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AN EMPIRICAL INVESTIGATION OF RELATIONSHIP BETWEEN ORGANISATIONAL STRATEGY AND TOTAL QUALITY MANAGEMENT PRACTICES IN MANUFACTURING UNITS IN TAMIL NADU

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Abstract

The major aim of the study is to identify the factors related to the implementation of Quality Management practices in manufacturing units from organization perspective, based on an empirical analysis and to identify the relationship between TQM implementation and organizational strategy. This study is limited to small manufacturing units registered with confederation of Indian Industries in Tamil Nadu. The instrument used in this study is a survey questionnaire. The samples of 110 units are selected for the study. The study implies that the presence of people involvement based organization strategy influenced the successful implementation of TQM and its success depends on the dimensions of top management involvement and organization culture which resulted in higher organizational performance. This encourages managers to accompany their TQM practices with the infusion and reinforcement of employee empowerment, shared vision, and style of an organization.

Keywords: manufacturing unit, organizational strategy, Tamil Nadu, TQM.

JEL Classification: M10, M11, M19

1. Introduction

Global competitive trend has made corporate to think of quality way of satisfying their customer. To compete in a global market, units must be equipped with the latest technology, up-to-date information, skilled employees and advanced managerial skills. The concept of quality management originated as a consequence of the question of survival during tough competition. It is a people oriented approach and has many implications on the strategy of the organization. Thus, the present study focuses on whether the organizational strategy influences the implementation of quality management practices in manufacturing units and to recognize the relationship between the same.

2. Review of literature

A thorough analysis of literature pinpoints that only selective organisations have made predominant continual improvements through quality programs and the success of TQM depends on organisation strategy, shared values, management style, and organizational structure (Robin Mann, Dennis Kehoe, 1993). Many researchers have identified the relationship between TQM practices and relevant factors like organisational strategy, culture. TQM and lean manufacturing recently become pervasive primary strategy for manufacturing performance enhancement (Anvari, 2011). Process Alignment and People Involvement are two key strategies for successful implementation of TQM. It provides useful insight into the organization that uses TQM as an organization strategic program (Richard *et al.*, 2004). Corporate case methods revealed that organisation may change their strategic approaches through TQM outcomes. Larger companies tend to gain greater benefits from TQM than smaller firms. The findings

have implications for managers wishing to formulate a business strategy based on TQM (Milé Terziovski, Danny Samson, 2000) and several authors have stressed the need for analysis of influence of strategy towards quality practices. It will lay out a simple, straightforward approach that how to utilize this new strategic management tool (Laza *et al.*, 1990). The study revealed that differences in TQM implementation depending on the selected strategy. It is also noticed that companies with greater degrees of co-alignment between their strategies and TQM are those with the highest levels of performance (Mar Fuentes *et al.*, 2006).

3. Research methodology

An interview schedule consists of eleven constructs was developed to empirically validate the TQM practices based on an extensive literature survey. The questionnaire used in this research consists of two parts. The first part is connected with implemented TQM practices of the organisation. It includes ten dimensions, namely top management commitment, customer focus, organisational culture, strategic planning and human resource management, continuous improvement, quality information system, infrastructure facilities, process quality management and supplier quality management. The second part is concerned with organisation strategy. The strategy has been measured by a 30 item questionnaire including the dimensions of both process alignment and people involvement.

From the literature review, it is identified that the collective effect of TQM on organisation strategic dimension is lacking. This paper attempts to bridge these gaps by answering the following research questions:

- What are the TQM practices practiced in small manufacturing units in Tamil Nadu?
- What kind of organisation strategy existing in small manufacturing units in Tamil Nadu?
- What is the relationship between organisation strategy and TQM practices in small manufacturing units in Tamil Nadu?

4. Hypothesis

- There is no significant difference between the practices of Quality Management among manufacturing units;
- There is no significant difference between the types of organisational strategy among small manufacturing units;
- There is no relationship between organisational strategy and TQM practices among manufacturing units.

5. Data collection

The questionnaire was delivered by the researcher to operation managers, quality managers, and other functional managers in manufacturing units. The researcher used the list of members of Confederation of Indian Industries as its sampling frame. Out of 1025 registered units, a sample of twenty percent of the total units from each group has been taken for the present study based on the stratified systematic random sampling method. Out of 205 units, only 110 small units were responded. Thus, sample constitutes 110 small manufacturing responses was selected for the present study.

6. Limitations of the study

The sample size (110) and area selected are small in character. Hence, the findings and conclusions of the study are valid to only small manufacturing units limited to Tamil Nadu only. Due to time and resource constraints the researcher has restricted the area of the study to Tamil Nadu

7. Data analysis

Researcher focused the small manufacturing units based on their capital investment in the present study. Quality certification is one of the important requirements for organising activities. Certification may encourage units to adopt TQM practices continuously. Hence, it is considered for analysis.

7.1 Relationship between certification and level of implementation of Total Quality Management in small manufacturing units

In order to identify the relationship between certification and level of implementation of TQM in small scale units, chi-square test was executed. The degree of relationship between the certification and the level of implementation of TQM among Small units are exhibited in Table 1.

Table 1 - Certification and the level of TQM implementation

Sl.No.	Certification	Level of TQM implementation			TOTAL
		Low	Medium	High	
1	Certified	10 (40)	13 (36.1)	12 (24.5)	44 (40.0)
2	Non certified	15 (60)	23 (63.9)	37 (75.5)	66 (60.0)
TOTAL		25 (100)	36 (100)	49 (100)	110 (100)

Source: Primary data
 Figures in the brackets denote percentage

It is highlighted from Table 1 that the percentage of implementation of TQM was high (75.5) among the respondents who have not yet certified and the same was low (24.5) among respondents who have certified in case of high level of implementation. The percentage of TQM implementation was the high (63.9) among respondents who have not yet certified and the same was the low (36.1) among units that have certified in units in case of medium level. On the other hand, the percentage of low level of TQM implementation was high (60.0) among non certified respondents in small units and the same was low (40.0) among units that have certified in small units in case of lower level. From the analysis, it is inferred that the high level of TQM was implemented by non certified respondents in small units.

In order to examine the formulated null hypothesis that there is no significant relationship between the certification and the level of TQM implementation in small enterprises, X² test was employed. The computed results were given in Table 2.

Hypothesis H0: *There is no significant relationship between certification and the level of TQM implementation in small units*

Table 2 - Certification and the level of TQM implementation (X² test)

Measure	Value	Degrees of Freedom	P Value*	Inference
Pearson Chi-square	16.998	2	.000	Significant at 5% level

* P < 0.05

The X² results indicated that the probability values were less than 0.05(P<0.05). Hence, the established null hypothesis is rejected. The analysis inferred that ‘there is a significant relationship between certification and the level of TQM implementation in small units’.

7.2 Analysis of Total Quality Management implementation by the respondents of Small Manufacturing Units

This section attempts to investigate the extent to which the TQM components are implemented by respondents of small enterprises. The mean, standard deviation and co-efficient of variation of score values of TQM components as perceived by the respondents of these two groups of units were computed

and t-test was used to examine the significant differences of means values between two groups. The analysis results are exhibited in Table 3.

Table 3 - Comparison of implementation of TQM between certified and non-certified

Sl. No.	TQM Components	Certified			Non-certified			Difference in mean score	‘t’ Value
		Mean	SD	CV (%)	Mean	SD	CV (%)		
1.	Top Management Commitment	3.90	1.03	26.4	3.16	0.99	31.3	0.66	3.769*
2.	Organisational culture	4.86	1.23	25.3	4.00	1.19	29.8	.86	3.648*
3.	Strategic focused Planning	3.91	1.00	25.6	3.24	0.97	29.9	0.67	3.501*
4.	Customer centric	3.89	0.99	25.4	3.20	0.96	30.0	0.69	3.591*
5.	Employee Management	3.92	0.99	25.3	3.24	.96	29.62	0.68	3.589*
6.	Continuous Improvement	3.17	.96	30.28	3.32	0.90	27.1	0.15	1.659*
7.	Process quality management	3.41	1.00	29.3	3.50	1.01	28.9	0.09	2.752*
8.	Quality Information System	3.80	1.26	31.5	3.70	1.21	32.7	0.10	1.871*
9.	Infrastructure & Facilities	3.18	0.91	28.6	3.50	1.13	32.2	0.32	1.869*
10.	Supplier Quality Management	3.61	0.96	26.6	3.50	1.09	31.1	0.11	4.182*

Source: Computed data

It is evidenced from Table 3 that a significant difference was found between mean scores of implementation of all the TQM components realised by certified and non-certified manufacturing units. The analysis of data indicates that the mean score of implementation of TQM components infrastructure and supplier quality management was found less as compared to the mean scores of implementation of other TQM components of certified and non-certified units. The mean value of organisational culture found to be high in both certified and non-certified units indicated the need for quality culture in an organization. The result of coefficient of variation indicates that in the case of certified units, the component ‘Employee Management’ and ‘organisational culture’ was found to be consistent in perception among the respondents. In the case of non-certified units, the component ‘continuous improvement’ followed by ‘process quality management’ was found to be consistent in perception among the respondents. A high fluctuation in perception was found in the component ‘quality information system’ in both certified and non-certified units.

In order to examine the relationship of agreement between certified and non-certified units for the component of TQM, rank correlation has been computed. The results are shown in Table 4.

Table 4 - Relationship of the agreement in perception for implementation of TQM between certification of the units-small units

Sl. No.	TQM components	Certified firm		Non-certified firm	
		Total Score	Rank	Total Score	Rank
1.	Top management commitment	454.2	4	506.7	3
2.	Organisational culture	451.3	2	526.4	1
3.	Strategic planning	455.4	5	517.2	6
4.	Customer focus	450.3	6	510.1	7
5.	Human resource management	450.8	1	529.2	2

6.	Continuous improvement	448.3	3	482.1	4
7.	Quality Information System	447.1	7	489.6	8
8.	Infrastructure facilities	446.2	11	471.4	10
9.	Supplier Quality Management	443.1	8	465.4	5
10.	Process quality management	445.4	10	501.1	9

Source: Computed data; Rank correlation Co-efficient(R) = 0.655; P value = 0.018

The computed value of rank correlation coefficient R (0.655) indicates that there is a positive correlation between the small units for the component ‘certification’ which is significant at 5 per cent level.

7.3 Dimensions of organisation strategy and the level of Total Quality Management implementation

The dimensions of organisation strategy are classified as soft and hard. The components of soft dimensions include people involvement. Process alignment is taken as hard dimension. An attempt was made to find the relationship between dimensions of organisation strategy and their level of perception of implemented TQM practices.

Table 5 - Dimensions of organisation strategy and the level of TQM implementation

Sl. No.	Firm type	Dimensions of organisation strategy		TOTAL
		Hard	Soft	
1.	Small	30 (42.25)	65 (48.5)	95 (46.3)

Source: Computed data

From the Table, it is inferred that the maximum level of TQM implementation was among the respondents who perceived the soft dimensions of organisation strategy.

The degree of relationship between organization strategic dimensions and the level of TQM implementation among the respondents are shown in Table 6.

