universities and enterprises of the RF regions



The process shown in Figure 5 is presented at the micro level; it is of a universal nature and can be detailed for each region, since the needs of each enterprise and the innovation financing system are unique. Let us analyze the presented process of interaction between the universities and enterprises of the regions:

- formation of a unified database of scientific and technological inquiries of specific enterprises in the region. To create this database, each enterprise must conduct an analysis of its economic activities, including financial indicators, social significance, *etc*. At the same time, it is necessary to analyze the need and profitability of introducing innovations and the way they are financed. It is advisable to classify companies

of the regions on different grounds: public, non-public; according to the size of the capital (statutory, joint-stock); according to the structure of the share capital (private, state, with the participation of the state), *etc*. This classification will clearly define the possibilities of financing the process of creating and implementing scientific and technological developments. It should be noted that the methods of financing directly depend on the level of industrial development of a specific region, its investment attractiveness, resource base, human resources, etc.;

- formation of results of scientific and technological forecasting at the macro- and micro-level; determination of requirements for scientific and technological developments and the possibilities of their implementation at the level of an individual company, the region itself, and the country as a whole. The results of scientific and technological forecasting will enable to identify the regions with the highest level of needs in scientific and technological developments, the necessary budget and ways of financing them, *etc*.;
- formation of the base of scientific and technological inquiries is a source of creating a database of research topics. Thus, on a competitive basis, universities can win and carry out the stated research work subject to agreements, establishing temporary creative teams. Moreover, universities can fully use their potential, thus attracting extra-budgetary funds for the development of their organization in different directions. Undoubtedly, the theme of each research work in the field of innovations should be directly related to the needs of a particular enterprise. It should be noted that the presence of a university that performs scientific work in the territory of a subject of the Russian Federation is not necessary, since the development of information technologies allows creating effective communications remotely;
- writing research works of an innovative nature by the respective universities. To write a scientific research work, the university undergoes a competitive selection procedure. For each topic of these works there can be different requirements to the staffing and qualitative composition of the creative team. Also, a contract is concluded with the university for the performance of the winning research work; the terms of reference are formulated and reconciled with the customer enterprise; a temporary creative team is created that meets the necessary criteria; the deadline for the performance of work is established, if necessary, in a step-by step manner. It is advisable to determine the requirements for the defense (acceptance) of the research work. If the innovative developments created by the university are to be put into operation, it is important to reflect the implementation process and other necessary technological procedures, *i.e.* establish constant feedback.

3. The establishment of entrepreneurial universities and public-private partnership mechanisms to create innovative developments for the industry of the regions can be another line of developing the university's innovative infrastructure.

The entrepreneurial university is a public institution that provides the basis for regional and national growth and development through more intensive interaction with the external environment. Generally speaking, this term is understood as a higher educational institution capable of attracting additional financial resources to support its activities, a university which uses innovative teaching methods, a university which develops close interaction with the business community where the innovations of universities' scholars are implemented.

Characteristics of the entrepreneurial university include (Puffal *et al.* 2016, Scoponi *et al.* 2016, Zieba 2013):

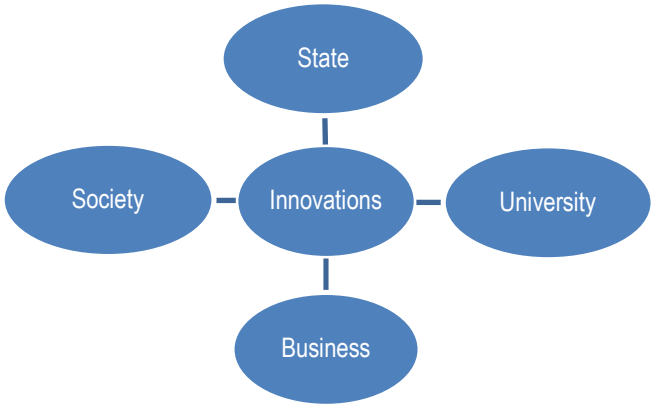
- for the university to become entrepreneurial, it is necessary to develop entrepreneurship in each of its parts; to create a single-minded university where each of the employees, each faculty shares a single system of values, this is a prerequisite for the establishment of an entrepreneurial university;
- having strong university's authorities is an important factor in transforming the university toward an entrepreneurial one, enhancing its flexibility, accelerating the perception of changes in the environment, responding to them, focusing on the increased and changed demand for university's services;
- the entrepreneurial university seeks sources of financing other than the state ones, and thus ensures its financial independence, which allows it to preserve its autonomy and prevent full commercialization (leaving the right to choose the type of commercial activity and refusing to sacrifice its mission, the quality of research and training);

- the entrepreneurial university develops various forms of partnership relations and links with the world outside the university, through which it provides the transfer of knowledge and technologies, establishes links with the business community, develops intellectual property, provides lifelong learning, finds additional sources of financing, develops interaction with alumni and so on.

However, the formation of entrepreneurial universities needs creating a regulatory framework at the federal and regional levels. It is advisable to form a mechanism of public-private partnership which is able to introduce the state-university-business-society interaction. These projects can be implemented at the regional level, since each region has its own specifics of development, human resources and scientific and technical potential. Thus, from the systemic state policy in the field of introduction of innovative developments in the enterprises of the regions, it is possible to pass to point developments and creation of targeted regional industrial development programs.

Figure 6 shows the elements that influence the formation of the universities' innovative infrastructure within the framework of public-private partnership.

Figure 6. Formation of the universities' innovative infrastructure within public-private partnership



From the of the university's viewpoint, there are four key formats of activities related to the innovative infrastructure facilities in the world practice: the transfer of a technology protected by a certain way to a third party based on the alienation of the exclusive right; transfer of the right to use technology to a third-party company on the basis of a license; performance of research and development by the university under the order of a third-party company and transfer of the results to it in accordance with the terms of the contract; conducting consultations by the faculty members under the orders of third-party companies in their spare time. Establishment of intellectual property management centers in the Russian universities which will work in the following areas: transfer of technologies, which involves the transfer of technology to the external owner, who will implement it further, application, entry to the market; commercialization of innovative technology, which involves the profit extraction by creating and organizing activities of small innovative companies at the university.