Table 6 - Dimensions of organisation strategy and the level of TQM Implementation

Sl. No.	Dimensions of organization strategy	Level of TQM implementation			TOTAL
		Low	Medium	High	
1.	Hard (Process alignment)	20 (80)	14 (38.9)	7 (14.3)	41 (37.3)
2.	Soft (People involvement)	5 (20)	22 (61.1)	42 (85.7)	69 (62.7)
TOTAL		25 (100.0)	36 (100.0)	49 (100.0)	110 (100.0)

Source: Computed data

It is found from the above Table 6 that the percentage of TQM implementation was high (85.7) among the respondents who perceived the soft dimensions and the same was low (14.3) among respondents who perceived the hard dimension in case of high level of implementation. The percentage of was high (61.1) among the respondents who perceived the soft dimension and the same was low (38.9) among the respondents who perceived in the category of hard dimensions in case of medium level of implementation. On the other hand, the percentage of was high (80.0) among the respondents who identified the hard dimensions and the same was low (21.02) among the respondents who identified the soft dimensions of organisation strategy in case of low level of implementation.

From the analysis, it is inferred that the high level of TQM implementation was among the respondents who perceived the soft dimensions of organisation strategy in small units. To find the relationship between dimensions of organisation strategy and the level of TQM implementation, ANOVA was employed and the result of the test is shown in Table 7.

Hypothesis: H0: *There is no significant relationship between the dimensions of an organization strategy and the level of TQM implementation in small units.*

Table 7 - Dimensions of organisation strategy and level of TQM implementation (ANOVA)

Source	Sum of Squares	Df	Mean Square	F Value	F 0.05	Inference
Between Groups	18.697	2	1.358	7.906	1.75	Significant
Within Groups	36.823	90	.167			
TOTAL	46.519	92				

The above Table shows that the calculated F value is 7.906 which is more than the Table value of 1.75 at 5 percent level with degrees of freedom (2,90). Hence, the null hypothesis is rejected. From the result, it may be concluded that there is significant relationship between the dimensions of an organization strategy and the level of TQM implementation in small units.

7.4 Analysis of impact of soft and hard dimensions of organisation strategy on Total Quality Management practices

Garvin (1988) pointed out that quality has multidimensional capabilities and that each of its dimensions can be used strategically to gain core competencies. The process management scale that was used includes items related to the important quality aspect of process control and process management (Flynn, Schroeder, and Sakakabara, 1994). Related to that, the researchers Youndt, Snell, Dean, and Lepak (1996) identified a human capital involvement in measuring the performance of the organisations to operationalize quality management strategy.

7.5 Impact of dimensions of organisation strategy on Total Quality Management practices of small units

Multiple regression analysis was done to study the effects of both soft and hard dimensions on TQM practices of various types of small units. The results are presented in the Table 8.

Table 8 - Dimensions determining TQM practices in Small Manufacturing Units

Sl. No.	Category	Size (N)	Constant (a ₀)	Regression Co-efficient		R ² Value	F Value
				Hard	Soft		
1.	Certified Units	64	1.793 (7.961)	1.311* (2.534)	1.346* (2.600)	.483	39.954*
	Non Certified Units	31	2.768 (5.474)	-.463 (-.442)	1.078* (2.973)	.659	6.429*

Notes: * indicates one per cent of level of significant; ** indicates five per cent level of significance. Figures in the parentheses are 't' values.

It is found from the analysis that the model is statistically significant for certified units. The R² value (0.783) explains variation in TQM practices by soft and hard dimensions to the extent of 78 per cent. The regression co-efficient indicates that both hard and soft dimensions of an organization strategy

collectively contribute to the implementation of TQM practices for certified enterprises. Accordingly, a regression analysis was performed to determine the effect of TQM practices with regard to soft and hard dimensions on TQM of non-certified units. The regression coefficients reveal that the soft dimensions have significant impact on TQM practices and the hard dimensions have no significant impact on TQM practices.

8. Discussion and implications

Quality management practices are viewed as strategic plan. Awarded units have initiated restructuring of their units to minimise bureaucracy. Customers are involved during the specification and design stages. Top management insists on communication and related training programmes. They are given more importance in enhancing human skills and involvement in quality improvement activities for sustaining in both local and global market. As the initiation of total quality management comes from top management, they should ensure that the quality policy is well understood by all the employees. It should be framed in such a way that there is a relationship between customer and company. It should be specific, measurable, and realistic. The policy can be promoted through circulation of report, newsletters, symposium cum training, brainstorming meetings, and personal contacts. Top management can meet employees in batches to communicate policy. This would also reflect the top management commitment in implementing TQM.

Regression analysis supported the view that units believe that quality-driven strategy, flexible communication flow and valuable information system, power relationship among employees and quality culture initiates TQM practices. This may be the reason for the influence of more of people involvement on TQM Certification that also provides customer a guarantee that a firm would be able to deliver products and services as specified. This results in increased customer satisfaction which is identified as the primary component of TQM implementation. An organization should always consider customers as their foundation for the business (Ramachandran Amudha *et al.* 2013). Thus the result suggested that organisation strategy is one factor that significantly influences the implementation of TQM programs.

To initiate Total Quality Management practices, small units might follow people involvement strategy where leaders generate opportunities for learning and motivate fellow employees to grasp opportunities. They should create and communicate a vision for the organisation. This vision makes people go beyond their capacities and thoughts and encourages them in the sense of assuming new levels of commitment and enthusiasm, integrating beliefs and values, necessary towards quality management practices. In order to implement the TQM programs, units may go for people involvement approach where leaders act as mentors and trainers, they pay attention to each individual's needs and assuring benefits for expected performance. They delegate, transmit courage, inspire collaborators and support development. TQM implies high levels of autonomy and control. The TQM practices insisted the teamwork and coordination, self- responsibility for quality, customer centric and continuous improvement is more likely to be satisfied in people involvement oriented companies. To conclude, the inspirational attitude of people involvement strategy is essential for a sustained implementation of Total Quality Management programme which promotes intrinsic value to achieve the desired results and intrinsic satisfaction of the employees.

Conclusion

Manufacturing units are the backbone of economic growth. These units are the major sources of technological innovation and new products. TQM practices are essential for units to face competition in era of globalization. Hence the adoption of TQM becomes very important for the attainment of a sustainable development. To be effective, TQM practices must be associated with its organisation strategy. The results of the present study suggest that implementation of TQM must be correlated with people involvement strategy of the organisation.

The study provides a model of critical success factors of TQM practices. Including other dimensions of organisation, a comparative of TQM practices of manufacturing with those of service enterprises may be carried out. Further research methods using case studies are required to analyse the relationship between strategy and quality initiatives.

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ASSESSMENT OF THE BALANCED SCORECARD SYSTEM FUNCTIONALITY IN SLOVAK COMPANIES

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Abstract:

Slovak companies record conflicting responses regarding the use of the balanced scorecard (BSC) system in practice. Apart from information on positive results there are reports referring to negative experiences, documenting the insufficient contribution of the BSC system. The starting point of the research described in this paper is based on the assumption that the BSC is not meeting the management expectations to the required level it was implemented into practice, yielding limited contribution, or reduced functionality. The results presented were aimed to verify the functionality or dysfunctionality of the BSC system and identify its degree in those Slovak companies businesses where the methodology has been applied.

Keywords: Balanced scorecard, strategy, research, benefits BSC, functionality/dysfunctionality BSC.

JEL Classification: D24, L10, L25, M10, M21.

1. Introduction

The methodology of the balanced scorecard (BSC) has been originally developed for performance measurement by Kaplan and Norton (2000), who were convinced that measuring company performance so “solely“ on the basis of financial indicator is no longer sufficient and does not fully correspond to the reality. It has been spreading throughout the world since its inception. The fact is supported by lots of research findings of reputable institutions e.g. Balanced Scorecard Institute, Bain & Company etc., results of studies conducted by Hoque & James (2000), Ittner, Larcker & Randall (2003), Davis & Albright (2004), Lipe & Salterio (2002), Olson & Slater (2002), Malina & Selto (2001), Bilodeau & Rigby (2007).

Further research findings (Bilodeau, Rigby 2007) show substantial growth in the application of BSC systems in the world that started in the year 2002, accompanied with improved ordering of the rest of the tools supporting management, to have been in active use with as much as 65 % of companies since 2006. Currently, the BSC is occupying a prominent position among other tools of company management.

This contribution is presenting BSC methodology as being applied in Slovak companies, all these based on a survey performed in year 2010. With due respect to the original theoretical assumption of international authors (Kaplan, Norton 2001, 2005, Johnson, Scholes 2000, Horvath & Partners 2002, Vysušil 2004), as well as to the publications of local authors (Gavurová 2011, Mihalčová, Gavurová 2007, Slávik 1999), the authors of have focused their research on the verification of functionality or dysfunctionality of the BSC system in selected Slovak companies.

2. Literature review

In the 90s of the 20th century, managerial theory and practice experienced transition in ways and procedures applied to quantify company performance from exclusive use of financial indicators to methods combining both financial and non-financial tools of measurement. This was the era of the beginnings of the BSC concept, with three distinctive generations having evolved from its inception till

the present version. The first era was typical for defining the four perspectives (the perspective of learning and growth, the perspective of internal processes, the perspectives of customer and that of finance) and a limited number of criteria in each of them (Kaplan, Norton 1992). After having made a right choice of goals and criteria, the BSC helps define the strategic direction of the company while enabling simultaneous measurement of its performance. Simple causalities among perspectives were apparent and well presented, yet not applied to specific purposes (Cobbold, Lawrie 2002).

The original BSC model was later replaced by a strategic map, which paid due respect to all the perspectives arranged in a causal hierarchy. It helped much in eliminating the risk of missing links among the goals of the individual perspectives and the duplicity of activities, thereby increasing the success rate of company strategy integration (Antošová 2012, Antošová and Gallo 2012). Despite of the great popularity of the BSC concept, research and theoretical are lean on detailed case studies from the period of time in terms of system implementation (e.g. Butler, Neale 1997), or practical experiences of companies (e.g. Ahn 2001). More widespread is the commercial writing (e.g. Schneidermann 1999), mostly from BSC fans (e.g. Lingle, Schieman 1996). The sources lack objective knowledge regarding system implementation. On the other hand, there are several surveys documenting the response of the entrepreneurial and non-business environment referring to the level of implementation in a selected sample of companies (Braam *et al.* 2002). The references are emphasizing the utility of the approach (Epstein – Manzoni 1997), also describing the deficiencies in the theses themselves and providing remedial actions (e.g. Eagleson, Waldersee 2000, Kennerley, Neely 2000, Teplická 2006, Gallo 2013). The era of the second generation is a big step forward for the BSC – from the one of measuring performance to the BSC – a system for strategy implementation. It defined the link between the metrics and goals as well as the goals and subjects responsible. Cascading and decomposition of goals has subsequently raised the issue of strategic alignment within the organization (Kaplan, Norton 1996, Olve, Roy, Wetter 1999).

The second area, causality, was shifted from the indicated links between the perspectives of the first generation towards to cause-and-effect relations between the criteria in the new generation. On one hand, this shift enriched the BSC system by a Strategic Linkage Model, but on the other hand it raised the conceptual issue, which has become the lurking object of discussion even today such as the way of analyzing, defining and verifying the causalities involved (e.g. Brewer 2002).

The discussions are focused mostly on two areas, namely, on how the strategic lineage model is conceived, in terms of interlinking the BSC and the vision and strategy (Cobbold, Lawrie 2002), so rarely defined in practice or not involved in company-wide consensus. The second area was about determining the target values to the individual criteria (Target Setting), where companies lack elaborate methodology.

The third generation BSC systems are typical for the interlinking strategy and the management of competitive advantages as well as the management of transformational changes. The strategic map and the established criteria are the bases for the analysis of scenarios of the „what-if“analysis. It is also possible to integrate planning and the budgeting process with the BSC (Miyake 2002). The first BSC models featuring a new item of the so-called Destination Statement – declaration of goals, are appearing on the scene in the course of 1998 – 1999. The number of subjects implementing the third generation BSC is continuously increasing (Shulwer, Lawrie, Andersen 2000, Lawrie, Cobbold 2001, Andersen, Lawrie 2002) since then on.

3. Methodology of research in Slovak companies applying the balanced scorecard

Basically, the research is aimed at „verifying the existence of BSC dysfunctionality and finding out its extent in selected Slovak companies, wherein the BSC methodology is or has been applied so as to identify the causes to it and inspect the mutual relations among them“.

By the nature of the BSC methodology, it is a quality-based research focused on the attitudes and experiences gained during its implementation into practice in Slovak companies. The research was conducted in three parts:

- Part one involved preliminary interviews with the managers of the individual respondents (companies), on the basis of which the company strategy, planned level of performance,

expected benefits of the BSC and the measure of failing to fulfil the plan due to imperfections in the BSC applications. The result is a quantification of the measure of BSC functionality or dysfunctionality;

- Part two involved research to find the concrete causes of the identified status by way of inspecting the potential causes of the BSC dysfunctionality. The results is a set of identified causes, which degrade the BSC functionality;
- Part three of the research was aimed at analyzing the relations between the potential causes of BSC dysfunctions and to be compared with the identified causes in cases of the individual companies. The result of this part is a system of causes to BSC dysfunctionality and description of their impact and effects to strategic management.

With due regard to the stated goal of research, the following hypotheses have been formulated in the Table 1:

Table 1 - Hypotheses formulated for the research in the application of BSC methodology in Slovak companies

Hypothesis	Wording of the hypothesis
H 1:	There are substantial differences among the respondents in view of the real fulfilment of the expected contributions of the BSC methodology.
H 2:	Based on the research conducted, a minimum of 50 % BSC dysfunctionality malfunction has been identified with least one half of the respondents.
H 3:	At least one half of the identified causes of BSC dysfunctionality, showing a statistically significant relation to the measure JEL Classification: of functionality, occurs when implementing the BSC into practice.

Source: Author's formulated

The target group of subjects of the research are companies with various socio-demographic and economic characteristics (residence, legal form of the company, branch, size, number of employees, yearly turnover and the number of years when using BSC), active in various branches of the Slovak economy, experienced in BSC methodology, excluding subject from public administration and financial sector. The selection of the sample took place in two phases.

Phase one involved collecting references on companies experienced in BSC methodology, i.e. to have been adapted to their own conditions. The selection of the sample was made using the method of non-random purposeful choice. It was justified also by the fact that the population the sample has been chosen from was difficult to in terms of correctness, facts, time and location. So far no database on applied BSC methodology has been set up in Slovakia. Consequently, our choice was based on references available on the internet as well as those obtained from the research that have been conducted hitherto (Gavurová, Jasovská 2008, Šoltés, Gavurová 2013). In total, we gathered references about 30 companies, which were supposed to be experienced with the BSC methodology.

During phase two, 20 companies have been chosen at random, using a generator of random numbers with the help of which the individual respondents were assigned values 0 (not entering the selection) and 1 (entering the selection). The subjects selected were addressed, while one of them informed on having no experiences with BSC and another one refused to take part in the research. So the research sample consisted of 18 subjects of which in 9 companies the BSC methodology being implemented in the time of the research, and in another 9 companies it was found out that they do not make active use of the BSC methodology or it had been stopped. Consequently, included in the sample were companies making use of the BSC and also those, which has stopped implementation for any reason. The latter group of companies was not excluded from the sample so as to enable objective assessment and comparison of functional, partially functional or dysfunctional applications of the BSC.

In part one, the research was realized by way of interviews and in part two in the form of a written questionnaire. Part three is focused on the application of structural analysis. The input data for the analysis were those obtained by a purposeful research on the process and contents of the BSC methodology application. The structural analysis resulted in a system of potential causes of BSC malfunction and their

mutual relations. Having compared the system with concrete causes obtained from the respondents, it was possible to formulate the conclusions as to the causes of the measure of BSC dysfunctionality in concrete situations and suggest recommendations. As the research was conducted anonymously, no names of companies are stated. The data from the respondents were collected in the year 2011.

In view of the content, the research material set up for the 1st generation BSC (performance measurement) and 2nd generation BSC (strategy implementation), as it was indicated in the previous research (Gavurová, Jasovská 2008) that 3rd generation BSC systems have not been implemented in Slovak companies, as it was proven in the course of research data collection.

3.1 Results regarding the benefits and satisfaction with the balanced scorecard

The difference between the expected benefits and actually realized benefits from the application of the BSC is considered as one of the indicators of BSC functionality or malfunction.

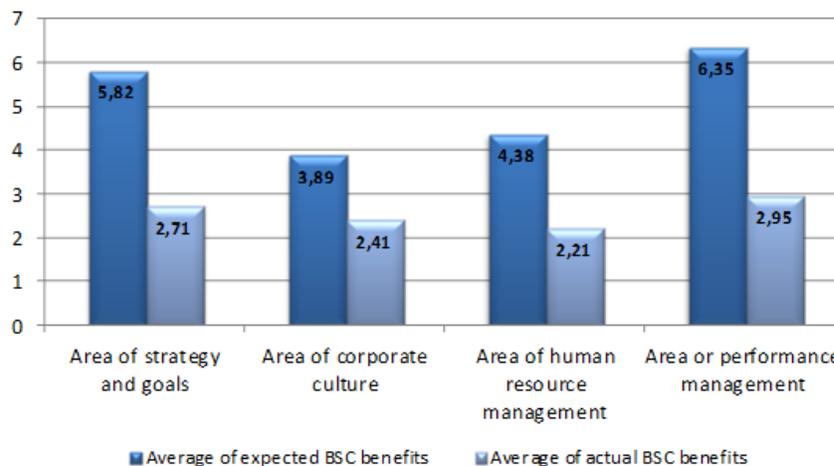


Figure 1 - Comparison of the expected and actual benefits of the BSC in the individual areas of application

When comparing the average values by the separately defined areas of applications in terms of BSC benefits one can state that the highest average values are those of the expected benefits, but also the actual benefits of the BSC in the area of strategies and goals as well as in performance management (Figure 1). Substantially lower averages are recorded in the area of company culture and human research management, both in the expected and actual benefits of the BSC for the company.

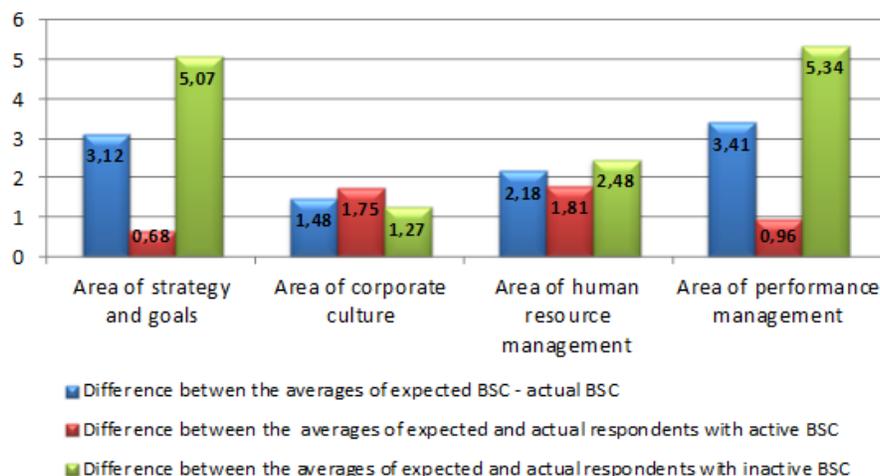


Figure 2 - Comparison of differences between the expected and actual BSC benefits

When comparing the differences between the expected and actual benefits for the individual areas (Figure 2), the most remarkable differences are apparent at respondents with inactive BSC, especially in the area of performance measurement and strategies and goals. On the contrary, the largest differences in the group of active BSC respondents are found in the area of company culture and human research management.

Detailed comparison of the average values of expected and actual benefits of the BSC, object of research, is presented in Figure 3. The respondents evaluated their satisfaction with the BSC on a scale from 1 (completely unsatisfied) to 7 (fully satisfied). The mean value stated by the respondents with inactive BSC is 1.0 point, at respondents with active BSC the average is 5.0 points. The overall average of satisfaction of all the respondents is at 2.8 points.

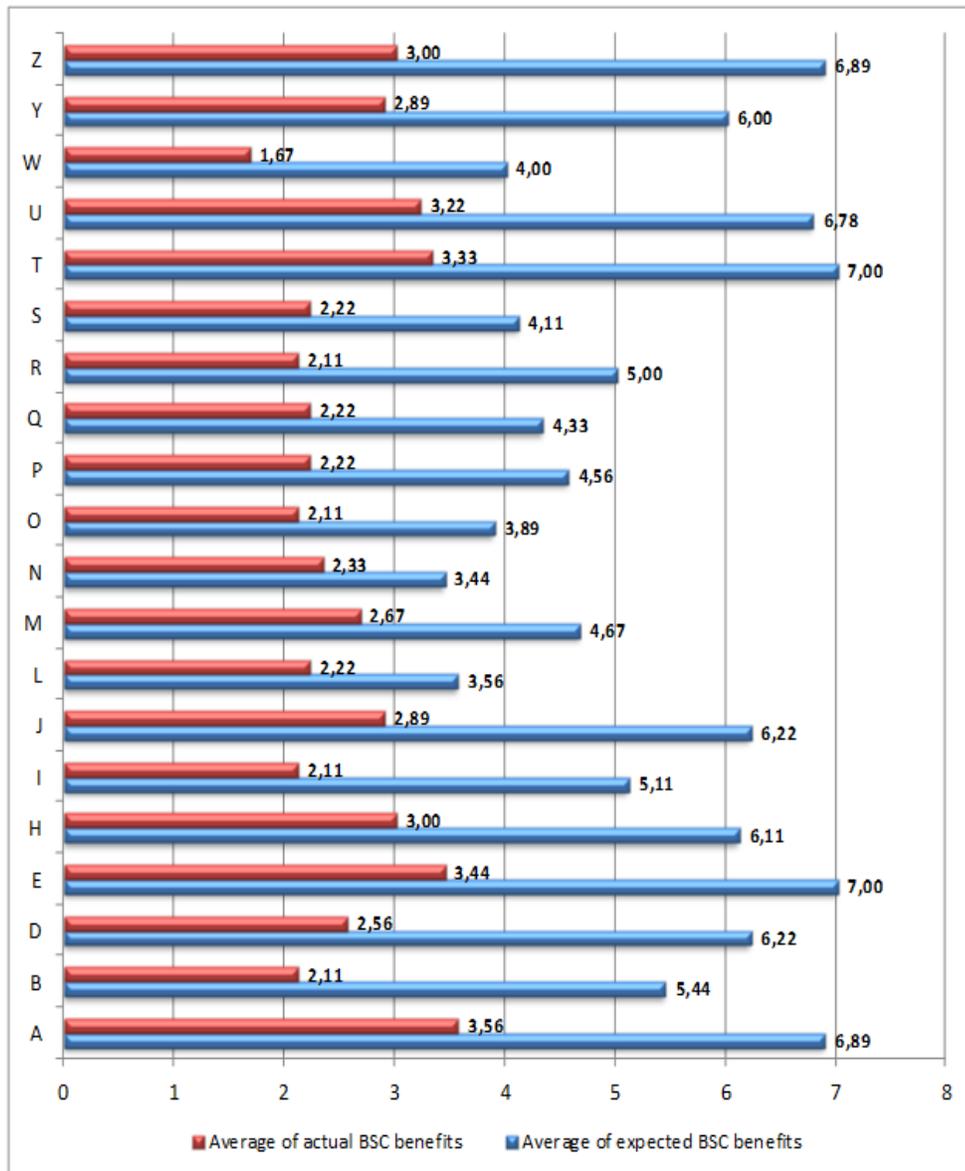


Figure 3 - Detailed comparison of the expected and actual balanced scorecard benefits