Thus, the process of interaction of the main participants of innovative processes in the business center, business incubator, technology park, innovation and technology center, multiuser center, technopolis, innovation center, special economic zone in the 'state-business-science' cluster proceeds in an ambiguous and non-linear manner, with rapid change of leaders in a complex interlacing of interests, goals and actual prospects. Therefore, the effective functioning of the entire innovation cycle: from receiving orders for new developments to promoting the intellectual activity results to the market is the most important task of the innovative economy. The main efforts in the innovation sphere should be directed to the formation of mechanisms for capitalizing intellectual potential and creating modern economic and production institutions and infrastructure elements for the development of innovative projects.

Conclusion

In the conditions of rapid development of society, fundamental changes are taking place in the system of higher education. Today we observe processes of sustainable integration and cooperation of science, education and the real sector of the economy, as a result of which high results are expected from the higher education system, first of all, making a significant contribution to the formation of regional and national innovative systems.

The article considers approaches to forming the university's innovative infrastructure as a set of interrelated and partly interdependent structural elements of the university's innovative activities with the overall goal of bringing innovative, organizational and information processes to a logical conclusion. The article reveals that the economic nature of the university's innovative infrastructure is determined by the high degree of influence exerted by innovative processes on the economic development of the region and the country.

The conducted analysis of the innovative infrastructure of 42 universities showed that the university's innovative activities are characterized, basically, by the stages of initiation and materialization of the idea; and such stages as the implementation efficiency assessment and innovation diffusion are in the course of formation and development. It can be stated that the appropriate management structure has not yet been formed, there are no clearly defined principles for creating the university's innovative infrastructure, and management functions at these stages of the innovation process have not been defined. Based on the outcomes of analysis of universities' R&D, it can be concluded that in most cases they are related to investment development, because there is no mechanism for their commercial implementation.

Studies of the universities' innovative activities have shown that most innovative infrastructures belong to the production and technological type of the organization, more than 20% of universities have an expert and consulting structure, 11% of organizations are characterized by a financial and investment structure. At present, 8 components of the innovative structure are characteristic for the universities: business centers, business incubators, technology parks, innovation and technology centers, multiuser centers, technopolises, special economic zones and innovation centers. Moreover, business incubators and innovation and technology centers can be referred to young innovative companies, which are present in 20 universities of the 42 surveyed. The multiuser centers available in 25 universities are the most common structure.

A parallel is drawn between a business company and a modern university with increasing frequency. In terms of business scope, number of employees, types of activities and other parameters, the university already refers to large management systems that are based on the principles and instruments of corporate governance. Studies have shown that the university's innovative activities depend on the state of the innovation environment, the external environment of the innovation organization. The main barrier to effective cooperation between universities and business is the absence or lack of institutional support, namely: there are no structures regulating innovation activities or they are insufficiently developed; there is no transparency in the organization of innovative activities; there is low level of trust among the participants and innovative infrastructure imbalance. Currently, the universities do not have permanent close cooperation with business in the innovation field. In addition, often they do not raise sufficient revenues from the commercialization of innovations.

The study showed that the range of innovative sectors of the regional economy and the need to introduce innovations should be expanded – it is not only industrial enterprises, but also enterprises of other sectors of the regional economy, since not all regions have industrial orientation – the share of agrarian-industrial sector is high, as well as the share of the construction industry materials sector and the tourism and recreation sector. Innovations should be focused, first of all, on those industries that are drivers of the regional economy as a whole.

To increase the effectiveness of interaction between scientific structures, universities, specific enterprises at the regional level, it is proposed to create the following model: to form a unified database of scientific and technological inquiries of specific enterprises in the region; on their basis, using the results of regional scientific and technical forecasting, to create a database of research topics; to arrange the implementation of priority research works of an innovative nature on a competitive basis; to implement the results obtained and commercialize innovation. The presented model is universal and can be detailed for each region, taking into account its specifics.

The advantage of the proposed model is the openness of the innovation process, as a unified base is formed for not only the inquiries of enterprises, but also for research and development.

Acknowledgements

The article presents the results of studies that are carried out on the topic: "Research and analysis of strategic programs for the economic and industrial development of the regions aimed at working out a set of measures to integrate the results of innovative, scientific and technological activities universities into the economic activities of subjects of the Russian Federation".

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Methodology for Universities Economic Impact Assessment in Central and East Europe Countries

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Abstract:

Universities are considered to be as one of the main drivers of regional development by a number of authors who are convinced of the positive impact of universities on the region. There are a number of methods of quantification the impact of universities on the region. However, due to the unavailability of data, these methods can not be applied to the countries of Eastern and Central Europe. Since the European Commission has not established any comprehensive methodology to analyze the impact of universities on regional level of countries of Central and Eastern Europe it is necessary to derive the data for regional impact analysis from national available data. The article analyzes the theoretical basis and various empirical studies measuring the impact of universities on the region. We also analyze the appropriate method for quantification of the impact, where the Flegg locational quotient was chosen, which is able to quantify the influence of universities in various fields of economic regional development, such as regional employment, added value, of output or income through regional multipliers obtained from national input-output matrix.

Keywords: university impact; economic impact assessment; FLQ; regional multiplier

JEL Classification: C67; I23; R15

Introduction

The article is focused on issue of universities economic impact assessment on regional level. Many empirical studies from this field can be found within the literature, but only few of them are from the Central and East Europe. The reason for this is unavailability of regional multipliers, which are the basic condition for induced (total) economic impact estimation for region.