In the light of the results graphically illustrated in Figure 3, one is able state the most expected benefits of the strategy decomposed into quantifiable criteria and the subsequent feed-back (marked as A

and E), to obtain a comprehensive view of the performance measurement and identify the weak points in the company performance (marked as T and Z.). The most frequent benefits are marked as A, E and T, i.e. the respondents are primarily focused on the quantification of the company strategy and performance.

With respect to the differences existing among the individual respondents, when evaluating, we made use of selected non-parametrical tests, *i.e.* the Friedman exact test, Neményi's method and Wilcoxon test. For tests, we have determined the level of importance to the 5%. Also identified were the substantial statistical differences in the field of expected and actual BSC benefits and the areas of differences existing among them. In the given categories, a statistically important difference is apparent between the respondents with active BSC and those with inactive BSC. Based on the actual findings, the given hypothesis H1 is not rejected.

3.2 Results of determining the measure of balanced scorecard functionality and dysfunctionality

For the purpose of research the extent of BSC functionality and dysfunctionality in the individual conditions of respondents is expressed as follows:

$$F_{Rj} = \frac{(C_{2-P_{Rj}} + C_{2-S_{Rj}}) * C_{1-C_{Rj}}}{\frac{\sum_{i=1}^n \frac{C_{1-S_{Rji}}}{C_{1-O_{Rji}}}}{i}}$$

where:

- F_{Rj} = measure of BSC system functionality at respondent $R_{j,}$;
- $C_{2-P_{Rj}}$ = number of point-based evaluation of questions from the questionnaire No. 6, 7, 8, 9, 11 in case of respondent R_j , (related to the BSC system of the 2nd generation);
- $C_{2-S_{Rj}}$ = sum of point-based evaluation of the questions of the questionnaires No. 12, 13, 14, 15, 16, 18 in case of respondent R_j , (related to the BSC system of the 1st generation);
- $C_{1-C_{Rj}}$ = point-based evaluation of satisfaction with the BSC system in case of respondent R_j ;
- \sum = arithmetic average of the quotients of the actually achieved benefits $C_{1-S_{Rji}}$ and the expected benefits $C_{1-O_{Rji}}$ in case of the respondent R_j ;
- $P_i, i=1, \dots, n$ = potential benefits of the questionnaire;
- $R_{j, j=1, \dots, m}$ = respondents of the research sample.

In view of the chosen point-score scale between 1 – 7 points for the purpose of research, the upper limit for the measure of functionality is 539 points, expressing the full, 100 % functionality of the BSC system, *i.e.* the maximum score of points for the questions related to the measurement of performance, strategy implementation, actual achievement in expected benefits to full extent and full satisfaction with the BSC system as it. This upper limit is marked as F_{max} . The deviation from this full functionality in direction of lower point scores level is expressing the extent of BSC dysfunctionality N_{Rj} in case of respondent R_j and is calculated in the following way:

$$N_{Rj} = F_{max} - F_{Rj}$$

For more lucid comparison and classification of the respondents on the basis of the extent of functionality and dysfunctionality, in terms of their individual BSC, is expressed in percentages. For the purposes of subject classification by their individual measure of BSC functionality and dysfunctionality, the following scale of percentual and point-score based measure of BSC functionality and dysfunctionality is applied (Table 2).

Table 2 - Classification of subjects by their extent of balanced scorecard functionality and dysfunctionality

Category	Measure of functionality (%)		Measure of functionality (points)		Measure of dysfunctionality (%)		Measure of dysfunctionality (points)	
	from	to	from	to	from	to	from	to
I.	100 %	80,0%	539,0	431,2	0,0%	20,0%	0,0	107,8
II.	80,0 %	60,0%	431,2	323,4	20,0%	40,00%	107,8	215,6
III.	60,0 %	40,0%	323,4	215,6	40,0%	60,0%	215,6	323,4
IV.	40,0 %	20,0%	215,6	107,8	60,0%	80,0%	323,4	431,2
V.	20,0 %	0,0%	107,8	0,0	80,0%	100,0%	431,2	539,0

On the basis of the classification as above the BSC of Category I. can be characterized as a fully functional system, providing reliable information for strategic decision-making. On the contrary, the BSC of Category V. is, practically, a completely dysfunctional system lacking support from the part of managers (Table 3).

Table 3 - Characteristics of the categories of BSC functionality

Category	Functionality of the BSC	Deficiencies or distorting information for decision-making
I.	Fully functional BSC	Without deficiencies
II.	Functional BSC	Improper setting of the BSC components
III.	BSC with limited functionality	Missing BSC components
IV.	Predominantly dysfunctional BSC	Missing components of the BSC and improper setting of the existing BSC components
V.	Completely dysfunctional BSC	Absence of conditions necessary for the implementation and application of the BSC

The measure of functionality and dysfunctionality of the BSC in the individual conditions of respondents with active BCS were expressed on the basis of the scores of answers obtained from the respondents. The results are resented in graphical form in Figure 4.

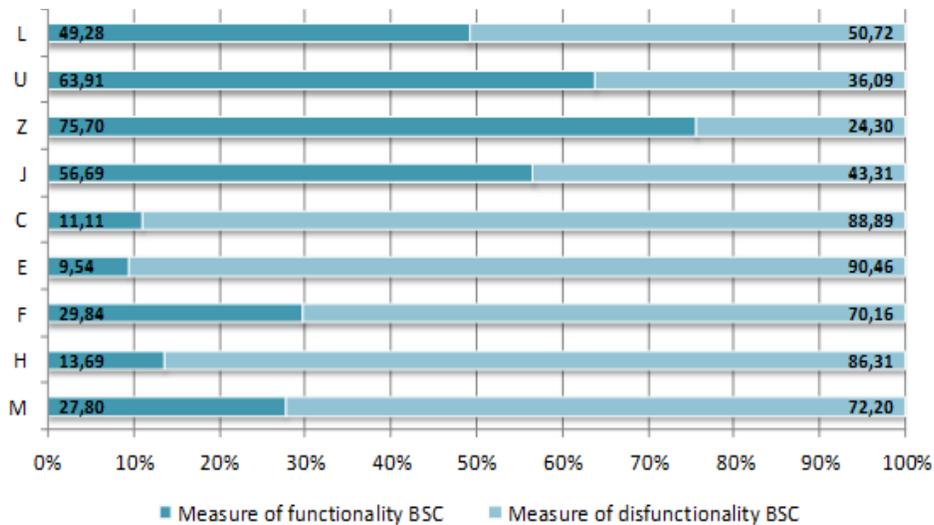


Figure 4 - Extent of BSC functionality and dysfunctionality by the individual respondents

The respondents were identified with various extent of fulfillment of their individual strategic goals and with various development in their strategic performance in time, as it was presented by the frequency analysis. They pointed out limitations to their individual BSC affecting their functionality, on the basis of which the measure of BSC and dysfunctionality were quantified. On the basis of the factual results obtained, Hypothesis 2 is accepted.

3.3. Results on the causes of balanced scorecard dysfunctionality

The respondents have shown both individual and common causes of dysfunctionality. Also calculated were the Kendall correlation coefficient tau for each pair of potential causes of dysfunctionality and the calculated measure of dysfunctionality and the calculated measure of BCS functionality, as well as the related testing characteristics and the P-value. In the process of implementing and using the BSC, 85 causes have been identified of which 11 have revealed a statistically important relation to the measure of BSC dysfunctionality. As it is obvious from the calculations and assertions presented in Table 4, of which 8 factors is in the process of implementing BSC into company practice and 3 factors are in the state of active BSC use. On the basis of these findings, Hypothesis H3 is not rejected.

Table 4 - Identified causes of balanced scorecard dysfunctionality with statistically relevant relation to the measure of balanced scorecard functionality

Order	ASSERTION
1.1	Stated criteria to the BSC goals are cascaded to the various levels of management and organizational units.
1.2	Within the company, the BSC criteria of individual levels of management and organizational units are harmonized in compliance with the strategy.
1.3	Strategic actions towards BSC goals are cascaded to the individual levels of management and organizational unit.
1.4	Within the company there is a harmony between strategic actions of the individual levels of management and organizational units in compliance with the strategy.
1.5	Performance of the employees and managers is linked to the BSC system and is monitored and evaluated in compliance with it.
1.6	Goals of the employees and managers are in harmony with the BSC interconnected with the system of motivation and remuneration.
1.7	Strategy Linkage Model of the BSC is cascaded to all level of the company management.
1.8	Strategy Linkage models of the BSC of the individual organizational levels are harmonized with that of the company-wide BSC.
2.1	Within the company, the existing perspectives of the BSC are subjected to regular analyses and evaluations – to ensure balance in the light of the overall strategy.
2.2	Within the company, the existing perspectives of the BSC are subjected to regular analysis and evaluation – in terms of the way and contents of cascading to all levels of management and organizational units.
2.3	Within the company, the way and contents of cascading of strategic perspectives to all levels of management and organizational units is subjected to regular analyses and evaluations.

The results obtained bay way of conducting research are related to the characteristics of implementing and using the BSC, evaluating the fulfilment of expected and actual benefits of the BSC system. Such a solution does not take into account the factor of time, which might affect e.g. the comparison of subjects with different length of the time of using the BSC, the abstraction from the gradual developmental changes of the BSC system since its implementation, or abstraction from the comparison of financial, economic and market results before the implementation of the BSC with the results obtained after having the BSC implanted etc.

Based on the aforementioned we are assuming that the beneficial findings could be revealed by a research focused on the gradual developmental changes of financial, economic and market results as a result of long-term usage of the BSC system. In this context, our further scenarios for future research are as follows:

- reassess the balance within the BSC system, trimming of the individual components of the BSC and their influence exerted on reliability of information provided by the BSC system for strategic decision-making;
- reassess causality in the BSC system, inspecting causalities among the components within the BSC system and their influence exerted on the reliability of information for strategic decision-making;
- reassess cascading and harmonization of the BSC system within the company and its influence exerted on the reliability of information provided for strategic decision making by the BSC system.

Conclusion

The contribution was oriented on the system of factors affecting the full functionality of the BSC methodology and the mutual relations among them. The research conducted helped identify and compare the expected and actual benefits of the BSC, measure of functionality and measure of dysfunctionality, further categorizing the causes of the status and the mutual relations between the individual causes with a representative sample of Slovak companies. As the problem of BSC is rather extensive, the contribution is presenting only the selected outputs of the research mentioned. Not included are e.g. the quantification of benefits in the form of value-based indicators, rate of return of the resources invested when implementing and maintain the BSC in practice, reassessment of the causalities within the BSC system etc.

Based on the outputs of the research conducted in local companies, a list of potential benefits from applying the BSC methodology in practice was compiled. The 20 potential benefits were grouped by their contents into four main areas, i.e.in the area of strategy and goals, corporate culture, human resource management and company performance management (Table 5).

Table 5 - List of potential benefits of the balanced scorecard methodology in practice

Area	Code	Potential benefit of the balanced scorecard
Strategy and goals	A	BSC decomposing company strategy (vision, mission, goals) into quantifiable criteria
	B	BSC interlinking strategy and the operative level of the company (participating in all organizational units)
	D	BSC causal interlinking of the criteria suggesting ways toward realization of the strategy
	E	BSC providing feed-back in terms of the extent of strategy realization
	H	BSC supporting focus on strategically important criteria
Corporate culture	I	BSC supporting implementation and management of changes within the company
	J	BSC increasing quality of information necessary for strategic decision-making
	L	BSC offering framework for communicating strategy throughout the company
	M	BSC supporting changes toward strategy-oriented corporate culture
	N	BSC supporting culture of innovation within the company
Human resource management	O	BSC supporting concentration on employees and strategic priorities
	P	BSC help identifying qualitative actors of perspectives and potentials for learning and growth important for achieving strategic goals
	Q	BSC motivating employees toward self-monitoring of performance
	R	BSC interlinking employees' remuneration with their individual performances
	S	BSC facilitating employees in their understanding relations between everyday work and company strategy

Performance management	T	BSC providing a comprehensive view on measurement of performance, measuring achieving goals
	U	BSC interlinking processes with company strategy
	W	BSC helps identify redundant processes and inefficient activities
	Y	BSC improving information awareness on actual company performance
	Z	BSC revealing weaknesses in company performance

It is not only theory but also research and practice of strategic management that drawing our attention to the interrelation that exists between strategic management and company performance at large, medium and small companies alike. Consequently, it is important for modern managers to become interested in new methodologies and ways of company evaluation based not only on measuring financial indicators of performance, but also on making use modern tools offering comprehensive approaches to strategic management, not leaving out a system such as the BSC. Its functional application in practice provides the company with reliable and undistorted information for strategic management, of which the successful existence of any company in the demanding and particularly unpredictable environment of entrepreneurship.

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WELLBEING AND INTERNAL MIGRATION IN ITALY: AN ECONOMETRIC ANALYSIS¹

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Abstract

We apply a double panel data econometric analysis (a static regional, for the period 1995-2011, and a provincial dynamic panel, for the period 2005-2011) for Italy, in order to evaluate which wellbeing factors can cause internal migration, by pointing out the relevance of subjective factors and economic variables. For what concerns social variables, we verify the Tiebout's hypothesis, according to which migration depends on the satisfaction of provision of public goods; furthermore, we consider the relevance of social cohesion in the migration process, according to the EU Regional Policies framework. As for the economic variables, we follow the Harrod-Todaro approach, according to which individuals migrate to improve their economic wellbeing related to labour market conditions.

Our results find that pull factors of internal migration are the high level of income per capita and the good perception of the quality of local services, while push factors of internal migration are the high perception of social insecurity and the huge level of unemployment with the latter increasing its influence during the crisis.

Keywords: internal migration, regional development, wellbeing, Tiebout's hypothesis.

JEL Classification: J11, R10, R58.

1. Introduction

Internal migrations are an economically relevant phenomenon for a number of reasons. Firstly, at global level, the amount of internal migrants is six times bigger than that of international migrants (UNDP, 2009). Secondly, in Italy, ever since the end of World War II, interregional migrations have been consistently larger than international in terms of amount, human capital intensity and displacement, duration (Berti, 2008). Thirdly, internal migrations can limit regional convergence in per capita income since migrants are mainly high-skilled individuals: the loss of (young) skilled labour force drags down human capital, making impossible the generation of virtuous circles of cumulative growth, resulting in a scanty level of economic development in the long run (Greenwood, 1997). Moreover, there are financial flows from Southern to Centre-Northern Italy in order to sustain young southern migrants living in precarious labour conditions in the North (Pugliese, 2009), especially in the earlier years of their experiences away from home. These financial flows contribute to deplete otherwise available cash and to sop it up towards the Centre-North. Finally, in Italy, at least since the second half of the 1990s, internal migrations from underdeveloped to developed areas have somewhat increased (SVIMEZ, 2007). For these

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reasons in this paper, we want to shed some brighter light on which factors (economic vs. social) related to wellbeing affect the choice of migrating among Italian Regions. This is achieved by means of two thorough econometric analyses carried out at both static and dynamic levels, for Italian regions and provinces and the periods 1995-2011 and 2005-2011 respectively. In our view, the need for these two econometric analyses is given by two facts: 1) to confirm that the statistical links found at a higher territorial level are similar to those at a lower level; 2) to overcome the constraint given by the limited number of units of the regional analysis which makes a dynamic panel data analysis unfeasible.

Economic factors are those usually connected with labour market while social factors are more akin to concepts like quality of life (Cebula, 2009), quality of public services supplied and social cohesion. The introduction of variables related to people's perception is indeed the main valued added for the regional analysis, as in the literature, authors mainly used objective variables to explain the determinants of migration. In fact, in the analysis of migration and to the best of our knowledge, only Cadwallader (1992), measures the subjective perceptions of individuals on regional economic variables.

Furthermore, from a policy viewpoint, our approach is highly consistent with the Italian regional policy approach, where local actors have a proactive role. For what concerns the provincial analysis, the loss of subjective factors (unavailable at that territorial level) is compensated by the huge increase in observations that allows for a well-performed dynamic analysis. Our results show that while both economic and social factors do have an impact on internal migrations in Italy evaluated at regional level and in a static framework⁴, when a dynamic analysis is performed on Italian provinces (and thus when the t-1 migration rate is considered), social contexts measured by the crime rate are relevant throughout the whole period. Oppositely, among the economic factors considered, unemployment is less important than the standard of life until the outbreak of the European crisis: indeed, starting from 2008, unemployment becomes again the main cause of migrations. This fact bears witness of the hardship that households and individuals have been exposed to since 2008, which has never been recorded in the last sixty years. The paper is organised as follows: in section 2 the theoretical framework is presented. Section 3 briefly describes data. In section 4 the econometric model is introduced and results are shown, while section 5 concludes.

2. Theoretical framework

Two types of wellbeing variables impacting on migrations are considered: economic and social-“quality of life” factors.⁵ As for the economic components, according to the approach first developed by Harris and Todaro (1970), individuals migrate from a region to another when the territory of destination is more advanced in the labour market in terms of wage levels and working conditions. In particular, individuals maximise their expected utility function that is directly proportional to the income they expect to earn and the probability to find a job, represented by the employment rate. Furthermore, some empirical studies underline that only a good combination of high wages and low unemployment can encourage a migration from different places (Etzo, 2008).

Social - “quality of life” factors are useful to verify the Tiebout hypothesis according to which *“the consumer-voter may be viewed as picking that community which best satisfies his preferences for public goods [. . .] the consumer-voter moves to that community whose local government best satisfies his set of preferences.”* (Tiebout, 1956, p. 418). In this sense, *“people ‘vote with their feet’ for the better provision of local public goods. Ceteris paribus, migrants prefer a region with better public goods provision”*. (Adrienko and Guriev 2004, p.17). The experience of the Italian regional policy, according to which the improvement of the social context is an effective instrument to promote regional development and individual and collective wellbeing (Barca, 2009), is a very useful theoretical handhold in this context. In particular, in the Italian National Strategic Framework 2007-2013, the most important governmental document for the regional development policies, the improvement of quality of life is the fourth political priority and is linked to social security and the quality of service provision. (DPS, 2007). Under this

⁴ Comparable results are obtained using fixed and random effects.

⁵ For an analysis of the interaction between social and economic factors, see Corsi and Guarini (2011).

approach, regional policies are able to increase the attractiveness and the competitiveness of a region by improving quality of life. Two elements characterize cohesion policies. First, public regional action has to focus on individuals and firms: institutions have to both involve local actors in the choice of political goals and instruments, and understand their problems. Second, institutions have to reduce social and territorial exclusion by improving all kinds of local services' systems.

Thus, following this approach, in this analysis quality of life factors are "the provision of basic public goods and services" and "social cohesion"; in particular in the regional analysis, some proxies (like the perceived quality of provision of train service and the perception of criminality respectively) are inserted.

Indeed, in the literature, social cohesion has often been related to disciplines like sociology, political science and psychology rather than economics. Due to the number of links to those different theoretical domains, no clear definition of social cohesion can thus be univocally cited. The variety of definitions exhibit varying widths of scope and widely diverging degrees of abstraction. The Bertelsmann Foundation (2012) helps us to classify these definitions in six groups: a) those linked to social relationships between groups and/or members of groups where the core factors are social networks, which also feature the concept of social capital in Putnam's sense (2000); b) those emphasising the orientation towards the common good (Ritzen, 2001); c) those combining orientation towards the common good with shared values that allow members of the community to identify joint goals and objectives (Kearns & Forrest 2000); d) definitions and studies based on the importance of belonging and identifying oneself with society (connectedness); e) those connected to the equal/unequal distribution of resources; f) those focusing on wellbeing, welfare and quality of life (objective and subjective quality of life). For what concerns this latter group of definitions, the link between social cohesion and quality of life has been not only abstractly underlined but also many a time analysed in depth. For instance, Berger-Schmitt (2002) argues that social cohesion is indeed a component of quality of life particularly in Europe, and distinguishes two essential goal dimensions inherent in the concept: the inequality dimension and the social capital dimension. She also provides a proposal on how to measure this conceptualisation of social cohesion within the framework of a European System of Social Indicators.

Also European organisations are well aware of this strong link: for example Eurofound (2005) finds that many regional interventions aimed at improving quality of life try to reach this objective by increasing social capital and/or providing more services through which social inclusion is fostered.

Furthermore, in 2010 the Council of Europe has adopted a new strategy for social cohesion where the reinvestment in social rights and a cohesive society is highlighted. This can be achieved by implementing policies which constitutes steps to promote "*the wellbeing and empowerment of families which are critical for the quality of life and the prevention of poverty*". Indeed, according to the Council of Europe, "*investing in a cohesive society also requires us to initiate policies that recognise every person's potential to contribute to quality of life for all. All members of society, including the poorest, have skills and values that can be mobilised for social cohesion*".