The aim of this article is to deal with the problem related to the regional multipliers and propose the methodology for economic impact analysis applicable in the Central and Easter EU countries. The main contribution of this article is in describing of theoretical and practical approaches for deriving of regional multipliers from the national input- output matrix.

In the first part, paper describes the theoretical background of EIA of universities on regional level and different types of impacts are discussed. The first group of impacts are the short term impacts, which generates direct, indirect and induced effects within the region. The sum of these impacts gives the overall university short term impact on a region. The second group of impacts are long-term effects related to accumulating knowledge, human capital and attractiveness of the area where the university is located.

The second part describes the five empirical studies for five different universities. For empirical studies of following universities were analyzed: University of Strathclyde in Glasgow, University of Birmingham, University of

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Warwick, Kent University and University of North Carolina. All of the mentioned universities have a different approach to measure its impact (short-term or long-term).

The last part proposes the methodology and it deals with the main differences found between the above-mentioned empirical studies. This part of the paper is describing the most appropriate approach which is devoting the regional multipliers from the regional i-o matrix through Flegg´s location quotient, FLQ. The part also deals with the description and application of four types of multipliers, which are the output multiplier, income multiplier; value added multiplier and employment multiplier.

1. The university and its role in the region

There has been a rapid development and growth in the number of universities in the recent years. Universities were defined traditionally as educational institutions, with main purpose to educate students. By doing this, the university contributes not only to improving regional human capital, but also through the spillover effect also to economic growth. These spillover effects are usually related to research activities of universities, which support localization of new firms within the region and help existing companies to be more competitive through innovation. At the same, time this effect increases demand for high-skilled workers. University, as one of the main drivers of economic development is characterized by a number of influences on the city, as well as on the region itself. The role of universities in regional economic development is discussed in many publications and contributions. Among the most famous authors of publishing in this field we include. D. Felsenstein, J. Goddard, P.S. Benneworth, H. A. Goldstein, H. Etzkowitz, K. Stokes, R. Florax, R. Thanki, H. Folmer, R. and M. Hamm Wenke. All authors agree on the positive impact of universities on the region and focuses on different aspects of the contribution of universities to regional development (Výrostová 2008). During the last 20 years a number of studies and researches about effects of higher education institutions on regional and national economic situation were created.

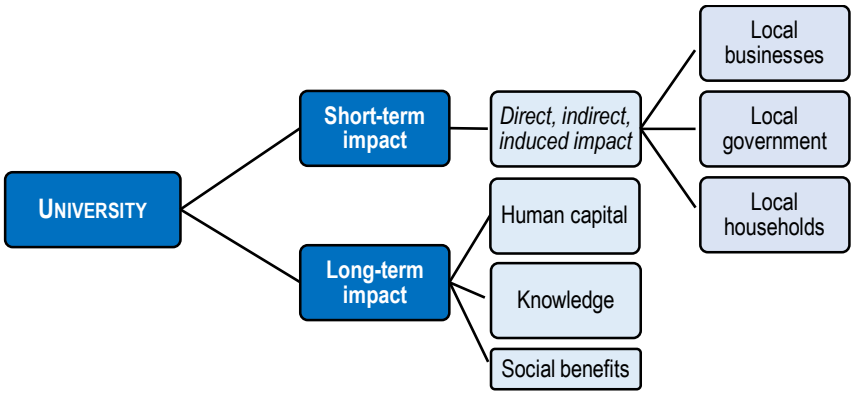
According to (Felsenstein 1996), the impact of universities in the region could be twofold. First impact can be considered as short-term impact, relating to expenditures. In particular, these are the expenditures made by students, staff or universities themselves (for staff salaries, purchase of goods and services, *et al.*). Even though the impact is short, the economy will take effect immediately, whether through increased demand for goods and services, through both increased employment and income. These short-term effects are divided into three smaller groups, depending on effects beneficiaries. The short-term impact of universities in particular concern households, local government and local businesses, respectively, household income, income of entrepreneurships or tax incomes (Felsenstein 1996).

These short-term impacts generate direct, indirect and induced effects within the region. Direct impacts are related to expenditures of universities and increase the demand for various goods and services within the region. Indirect impacts are caused by the increased regional demand for goods and services from university students and employees. Finally, induced effects are related to further round of purchases realized by firms, which benefits from direct and indirect effects. These induced impacts are usually estimated with use of regional multipliers. The overall impact of universities on the region is thus represented by sum of direct, indirect and induced impacts.

The second group of impacts are long-term effects related to accumulating knowledge, human capital and attractiveness of the area where the university is located. These affects are related to human capital, which universities help to increase, concerning only capital remaining in the region. Secondly, there is an improved knowledge base, in particular by linking universities and industry. Finally, the university in the long run improve the attractiveness of the area as it creates positive externalities related to the quality of life, such as the location of the companies, and various social and cultural benefits for the region. It shows that in the case it is about not only the financial measurements of spending, but also that universities affect the region in the long term in various areas, which are difficult to quantify. Therefore, it is difficult to find a suitable model to determine the long-term impact.

The next figure shows the distribution of different kind of impact of universities on the region.

Figure 7. University impact types



Source: authors based on (Výrostová *et al.* 2007)

According to previous research of Goldstein, Maier, and Luger (1995) (Drucker *et al.* 2007) there are eight different functions of modern research universities that could potentially lead to economic development impacts. First of all, the *creation of knowledge*, which is the main goal of universities. Secondly, *Human-capital creation*, which helps the university, its students and researchers in developing their own intellectual and technical skills. Thirdly, *transfer of existing know-how*, which helps to apply already existing knowledge to solve a new problem, usually to improve some product or a process. *Technological innovation*, the fourth function, which helps to create a new product and process at the university itself, and often leads to patenting or licensing the results. Next, the *Capital investment*, which refers to constructing and maintaining buildings, laboratories, research parks, and other infrastructure. Furthermore, there is *Regional leadership,* which includes the employees of the university and their direct participation on local committees and boards. The last but not least, *Knowledge infrastructure production*, which are not only the institutions which produce knowledge, but also the learning capacities of firms, workers, and institutions and the network of connections among them. Finally, *the influence on regional milieu*, which refers to attracting and concentration of highly educated professionals, who deliver their contributions to their surrounding areas.

2. Theoretical and empirical studies of universities importance evaluation

The previous text outlined typical university impact on the regions. Keeping former distribution of university impact to long and short term, this chapter describes in more details the theoretical and empirical outcomes of this issue.

There are many approaches to the methodology of measuring the impact of universities in the short term. The short-term impact of universities focuses mostly on impacts of students, employees or universities expenditures realized within particular region. Estimation of these impacts can be based on the theory of export base, while the university, as the basic industry, by exporting its goods and services (education) increases the demand in the local sector. (Rehák *et al.* 2015). Another approach to short term impact measuring is ACE method that examines the impact of universities on households, local businesses and government (Výrostová *et al.* 2007). The disadvantage of this approach is according to authors, that this method does not take into account the resolution of local and regional impact. According to these authors the short-term effects of universities on the economy may be also measured and evaluated through analysis of income and expenditure which Keynes (1936) described as an analysis of the gross output and disposable multiplier. Another approach is the use of input-output analysis, which through a complex matrix of inter-branch relations and multipliers helps to estimate what is the overall change in the economy as a result of changes in different parts of the local demand. This is also the most used method in empirical studies dealing with the regional economic impact of universities.

The estimation of university long term impact is more difficult issue. Quantification of long term impact is usually based on neoclassical theories and the new growth theory. (Rehák *et al.* 2015). The long-term effects, as it was mentioned above, are usually related to the accumulation of knowledge capital or increasing the overall

attractiveness of the area. Knowledge production function is one of the approaches used for evaluation of long term university impacts (Jaffe 1989). Knowledge production function explains the positive relationship between university expenditures on research and development and private sector innovations. Another example is the (Felsenstein 1996) approach, which focused on the increase of human capital, in terms of expected future earnings of university graduates who spend these revenues in the local region.

Most of the empirical studies are based on previously described theoretical models. Empirical impact studies are mainly used for assessing university impact on the region or national economy. There can be found different types of empirical impact studies in the literature. Most of them are focused on short term effects by estimation both direct and indirect impacts of universities. (Drucker *et al.* 2007) in his article, for example, describes different ways to estimate this impact, such as growth accounting, regional input-output modelling, estimation of Keynesian multipliers or regional economic forecasting model.

As an example the impact study of Biggar Economics 2013 University of Strathclyde in Glasgow can be used (Biggar Economics 2013). This study describes not only short-term effects, but also deals with estimation of universities impacts on innovation and the development on local, regional and national level. The study divided influences into four groups: direct impacts, impacts on suppliers, employees and impact of expenditure from capital expenditure. The impacts are estimated on the basis of gross value added and number of employees. The suppliers were divided into 2 groups based on the location and industry and were analysed as well. The number of jobs it has received on the basis of turnover per job in all sectors were also estimated. According to study authors, by calculating the impact of employees it was needed to divide the employees on those employees who spend their income in the city (residents) and those who are not residents. The total expenses of students or students' work in turn are used to estimate the impact of the students themselves on the city of Glasgow. The authors of the study consider also the long-term impacts, which were described as a future productivity growth through higher education of residents. The multiplied effects that these impacts cause were calculated based on the Scottish economy and for the multipliers itself in Glasgow using one third of that value.

Another example of the university which assessed the impact of the University through impact studies is the University of Birmingham (Oxford Economics 2013) and focuses on education, employment, economic impact, research, internationalization and community development. These impacts were evaluated by the regionalised input-output analysis, in which the university uses the Flegg local quotients adjust national I-O tables for regional use. The economic impact has been estimated on the basis of value added, number of jobs and tax revenues. To estimate the impact of research and development, the study was focused on acquired research and development funds, on number of publications or patents or on university participation in spin-off companies. Other areas, such as internationalization and community development were estimated by the number of visitors on international conferences and the success of various social projects, the number of volunteers and operation of infrastructure.

The next example of empirical study is the University of Warwick (Impact studies of University of Warwick 2013). The University impact in this study was based on estimation of economic impact, innovation, education and training, culture and community and global networks. The university's economic impact was estimated by spendings of staff, students and university itself, which was weighted for seasonal differences and indirect multiplier effects. The innovation impact was estimated through the analysis of the science park owned by the university. The park provides full range of different services to more than 1800 companies in the region and it also attracted new companies, which creates new jobs in the region. The university also helps support SMEs performance in the region through the newly launched Enterprise Research Centre. Long term impact was evaluated through the university the partnership with different healthcare organisations (Warwick healthcare partnership). The long term effects of university were for example visible in children's increased reading skills or their confidence, which the university helps to improve through various volunteering projects.

The regional impact of Kent University (Impact studies of University of Kent 2014) was also measured using empirical impact study. For instance, through expenditures of international students, the university made an important contribution to the UK balance of trade. The university is also one of the largest employers in the region with around 3400 employers. The university had also an important role in the recent economic recession. Since the university is a non-profit organization, during this time, its expenditures were generating economic activity, output