Also the provision of transport services can influence quality of life directly with their use and indirectly as an instrument for the provision of other services and goods. Furthermore, the quality of public transport services is related to the quality of the environment as it can foster the reduction in the use of the private transport (Italian Ministry of Economic Development, 2007). According to the European Commission, transport services are very relevant for regional development, mainly for the rural areas that are characterised by a high propensity to emigrate. Transport services in a region are all the more relevant when they allow connections with other regions and permit an easier access for firms and people to different kinds of services, like business or social and cultural services. In rural areas, the quality of transport services is tantamount to a good link with the regional centres; while in the urban areas, the quality of transport network concerns the efficiency of urban system (European Commission 2010). Often, policies are concentrated on physical infrastructure, but from the regional policy point of view, the infrastructure is only the precondition of development, while what matters is the provision of services (Omtzigt, 2009).

The other social variable linked with the quality of life in the regional analysis is criminality (Powdthavee 2005). According to Powdthavee (2005), high level of crimes is correlated positively with lower levels of perceived quality of life. Crimes can affect negatively quality of life both directly by reducing trust and increasing fear in people so much that they decide to emigrate, and indirectly by increasing costs for firms that decide to transfer production, with negative consequences for the locals (Deller and Ottem 2001). Crimes can reduce social capital - which is universally regarded as a paramount instrument for regional development - in its two dimensions: structural (such as social network) and cognitive (such as the willingness to connect people). According to policy makers, crimes and the perception of personal safety are essential elements in order to measure social wellbeing and individuals' happiness, because they have a long term social impact on both victims and those close to them. In fact, "[...] *crime on others in the neighbourhood may increase the probability of victimisation and therefore heighten the levels of fear and anxiety for non-victims living in the area.*" (Powdthavee 2005, p.542).

In the provincial analysis these variables are not available: for this reason the choice has fallen on another objective social factor: crime rate. This constraint does not allow us to discern between economic and quality of life determinants. Nonetheless, the number of observations rises: this increase is a necessary condition to perform a reliable panel data dynamic analysis, i.e. one where the lagged dependent variable – the internal migration rate - appears among the RHS variables. We are well aware that the two different analyses are incomparable: this notwithstanding, the latter analysis allows us to break the analysed time period between the years before the crisis and those of the crisis. This helps us to see whether changes in the relevance and/or (statistical) significance of the parameters have occurred.

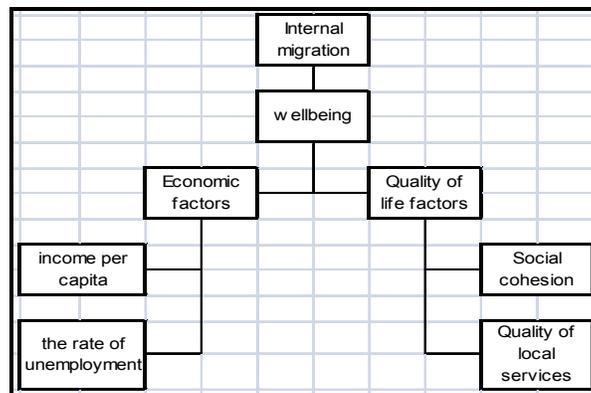


Figure 1. The determinants of internal migration

3. Descriptive analysis

Figure 1 and Table A.1 in the annex show, respectively, the main determinants of migration (whether economic or related to life quality aspects) and the net migration rate dynamic among Italian Regions in the period 1995 - 2011 and Provinces in the period 2005 - 2011. Scrutinising what occurred in those time frames is particularly interesting because, after 1994, internal migrations in Italy have started again to increase notably (Etzo, 2007). As in the previous periods, Italian population exhibit the usual migration path from Southern regions to those of the Centre-North. The area with most emigrants is that of the so called the “Convergence Regions” (Campania, Apulia, Calabria, Sicily). These Regions are those having a per capita gross domestic product (GDP) less than 75% of the EU25 average. The other Regions recording a negative net internal migration rate are the Southern non-Convergence Regions (Basilicata, Molise, Abruzzo and Sardinia). Oppositely, the Regions that receive the largest quota of immigrants in relation to their population are those of the North-East (Friuli Venezia Giulia, Veneto, Trento, Bolzano, Emilia Romagna), followed by the Central Regions (Lazio, Marche, Tuscany and Umbria) and the North-Western (Piedmont, Lombardy, Aosta Valley, Liguria). More in depth, data show that those with the highest (negative) net internal migration rates are Calabria and Campania, while the regions with the highest positive migration rate are Emilia Romagna and Marche. These data confirm the change occurred

in migrational trends. Up to the Italian economic boom (that came about in the sixties) the North-West represented the main destination of migrants coming from all the other parts of Italy (exclusive of Lazio where the strong attractor constituted by the capital city of Rome is located); after that period North-Eastern and Central Italy have become areas characterised by a high internal (and external) immigration rate because of their economic development and the economic crisis of the old “industrial triangle” – Milan, Genoa, Turin (Golini 1974) situated in the North-West.

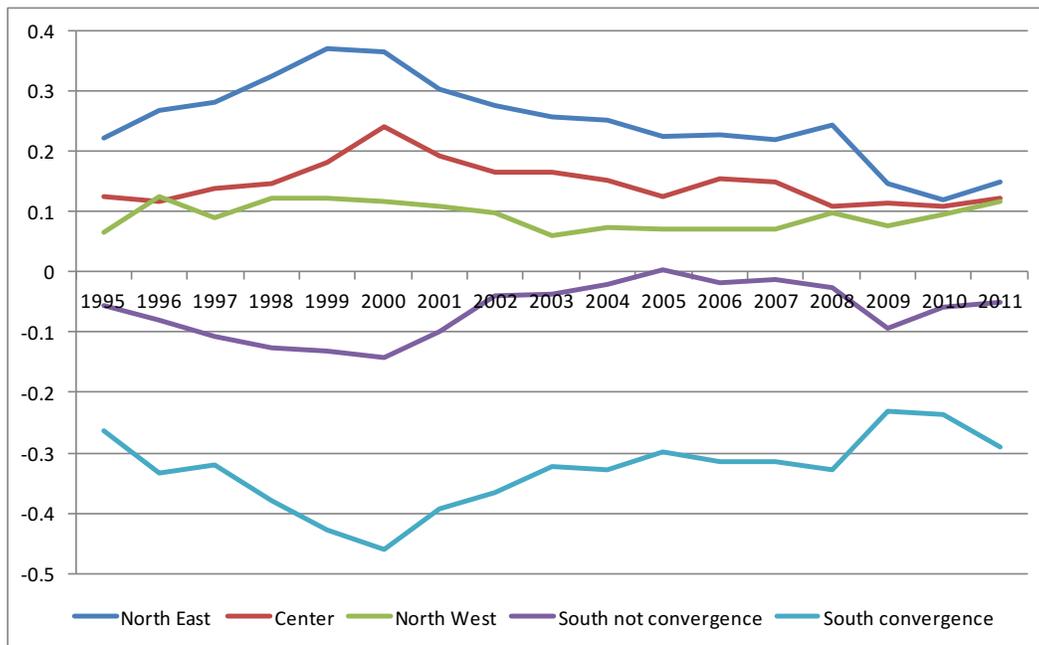


Figure 2. The Net Internal Migration Rate in Italy (1995-2011)

Note: The Net Migration Rate = [(inflows-outflows) / residential population]*100. Southern convergence Regions are the following: Campania, Apulia, Calabria, Sicily. Southern non convergence are: Abruzzo, Molise, Basilicata, Sardinia.

4. Econometric model and results

The data used are obtained by three databases built by the ISTAT (Italian Institute of Statistics): “Base dati territoriale per le politiche di sviluppo”; “Conti regionali territoriali”; “DemoIstat”. The period of analysis is 1995-2011 for Italian Regions and 2005-2011 for Provinces. According to the Harris and Todaro’s framework (1970), the dependent variable representing the migration phenomenon is the net migration rate calculated as follows (eq. (1)):

$$m_i = \left(\frac{I_i - E_i}{P_i} \right) * 100 \quad (1)$$

where I_i , E_i and P_i are respectively the level of immigrants to the i th region (inflows), the level of emigrants from the i th region (outflows) and the level of population resident in the i th region. The independent variables for the regional static analysis are the following: per capita GDP, unemployment rate, degree of satisfaction towards railway services (expressed as the percentage of people satisfied over the total number of households), crime perception (expressed as the number of households very much or quite sensitive to the risk determined by crimes committed in the region they abide). For the provincial

dynamic analysis, the independent variables are: the unemployment rate at provincial level, life standard (expressed as an index composed of housing costs, family consumptions, family savings, pensions, rate of inflation, GDP per capita) and crime rate (thefts and robberies per thousand inhabitants). In this case of course, the lagged dependent variable is added to the RHS of the equation. The variables are expressed in gaps with the respect to the national value: $x_{hig} = x_{hi} - x_{hN}$ where x_{hig} is the difference between the regional value x_i and the national x_{hN} . Values are expressed in logarithms or percentages.

The equation for our panel analysis (in the regional case) is the following

$$m_{i,t} = A + \alpha_1 y_{i,t-1} + \alpha_2 u_{i,t-1} + \alpha_3 c_{i,t-1} + \alpha_4 s_{i,t-1} + \mu_i + \tau_t + \varepsilon_{i,t} \quad (2)$$

In eq. (2) i refers to the Italian Regions, t is the year considered, m is the net internal migration rate, A is the constant, y is the regional gap in per capita gross domestic product expressed in natural logarithms, u is the regional gap in the rate of long term unemployment, c is the regional gap in the percentage of families that are very much or quite sensitive to the risk of criminality, s is the regional gap in percentage of persons that are satisfy with train service, while $\alpha_1, \alpha_2, \alpha_3, \alpha_4$ are the coefficients. If the coefficient has a positive sign the variables should be considered a pull factor (its increase causes an increase in internal immigration), while, if the variable has a negative sign it should be considered as a push factor (its increase causes a decrease in internal immigration). Finally, μ_i is the individual effect that can be deterministic (Fixed Effect model) or stochastic (Random Effect model), τ_t represents the time deterministic effect, ε_{it} is the white noise. We made use of subjective measure for quality of life variables in the regional analysis. The random effect analysis shows a larger coefficient compared to that of the fixed effect (see Table A.3). The other coefficients do not change in the shift from random to fixed effects. If anything, variables retain their strong statistical significance. The Hausman test shows a very low chi square (1.27), and high p-value (0.867). Thus, this leads us to think that the model with stochastic (random) individual effects is more reliable with respect to that with deterministic (fixed) individual effects. As already commented above, this result is only interesting for the per capita GDP (the only variable whose coefficient changes among the two specifications).