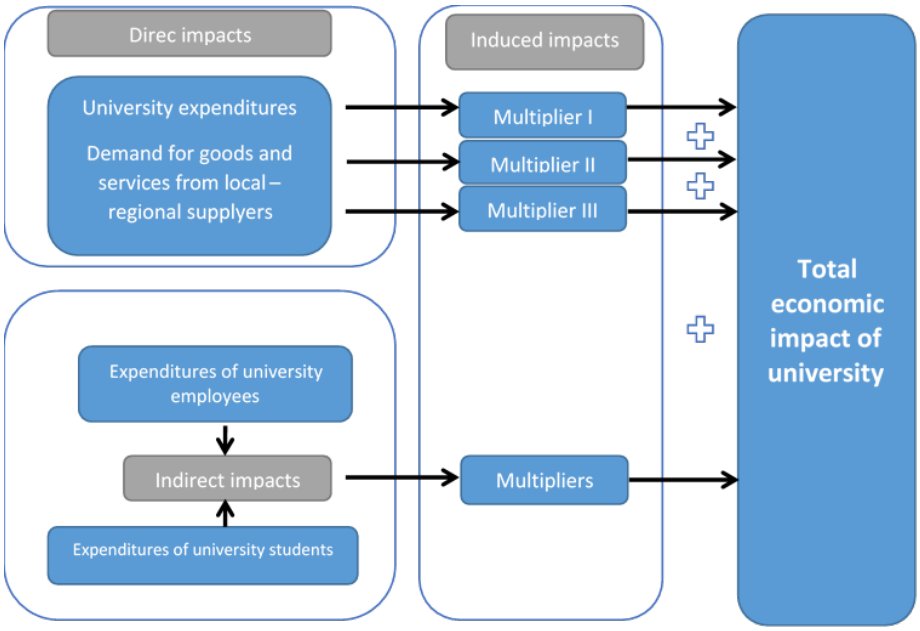
and jobs in the region, while many other businesses were contracting. There is a number of cultural and sport activities, which the university makes a key contribution to, so that it could spend all the additional incomes through sold tickets or spending of the visitors. The university itself also provides opportunities for those, who would like to boost their region with supporting the community through various volunteering activities. Finally, the University of Kent provides the largest conference venue in the south east. During the spring and summer holidays a number of different events take place, which increase the number of visitors and its spends in the region. In the case, the university impact evaluation was based on estimation of all described activities on the region.

The last empirical study selected for this paper is the University of North Carolina (Luger *et al.* 2001) which examines the quantification of net and gross short-term effects. The overall university impacts on the region are considers as the gross impacts while the net impacts are calculated as impacts directly related to university existence (the effects that would not exists without existence of university) In connection with this quantification, the authors from the university uses the REMI model, which consists of input-output analysis and additionally incorporates an analysis of the labour market or the stock or capital requirements, wages and prices. The model works on the basis of estimating the future development of the economy, which is compared with developments that would occur even without the existence of the university.

3. Methodology framework for short-term university impact assessment

The previous part of this paper, dealt with theoretical models as well with the empirical impact studies of universities on the city or region. One of the main aim of this article is to propose the methodological framework for university impact assessment for universities in Central and East Europe. As can be synthesized from previous text the university impact assessment consists of three basic steps. First of all, measurable university impacts must be identified. All of the analysed studies considers mostly the expenses of students, university staff and university itself as the main short term direct impact on the region. The second step is to adjust these direct and indirect expenditures to impacts on regional economy. This step contains for example the adjustment of staff savings, excluding no regional suppliers from analysis etc. The last step is the calculation of induced effects.

Figure 8. The total economic impact of university



Source: authors

The figure refers to the quantification approach of direct, indirect and induced effects. For direct impacts are considered to be the expenses of universities. These impacts affect the region directly by the universities of demand

for various products and services from suppliers. To quantify these impacts, a list of all purchases from suppliers divided into four groups, depending on whether the company local, regional, national and foreign is required. On the other hand, employee's expenditures and student's expenditures are estimated based on a questionnaire survey, and it is particularly important to exclude those employees, respectively students from the survey, whose expenses are going out of the local city or region. Induced effects are estimated through regional multipliers of output, employment, value added and income. Finally, the overall regional economic impact of universities on regional output, employment, value added or income is calculated as the sum of direct, indirect and induced effects.

This is also the part where the main differences between these studies was found. As we stated above, some studies used as the regional multiplier one third of the national one, some of them rather use the REMI model to calculate the regional impact while the others use the regional multipliers. In most of the Central and East Europe countries the regional multiplies and not available. It is also one of the reasons why impact studies are generally not available so often in these countries. The most common approach for regional multiplies calculation is the use of Input Output (I-O) model. There exist development general models such as IMPLAN or RIMS II, which are based on I-O models and provides regional multipliers. These models are not providing multipliers for Central and East Europe countries and applies fee for use. The next possibility is the use of econometric models such as REMI, or HERMIN, but again in most of the Central and East Europe countries it is not possible due to unavailability of needed regional data. (Džupka, *et al.* 2008). The last choice is already mentioned Keynes multiplier, but the quantification of these local multipliers are very demanding on primary research. The most useable approach therefore is to devote the regional multiplies from regional I-O matrix. There exist two basic possibilities for the compilation of the regional I-O matrix. The best approach is the primary research. This approach is very time and money demanding and therefore it is applied usually in large regions, like for example German federal states. For smaller regions which are typical for Central and Eastern Europe countries the best possible way is to derive regional I-O matrix from the national one. The most used approach nowadays is the use of local quotients. These quotients mostly use the employment to express the ratio between the share of employment in a particular sector in the region and the corresponding share of employment in the sector in the national economy. Thank to this approach, it is possible to get the I-O matrix, which reflects better sectoral structure of the regional economy. If this quotient is greater than 1, it means that the sector has a small representation in the regional economy and it can be supposed, that this sector itself will not be able to cover all regional demand of its products and services. In other case, when the quotient is lower than 1, the region is sector specialized and does not require import from another regions. By multiplying of national technical coefficient by computed location quotient the need of regional import can be estimated and the regional technical coefficient of particular sector can be derived. (Džupka, *et al*. 2008)

The first possible location quotient, which can be used for adjusting the national matrix to regional, is the simple location quotient (SLQ). Let's assume, that E_{ir} (E_i) is the regional (national) employment in *I* sector (i=1, ...,n) and $E_{.r}$($E_{..}$) is the total regional (national) employment, then to calculate the SLQ we use the following formula:

$$\mathrm{SLQi} = \frac{E_{ir}/E_{.r}}{E_{i.}/E_{..}} \tag{1}$$

(Kowalewski, 2012)