Table 1. Regional analysis: static panel

	Static panel	Random Effect			Fixed Effect		
	R-sq overall = 0.72	Coef.	Std. Err.	P> z	Coef.	Std. Err.	P> z
economic context	per capita gdp	0.344	0.110	0.002	0.571	0.222	0.011
	unemployment rate	-0.023	0.003	0.000	-0.023	0.003	0.000
social context	satisfaction in railway services	0.004	0.001	0.005	0.003	0.001	0.007
	crime perception	-0.003	0.001	0.003	-0.003	0.001	0.005
	year	-0.001	0.001	0.072	-0.001	0.001	0.076
	constant	2.979	1.648	0.071	2.964	1.652	0.074

According to the results shown in table 1, all independent variables used are significant. Then we can argue that for the period 1995-2011, internal migration in Italy depends on different gap factors concerning the general economic context, the labour market conditions, the social cohesion and the provision of local public services. Specifically, the push factors are the high levels of unemployment and the high perception of criminality, while the pull factors are high levels of income per capita and the high perceived quality of the railway services. For what concerns the significance of economic determinants of migrations, these results validate the relevance of Harris-Todaro approach. Furthermore, the analysis

points out that in the second half of '90s there has been a “migration structural break” with respect to the previous long period 1973-1996. Indeed, according to Fachin (2007) over the 1973-1996 period there was a so called “empirical puzzle”: migration trend to decrease while economic regional gap increased. Arguably, migration did not depend on labour market-economic considerations. In the next 1995-2008 period, migration was affected more by the situation in the local labour markets. With reference to the significance of quality of life factors, the analysis verifies the Tiebout hypothesis: quality of life factors are determinant for people if they decide to move from an Italian Region to another.

The Provincial analysis is carried out by means of a dynamic difference GMM panel analysis on account of the increase of units (103 vs. 21 of the regional case). In other words another term (say, $\beta_{m_{i,t-1}}$) has been added to eq. (2) above. This dynamic analysis has not been performed in the regional case, due to the low number of observations which would cause the Arellano-Bond autocorrelation tests to likely have little power (Roodman, 2006)⁶. Time dummies are again included as they prevent the most common form of cross-individual correlation, contemporaneous correlation.

Table 2 - Provincial analysis: dynamic panel

Difference GMM 2005-2011		Coef.	Robust Std. Err.	P> z	Difference GMM 2008-2011		Coef.	Robust Std. Err.	P> z
economic context	unemployment rate	-0.106	0.055	0.053	economic context	unemployment rate	-0.236	0.111	0.033
	standard of life	0.011	0.003	0.000		standard of life	0.006	0.003	0.056
social context	crime rate	-0.099	0.032	0.002	social context	crime rate	-0.110	0.036	0.003
	migration (t-1)	-0.618	0.068	0.000		migration (t-1)	0.591	0.067	0.000
	year	-0.042	0.026	0.103		year	0.068	0.062	0.274

Results shown in Table 2 for the whole period 2005 - 2011 show that push factors - unemployment rate and crime rate are significant (the former with a significance slightly overpassing the 5% significance), and so is the pull economic factor constituted by life standard(see, table A.4). When the Eurozone crisis period (2008 - 2011) is analyzed, the crime rate retains its statistical significance while its coefficient lowers somewhat (from -0.099 to -0.11). For what concerns the economic determinants, the significance of the unemployment rate becomes stronger as does its negative effect (the coefficient passes from -0.106 to -0.236). The opposite occurs for the life standard. We interpret this shift as follows: the hardship and the loss of jobs experienced by households and individuals from 2008 onwards have caused the internal migration rate to be more linked to the most traditional economic factor, the unemployment rate, rather than the standard of life. The Hansen statistics shows the validity of the choice of (internal) instruments both for the whole and the Euro crisis periods.

Conclusions

We have investigated the relevance of some socioeconomic factors for internal migration in Italy in the period 1995 - 2011, by applying a double panel data econometric analysis: a static regional and a provincial dynamic panel. According to our regional results, Italian internal migrations are influenced significantly by variables related to labor market and economic wellbeing and by factors related to the quality of life. In particular, the pull factors of internal migration are the high level of income per capita and the good perception of the quality of local railway services, while the push factors of internal migration are the high level of unemployment rate and the high perception of insecurity. When provinces

⁶ To check for first-order serial correlation in levels, the second-order serial correlation in differences has to be looked for. In point of fact, negative first-order serial correlation of error terms in difference is expected, and evidence of it is uninformative.

are examined, results do not change much. However, a shift among the economic determinants (from the standard of life to the unemployment rate) is encountered, correspondent to the inception of the Eurozone crisis.

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ANNEX

Table A.1. Regional net internal migration rate

	Mean 1995- 2011	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Emilia Romagna	0.41	0.38	0.44	0.44	0.50	0.62	0.59	0.52	0.45	0.39	0.42	0.41	0.41	0.34	0.42	0.24	0.20	0.24
Trento	0.27	0.27	0.29	0.28	0.30	0.31	0.31	0.19	0.21	0.27	0.34	0.21	0.21	0.27	0.26	0.24	0.30	0.30
Marche	0.25	0.28	0.29	0.31	0.38	0.32	0.35	0.38	0.35	0.31	0.29	0.24	0.21	0.28	0.22	0.07	0.01	0.05
Umbria	0.24	0.24	0.32	0.25	0.26	0.29	0.38	0.27	0.28	0.22	0.20	0.27	0.20	0.22	0.23	0.21	0.18	0.08
Friuli Venezia Giulia	0.22	0.14	0.14	0.23	0.27	0.33	0.39	0.33	0.30	0.27	0.24	0.17	0.17	0.25	0.22	0.14	0.12	0.14
Tuscany	0.21	0.19	0.22	0.22	0.24	0.31	0.32	0.28	0.24	0.24	0.21	0.19	0.20	0.16	0.15	0.17	0.16	0.16
Aosta Valley	0.15	0.39	0.42	0.44	0.42	0.15	0.26	0.09	0.13	0.30	0.25	0.24	0.01	-0.23	-0.12	-0.17	-0.05	0.05
Veneto	0.13	0.12	0.17	0.18	0.21	0.19	0.20	0.15	0.15	0.16	0.12	0.09	0.09	0.11	0.11	0.05	0.03	0.05
Lombardy	0.12	0.07	0.15	0.10	0.15	0.16	0.16	0.15	0.14	0.08	0.10	0.10	0.10	0.11	0.12	0.09	0.12	0.14
Bolzano	0.10	0.01	0.03	0.08	0.04	0.09	0.08	0.00	0.04	0.07	0.08	0.15	0.14	0.09	0.17	0.18	0.17	0.22
Abruzzo	0.07	0.08	0.08	0.09	0.08	0.05	0.03	0.09	0.08	0.07	0.11	0.17	0.07	0.12	0.10	-0.03	0.01	0.02
Liguria	0.07	-0.01	0.00	0.00	0.02	0.03	0.06	0.06	0.08	0.10	0.12	0.14	0.11	0.05	0.10	0.10	0.08	0.11
Lazio	0.06	0.02	-0.03	0.02	0.00	0.04	0.14	0.07	0.05	0.07	0.07	0.02	0.10	0.09	0.03	0.08	0.09	0.13
Piedmont	0.05	0.09	0.12	0.09	0.10	0.07	0.05	0.04	0.01	0.00	-0.01	-0.02	0.00	0.01	0.06	0.05	0.06	0.07
Molise	-0.06	-0.09	-0.03	-0.07	-0.11	-0.10	-0.07	0.01	0.06	-0.03	-0.09	-0.13	-0.06	-0.10	-0.03	-0.07	-0.11	0.00
Sardinia	-0.07	-0.08	-0.11	-0.17	-0.19	-0.19	-0.22	-0.19	-0.05	-0.03	-0.01	0.02	0.04	0.02	0.01	-0.03	-0.01	-0.05
Sicily	-0.26	-0.22	-0.29	-0.27	-0.33	-0.38	-0.44	-0.34	-0.31	-0.28	-0.25	-0.18	-0.21	-0.21	-0.21	-0.14	-0.15	-0.18
Apulia	-0.28	-0.26	-0.33	-0.30	-0.34	-0.33	-0.36	-0.29	-0.28	-0.26	-0.26	-0.25	-0.29	-0.27	-0.26	-0.21	-0.19	-0.24
Basilicata	-0.34	-0.25	-0.35	-0.35	-0.36	-0.37	-0.34	-0.29	-0.32	-0.30	-0.30	-0.34	-0.37	-0.37	-0.40	-0.42	-0.35	-0.24
Campania	-0.40	-0.28	-0.35	-0.36	-0.42	-0.49	-0.54	-0.49	-0.46	-0.38	-0.38	-0.39	-0.40	-0.41	-0.46	-0.29	-0.32	-0.39
Calabria	-0.40	-0.32	-0.41	-0.38	-0.45	-0.57	-0.48	-0.45	-0.39	-0.38	-0.50	-0.43	-0.39	-0.37	-0.38	-0.31	-0.31	-0.36
North-east	0.25	0.22	0.27	0.28	0.33	0.37	0.37	0.30	0.28	0.26	0.25	0.23	0.23	0.22	0.24	0.15	0.12	0.15
Centre	0.15	0.12	0.12	0.14	0.15	0.18	0.24	0.19	0.17	0.17	0.15	0.12	0.15	0.15	0.11	0.11	0.11	0.12
North-west	0.09	0.07	0.13	0.09	0.12	0.12	0.12	0.11	0.10	0.06	0.07	0.07	0.07	0.07	0.10	0.08	0.10	0.12
South non convergence	-0.06	-0.06	-0.08	-0.11	-0.12	-0.13	-0.14	-0.10	-0.04	-0.04	-0.02	0.00	-0.02	-0.01	-0.02	-0.09	-0.06	-0.05
South convergence	-0.33	-0.26	-0.33	-0.32	-0.38	-0.43	-0.46	-0.39	-0.37	-0.32	-0.33	-0.30	-0.32	-0.31	-0.33	-0.23	-0.24	-0.29

Note: The Net Migration Rate is calculated as follows: [(inflows-outflows) / residential population]*100. Regions are ranked by their own periodical (1995-2011) mean.

Table A.2 - Description of the regional variables

Variable		Mean	Std. Dev.	Min	Max	Observations
Migration rate gap	overall	0.026	0.244	-0.565	0.623	N = 357
	between		0.236	-0.404	0.413	n = 21
	within		0.078	-0.354	0.312	T = 17
gdp gap	overall	-0.045	0.267	-0.525	0.371	N = 357
	between		0.272	-0.474	0.320	n = 21
	within		0.019	-0.095	0.025	T = 17
unemployment rate gap	overall	-0.114	4.912	-9.053	14.085	N = 357
	between		4.845	-6.388	10.040	n = 21
	within		1.307	-4.177	3.931	T = 17
satisfaction in railway services gap	overall	-0.064	6.971	-23.764	21.973	N = 357
	between		6.405	-16.340	13.945	n = 21
	within		3.067	-11.131	9.726	T = 17
crime perception gap	overall	-6.891	10.817	-28.489	26.596	N = 357
	between		10.557	-20.592	19.328	n = 21
	within		3.251	-16.321	2.686	T = 17

Table A.3 - Description of the provincial variables

Variable		Mean	Std. Dev.	Min	Max	Observations
migration rate gap	overall	0.452	2.651	-7.832	9.492	N = 750
	between		2.482	-6.103	5.836	n = 110
	within		0.924	-2.983	4.430	T-bar = 6.818
unemployment rate gap	overall	7.631	4.178	-2.900	19.400	N = 750
	between		4.014	-0.814	17.543	n = 111
	within		1.293	3.160	12.945	T-bar = 6.757
quality of life index gap	overall	0.636	71.023	-165.000	260.200	N = 740
	between		65.800	-142.471	189.929	n = 108
	within		25.676	-135.064	99.593	T-bar = 6.852
crime rate gap	overall	-4.206	8.748	-20.500	34.500	N = 728
	between		8.544	-17.900	26.400	n = 104
	within		2.030	-12.906	4.908	T-bar = 7

Table A.4 - Provincial dynamic analysis. Tests

	Difference GMM one step 2005-2011		GMM Difference GMM one step 2008-2011	
	z	P> z	z	P> z
AR(1)	-4.860	0.000	AR(1)	-4.360 0.000
AR(2)	0.75	0.451	AR(2)	0.87 0.382
Hansen test	58.67	0.139	Hansen test	58.17 0.075

THE EFFECT OF OIL PRICES ON RESIONAL PORTFOLIOS OF KOREAN SMAL AND MEDIUM ENTREPRISE: FEATURES ON REGION, SUB-PERIOD, AND MEASUREMENT TYPE OF OIL PRICE CHANGES⁷

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Abstract

By making use of the newly constructed regional portfolios of Korean SMEs, this paper examines the effect of oil price changes on these portfolios returns. The results from the multifactor market model are as follows: (1) the portfolios classified in the capital area (Seoul, Incheon, and Gyeonggi-do-do) are less likely to be significantly exposed to oil price changes rather than others in non-capital area; (2) portfolios are more likely to be significantly exposed to oil prices changes when oil price changes are sizable; (3) portfolios are more likely to be significantly exposed to the type of oil price changes measured by the 'random-walk' assumption rather than by the 'GARCH (1,1)' process. These results suggest informative features on oil price exposures of Korean SMEs.