This approach however does not consider the interregional trade and the fact that each regional sector can import and export goods and services at the same time. This shortage was eliminated by the cross – industry location quotient (CILQ), which is considered to be the first improvement of the SLQ. This approach is based on the relationship between the regional sellers to regional buyer's sector and the national sellers to the national buyer's sector. In other words, the CILQ is the share of the national SLQ on the regional SLQ. The following formula is used for calculating the CILQ:

$$CILQ_{ij} = \frac{E_{ir}/E_{jr}}{E_{i.}/E_{j.}} = \frac{SLQ_i}{SLQ_j} \quad (2)$$

where: E_{jr} (E_j) is the regional (national) employment in the buyers' sector. The main disadvantage of this formula is that it does not take into account the size of the region.

This problem was solved by the Flegg´s location quotient (FLQ), which considered the region size via parameter λ^* ($0 \leq \lambda^* < 1$) calculated as:

$$\lambda^* = \left[\log_2\left(1 + {}^{E_{.r}}/_{E_{..}}\right)\right]^{\delta} \quad (3)$$

where: $E_{.r}$ ($E_{..}$) is the total regional (national) employment. Since the λ^* is the size of the region, the bigger the region the higher value of λ^*. The Exponent δ from interval $0 \leq \delta \leq$) is an element of flexibility by changing the convexity of the function λ *. The higher the value of δ the lower the value λ *. The value of δ is a matter of empirical research.

The FLQ formula is as follows:

$$FLQ_{ij} \equiv CILQ_{ij} \times \lambda^* \quad (4)$$

(Flegg, *et al.* 1997)

The application of FLQ for adjusting the national i-o matrix to regional is described in following formula:

$$R_{ij} = \begin{cases} a_{ij}^N & ak\ FLQ_{ij} \geq 1 \\ FLQ_{ij} \,.\, a_{ij}^N & ak\ FLQ_{ij} < 1 \end{cases} \quad (5)$$

The regional I-O matrix R_{ij} consist of national technical coefficients (a_{ij}^N) (from national i-o matrix) adjusted by FLQ while $FLQ_{ij} < 1$. In case the $FLQ_{ij} \geq 1$ the national technical coefficient is equal to its regional counterpart. Using regional I-O matrix the regional multiplies can be derived and used for estimation of induced impact of university from particular region. Generally, four types of multipliers can be derived from regional I-O matrix:

- Output multiplier;
- Income multiplier;
- Value added multiplier;
- Employment multiplier.

The regional output multiplier measures the total impact through the output coefficients of individual sectors. This multiplier shows the increase in the total output in financial terms. The second type is the income multiplier, which is the total value of employee's income needed to fulfil the additional unit of total demand for the output of this sector. The employment multiplier shows the increase in the total output in employees in terms of estimating the impact of an increase in the sectors output on the total employment in the specific region. The value added multipliers shows the relationship between the added value of a specific sector and the total output of this sector. (Coughlin *et al.* 1991)

Conclusion

The article discusses the economic impact assessment (EIA) of universities in the region and finding appropriate ways of measuring this impact. This article focuses mainly on Central and Eastern Europe because these countries lack a comprehensive approach to assessing these impacts through regional multipliers.

Many authors have considered the impact of universities on the region and the municipality as a positive, thanks to which the region is becoming a competitive institution, which by increasing the quality of human capital

in the region and spillover effects supports the arrival of new companies to the region and helps existing businesses with innovations. For this reason, finding out the economic impact of the university community or region is crucial for obtaining grants and subsidies from the state budget or the budget of the European Union.

EIA is usually used to demonstrate the importance of the university for the community or region in terms of impact on regional output, employment, value added or income. The article discussed the approach to assessing these impacts through regional multipliers derived from national and I-O matrix.

The main advantage of proposed methodology is that it can also be used in countries, where no regional multipliers available. The only need for data is the availability of national I-O matrix and also information about regional employment, regional value added, regional output and finally, the regional income.

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The Labor Migration in the Context of Value Orientations of Russian Youth

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Abstract:

The paper deals with the problem of perception of migrant workers in host societies. Active migration flows and growing intercultural interaction have determined the need for the optimization of labor migrants' socio-cultural environment. It is impossible to accomplish without public attitudes monitoring. In this regard, the youth aged 18-24 was surveyed. Empirically obtained results of questionnaires for students (n=5 355) have proved our assumption that majority of young people associate the growing of number of labor migrants with the adverse consequences for socio-economic life. Thus, 38,5% have a negative attitude to migrant workers in general. More than half of respondents supported the complication of legislation for labor migrants, which is combined with the current trends of reforms in migration policy in European countries. In summary, we suppose that attitude of the young indigenous population to migrant workers has a proclivity to develop into the problems of internal interethnic relations and marginalization.

Keywords: migration; socio-cultural environment; youth values determination; rejection of labor migrants; Russian Federation.

JEL Classification: O15.

Introduction

In the context of expanding globalization, the problem of coexistence of diverse cultures has become more urgent (Killen and Wainryb 2000). Two main causes that determine such situation can be identified. Firstly, there is multinational composition of countries (Gordienlo 2014); secondly – constantly growing migration flow (Vezzoli, Villares-Varela, and Haas 2014).

At present moment, Russia is a center of Eurasian migration system (Tarr 2016). It is interested in consolidation in the post-Soviet space and considers interaction with CIS countries as a priority of own migration policy (Ivakhnyuk 2006, Ryazantsev *et al.* 2015). Emphasis is placed on the fact that immigrants would be able to solve economic problems (Denisova 2014).

Actually, attracting of labor migrants can minimize the deficit in highly qualified personnel (Castles 2000). Although, this may entail negative consequences in the form of lower wages for local workers, or increase the level of unemployment (Stark and Bloom 1985). In this regard, Asian governments have set a minimum remuneration for foreign employees (Balch 2010) and have created special departments or agencies to manage labor emigration, such as the Bureau of Manpower, Employment and Training in Bangladesh, or the Office of the Protector of Emigrants within the Ministry of Labor in India.

At the same time, European and Australian authorities actively implement reforms aimed at selecting certain migrants (Hollifield, Martin, and Orrenius 2014). Russian laws complicating the legalization for migrant workers from CIS countries with visa-free entry to Russia came into force on January 1, 2015. Therefore, citizens of Uzbekistan and Tajikistan will be able to travel to Russia only by foreign passports, not by internal passports or equivalent documents (Tkach and Bredikova 2016).

The significant increase in the number of immigrants in Russia, which ranges from 6 to 6,5 million in first half of 2016, leads to the emergence of new social conflicts (Vakulenko and Leukhin 2016). That is why we define

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the rejection of labor migrants by nationals in host countries as an acute question. We examined young nationals as a special category because of the critical level of opposition to other values.

The optimization of such situation is frequently considered by scholars in the context of multiculturalism (Green and Staerklé 2013). We can note that multiculturalism differs from the model of cultural unity that was a characteristic of the 20th century, when the culture of ethnic majority had dominated and ethno-cultural minorities were assimilated or absorbed as a subcultural community (Kymlicka 2012). Thus, it is directed to providing equal opportunities for members of society in all spheres of life (Pakulski and Markowskiand 2014). It means that the participants of intercultural interaction enter the process of communication with different communicative expectations that are determined by the peculiarities of their native culture and stereotypes that influence their assessment of the partners from other cultures (Vertovec 2010).

We understand marginal culture as a special kind of subculture that has its own specific features. Unlike titular communities that are characterized by the openness of communication, marginal groups lead a secluded life, either not integrating at all or integrating slightly into the socio-cultural environment of their host country. Emotional depression, hidden aggression and inaction strengthen a polarization of world perception (friends and foes) and make social tension that can be hidden or open much deeper (Kretsedemas 2013).

It should be taken into the account that language barrier also breaks communicative links with the social environment in which they live and forms a negative attitude to the outside world because it is perceived as foreign and hostile. Lack of language skills creates not only cultural-communicative, speech and psychological barriers for full social and professional interaction within the legal framework of society. Language barrier serves as basis for conservation of closed ethnic groups that for some reason found themselves in conditions of “forced intercourse” with the representatives of other ethnic groups, authorities and employers (Toffler 2002).

We see the formation of a new social space full of various cultural codes, symbols, meanings that constitute eclectic or “mosaic” culture minimizing opportunities for cultural dialogue. According to N. Luhmann, new forms of sociality that appear under such circumstances are directed not to interpersonal interpenetration but to pragmatic orientation. Such state of a person is typical for both the host country and migrants. Closed communication space of local societies provides migrants with unity of language, preservation of traditions and norms of communication, peculiarities of domestic culture and limits their integration into cultural-communicative space of titular nations (Aronin and Singleton 2012).

Due to some objective circumstances, large numbers of migrants form social groups that appear outside positively oriented social systems – schools, higher educational establishments, social organizations, political parties, labor unions etc. Under the conditions of semi-legal existence, groups of migrants form their own social systems, the life style of which often contradicts moral and legal regulation of social processes (Rios 2011).

However, modern forms of transport and communication make it possible for labor migrants and their descendants to maintain long-term links with the ancestral homeland (McLaren 2012). This becomes the basis of transnational development of communities.

The countries, which receive immigrants, have been able to cope with this situation more easily, since absorption of immigrants has been part of their myth of nation building. However, this mainly applies to European countries (Kolst 2014).

It is pertinent to point out that the key question for Russia is whether immigration will lead to settlement, formation of ethnic communities, and new forms of cultural diversity. Whatever the policies of the government are, they may cause adverse reactions of certain types of the population. The world experience of the last 10 years shows that youth perceive the newcomers as the cause of insecurity (Edge and Newbold 2013, Testé *et al.* 2012, Lavrič *et al.,* n.d.).

Moreover, migrants may be seen by society as a danger to public cohesion. It can be confirmed by the expansion of European extreme-right parties establishing anti-immigrant campaigns (Art 2011) and by the policies for large-scale deportations during the Asian Crisis in 1997-1999 (Castles and Miller 2009).

Whereas nearly quarter of the Russian population is under the age of 25, we suppose that the question of attitude of young indigenous population to migrant workers has a tendency to develop into the problem of interethnic relations inside the country.

1. Methodology

1.1 Sample

The poll was conducted in order to determine the youth attitude to the labor migrants. The research was carried out in 2015 on the basis of N. I. Lobachevsky State University of Nizhny Novgorod, Nizhny Novgorod State Technical University n. a. R. E. Alekseev, Nizhny Novgorod State University of Architecture and Civil Engineering, and Kozma Minin Nizhny Novgorod State Pedagogical University (Russian Federation). The multistage sample has constituted 5,500 students-Russian nationals aged 18-24. Each questionnaire included 4 questions (Table 1).

Table 1. The structure of the questionnaire

№	Question
1.	What is your attitude to the labor migrants in your country?
2.	What are the consequences of increasing the number of labor migrants?
3.	How are you ready to express your position on the problem of migrants?
4.	Do you think Russian authorities should make state laws regulating external labor migration more strict?

1.2. Research process

5,355 valid questionnaires were received and summarized. Quantitative data, obtained from the poll, was supplemented by qualitative analysis.

2. Results

Data of the analysis of youth value orientations in the sphere of interethnic relations show that 38,5% of young people have a negative attitude to the labor migrants on the territory of Russia. But the difference with the positive indicators constituted only 1,5% (see Table 2).

Table 2. The general attitude of youth to migrant workers

Answer	% of students
Positive	37,1
Neutral	24,3
Negative	38,6

The majority of respondents associates the increasing number of labor migrants with the adverse consequences for socio-economic life, namely with the growth of crime rates, inter-ethnic conflicts and reduction of the number of jobs for the host country nationals. At the same time, 2088 students think that migrant workers can effect on the increase of national production (Table 3).

Table 3. The consequences of increasing the number of labor migrants

Answer	% of students*
Reduction of the number of jobs for Russian nationals	76,4
Rising crime rates	38,1
Increased risk of inter-ethnic conflicts	55,0
Increase in national production	39,0
Filling disreputable vacancies	28,0
Growth of housing prices	11,4
Demographic improvements	16,0
The growth of cultural diversity	10,4
No consequences	0,5

*Note: *The sum of answers exceeded 100% because it was possible to give more than one answer*

Concerning the willingness of youth to express position on the problem of labor migrants, we can state that 9,3% of students are ready to take part in protest actions. It may be related with the outbreaks of interreligious and interethnic conflicts in North Caucasus in 2014 that were transferred to Povolzhye and Central Russia. We suppose, these events had a great impact on the increase of tension among youth and influenced the changes in priorities of consciousness of the respondents. Simultaneously 51% of surveyed prefer not to take any activity in this case (Table 4).

Table 4. Ways to express position on the problem of labor migrants

Answer	% of students*
None	51,0
Rallies, demonstrations, pickets, and other protest actions	9,3
Through Internet forums, blogs, social networks	38,7
Appeal to authorities	10,2
Showing support to parties and organizations with the position congenial to yours	10,0
Talks with friends and acquaintances	37,5

*Note: *The sum of answers exceeded 100% because it was possible to give more than one answer*

However, slightly more than half of respondents support legislative changes that would complicate the being of migrant workers in Russia. 889 of surveyed consider changes to migration legislation as inappropriate (Table 5).

Table 5. Students' answers to the question «Do you think Russian authorities should make state laws regulating external labor migration more strict?»

Answer	% of students
Yes	56,0
No	19,1
No changes needed	16,6
I do not care	8,3

Data show that the youth negative attitude to the labor migrants is influenced by social stereotypification. Whereas globalization of the information-communicative space promotes the creation of social distance from certain social categories, it is necessary to monitor the attitudes of young people in multi-ethnic environment.

3. Discussion and conclusion

Obtained results confirm the aggravation of the marginalization issue. Within the cultural approach, this term is examined as a consequence of migration and intercultural interaction (Park 1928). In this regard, (Durkheim, Lukes, and Halls 2014) had noted the complex processes of cultural interaction, especially among young people of both migrant and titular nations, revealing the problem of social anomie.

Numerous forms of deviant behavior appear in groups of migrants due to the poverty, low level of education, rejection of cultural standards of the host country (Savrutskaya, Nikitin, and Semenov 2014). Thus, so-called "effect of the third generation" in France in 2005-2006 shows that the problems of migration, marginalization and anomie are poorly studied (Claire, Laitin, and Valfort 2014).

In the countries of Western Europe, the ideas of multiculturalism have been used as a methodological basis for setting out principles of migration policy in accordance with the traditions of liberalism and democracy. However, as leading politicians of these states confessed, this policy did not reduce tension in interethnic relations (Locke and Bailey, *n.d.*).

Goss and Lindquist (1995) had developed the theory of structuration to international labor migration using case study material from the Philippines. Later their achievements were used to study migration processes in Poland (Szewczyk 2015) and Vietnam (Hoang and Yeoh 2015).

Determining the attitude of students to labor migrants in Russia we rely on the psychosemantical approach (Petrenko 2010). It implies that the perception of representatives from different ethnic or social groups provides the usage of differentiation mechanism. Thus, the poll conducted by the Institute of Sociology and the Center for Ethno-

Political and Regional Studies of Russian Federation, which covered 11.864 respondents, showed that 16% of the surveyed were hostile towards migrants who came only to work and did not intend to live in Russia permanently (Mukomel 2011).

It can be assumed that such public attitudes as well as devaluation of the ruble partially caused cautious relation of citizens of the Baltic States to the prospects of working in Russia (Denisova 2014) and also the interest of the nationals of Georgia and Azerbaijan in employment in Western countries (Yunusov 2013).

Presently, the flow of workers coming to the country consists mostly of representatives of the CIS countries (Uzbekistan, Tajikistan, and Ukraine) and China. The citizens of Germany, Great Britain and the United States dominate among the highly qualified foreign specialists (Labor and Employment in Russia, 2013). Therefore, the potential of labor migration is still large.

International events connected with the outbreaks of ethnic and religious conflicts in Karelia, in Manezhnaya Square in Moscow, in Birulevo and Arzamas in Nizhegorodsky region have proven that there is certain tension in the sphere of international relations among youth (Dafflon, *n.d.*). Evidently, these problems are connected with the attitude of the rising generation towards migrants, including labor migrants, and they should be sorted out. The problem of coexistence of diverse cultures identifies the need to examine public opinion on labor migrant flows. The views of youth are of special interest.

The poll showed that 38,5% of young people have a negative attitude to the labor migrants on the territory of Russia, while the positive indicators constituted 37,1%. The main causes of the newcomers' rejection are associated with the possible growth of crime rates, inter-ethnic conflicts and reduction of *the number of jobs for the host country nationals. Therefore, more than half of students were in favor of* legislative changes that would complicate the being of migrant workers in Russian Federation. 515 respondents had willingness to express position on the problem of labor migrants by rallies, demonstrations, pickets, and other protest actions. 38,7% of surveyed are ready to do this through Internet forums, blogs and social networks.

The submissions may be useful for the following research on marginalization, multiculturalism, interaction of migrant and titular nations, convictions of youth, and problems of social anomie.

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