Keywords: oil price exposure, Korean SME, multifactor market model, GARCH.

JEL Classification: G12; L71

1. Introduction

As oil prices movements during the past decade have been dramatic, the research interest in the effect of oil price changes on the economy has recently grown. Skyrocketing from about \$40 per barrel in mid-2000s, crude oil prices finally reached the record-high in July, 2008 but sharply fell down by around a third of the record-high in December, 2008 due to the global financial crisis. Then oil prices resurged and tend to be moving around the level of \$100 during a few of years. Considering that oil is a crucial resource for the economy, it is highly presumed that the recent oil price changes affect economic activity through various channels. Yet, most of existing studies are macroeconomic perspectives by asking how macroeconomic variables, such as, GDP, consumption, inflation rate, etc., are affected by oil price changes.⁸

Unlike most of previous studies, this paper examines Korean SME portfolios returns and oil price changes from 2007 to 2011, when the changes are dramatically volatile. In specific, this paper investigates how the effect of oil price volatility on Korean SME portfolios is different by the region, sub-period, and measurement type of oil price volatility. This firm-level analysis is meaningful in that it reflects a microeconomic perspective and provides the features on oil price exposures of Koran SMEs which is the distinctive case study in the oil price exposure field.

2. Literature review

As mentioned before, most of existing empirical analyses dealing with the effect of oil price on economy pay attention to the macroeconomic variables, such as, national production, inflation rate, consumption and expenditure, etc. As a representative and pioneering work on the macroeconomic effect, Hamilton (1983) suggested the widely-accepted result that oil price shocks contract macroeconomic variables and eventually caused depressing economy. Burbridge and Harrison (1984) also found that oil price shocks of early 1970s and 1980s increased both wages and price levels in 5 developed countries, Canada, Japan, Western Germany, UK, and USA. After these two papers numerous papers using various methodologies and updated data have provided similar results. Hamilton (2009) as the most recent paper

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⁸ For more details, see Section 2. Literature Review

reconfirmed that the 2008-09 oil price shocks depressed US economy by lowering growth of GDP. The results, in common, showed the negative impact of oil price shocks on these macroeconomic variables.

There also exists a long history of literatures focusing on stock market return to find the effect of oil prices changes with macroeconomic perspectives. Chen et al (1986), as one of the earliest works, found that the impact of oil prices on US stock returns was statistically insignificant from 1959 to 1984. Huang et al (1996) also estimated that US stock returns from 1983 to 1990 were not significantly affected by oil prices changes. Jones and Kaul (1996) extensively studied USA, Canada, UK, and Japan and find US and Canadian stock market rationally react to oil shocks while UK and Japan irrationally react to the shocks. More recently, Kilian and Park (2009) using oil price shocks as endogenous variable suggested the reason why the oil effect is insignificantly estimated, which is that increases in oil price have either positive or negative effects on stock returns since the increases not only depress aggregate demand but also encourage aggregate supply. So, when these effects are offset simultaneously, the effect is estimated to be very small and insignificant, and even the sign of the effect could be either positive or negative.

However, empirical studies about the effect of oil prices on economy with microeconomic perspective have not been abundant. Recently, Sardorsky (2008) examined the effect of oil price changes on stock returns of North American oil companies and found that the effect was positively estimated. In specific, degree of the positive effect is lower as global proven oil reserve increases but is higher as global oil production increases. Gogineri (2010) suggested that industries depending more on oil tend to be more affected by oil price changes, and Bredin and Elder (2011) also provided similar results that US industrial portfolios having much association with oil, such as, oil products and gas, transportation, and so on, are more likely to be affected by oil price changes although other portfolios tend to be insignificantly affected by oil prices.

Realizing not only that oil prices are an attentive issue for the recent years but also that the effect of oil price with microeconomic perspective has been rarely analyzed, it is meaningful to examine the effect of oil price changes on Korean SMEs portfolios for the recent period, 2007 - 2011. In addition, by comparative analyses on region, sub-period, and measurement type of oil price changes, this paper attempts to uncover how oil price risk of Korean SMEs is differently estimated by these three factors. It is expected that this paper contributes to filling in the void of existing literature which mostly focuses on macroeconomics and have not studied the Korean SME case although Korea is one of leading emerging economies in the world..

3. Sample data and methodology

The basic data pool for firm selection is from the NICE Information Service (formerly called as Kisinfo before the M&A year of 2010 and then has changed into the name of KISVALUE). KISVALUE is known as a leading credit-rating agency in Korea as well as the most widely-used firm-level data source (e.g., Ahn *et al.*, 2008; Choi, 2010; Choi, 2012). The criterion for defining SMEs in Korea is the code No. 2 of the SME Act, Rep. of Korea regulating that SME should be either with employees under 300 or less than 8 billion Korean Won (KRW) capitalization from 2007 to 2011.

Under the above criterion for Korean SME, this paper examines the firms that have their headquarters and primary production facilities located in 7 regions: ‘Seoul’, ‘Gyeonggi-do’, ‘Incheon’ ‘Gyeongsangbuk-do’, ‘Daegu’, ‘Gyeongsangnam-do’, and ‘Busan’ because these areas are regarded as representatives having foreign involvements (Choi, 2012)⁹. The total number of the SMEs located in these representative 7 regions is 508. By region, 224 are for ‘Seoul’, 26 for ‘Incheon’, 177 for ‘Gyeonggi-do’, 15 for ‘Daegu’, 16 for ‘Gyeongsangbuk-do’, 27 for ‘Gyeongsangnam-do’, and 23 for ‘Busan’. So, I grouped these firms’ stock prices into for each regional portfolio by averaging them and then examine

⁹ Choi (2012) documented that these 7 regions in the country take considerable foreign trade ratio among other regions by suggesting the government survey report. Other regions’ foreign trade ratio is little and even lower than miscellaneous category. In addition, the map of Republic of Korea, demonstrating these 7 representative regions is provided in Appendix.

how each regional portfolio returns are exposed to oil prices changes. Table 2 provides basic descriptions for each portfolio on returns, sales, and export ratio (=export/total sales).

Table 1. Basic statistics of each regional portfolio grouped by the selected SMEs 2007~2011

Regional Portfolio	Returns			Sales			Export Ratio		
	Mean	Stddev.	Min/Max	Mean	Stddev	Min/Max	Mean	Stddev	Min/Max
Seoul	0.0013	0.038	-0.22/0.13	491.5	58.2	434.8/583.0	17.44	1.08	16.2/19.2
Incheon	0.0017	0.041	-0.22/0.13	461.0	121.2	309.0/593.4	31.06	3.92	25.8/34.4
Gyeonggi-do	0.0006	0.039	-0.22/0.13	525.3	94.0	435.8/697.2	31.74	1.39	29.8/33.4
Daegu	0.0022	0.052	-0.22/0.13	843.5	71.1	777.6/936.8	68.22	4.74	60.1/74.2
Gyeongsang buk-do	0.0013	0.061	-0.22/0.13	686.8	64.4	592.9/766.5	28.28	3.16	22.7/31.5
Busan	0.0007	0.050	-0.22/0.13	757.0	126.7	601.3/938.3	33.50	1	31.4/35.0
Gyeongsang nam-do	0.0023	0.048	-0.22/0.13	767.8	180.0	561.1/989.9	25.90	1.24	24.8/27.5

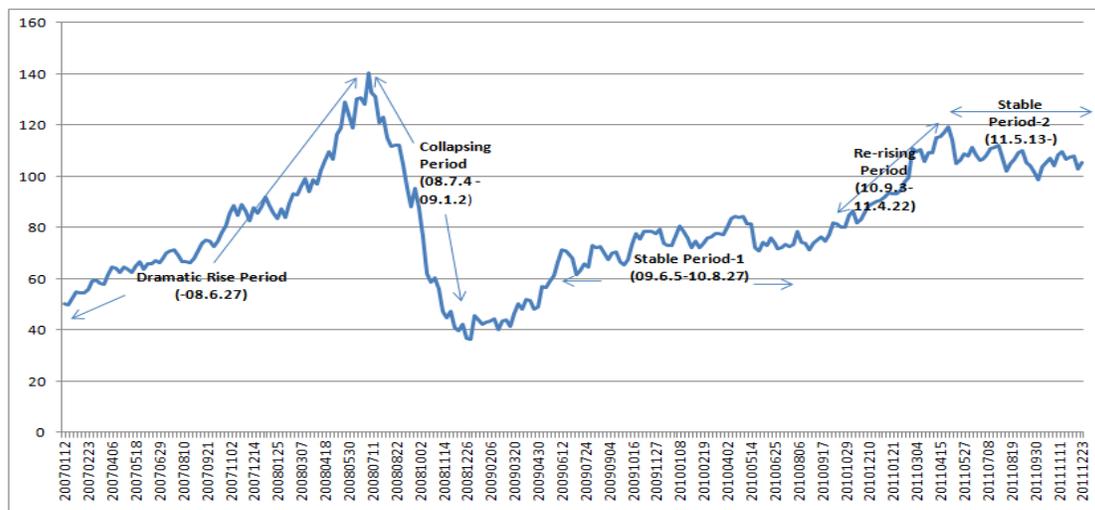
Source: KISVALE

Note: Sales are 100 million Korean Won and Export Ratio is in percentage (%) term

For oil price data, the Dubai crude oil spot prices are used since the Dubai takes about 80% of total imported crude oil for Korea which uses 100% imported crude oil without domestic production. Data source is Korea National Oil Corporation (KNOC) and the price trend from 2007 to 2011 is shown in Figure 1. Apparently, the price has 5 different states:

- [1] Dramatic Rise Period;
- [2] Collapsing Period;
- [3] Stable Period-1;
- [4] Re-rising Period;
- [5] Stable Period-2.

So, this paper will conduct 5 sub-periods analyses in addition to the entire sample period (2007~2011) analysis. These sub-periods analyses are expected to reveal whether oil price exposure is different by state of oil price changes.



Source: Korea National Oil Corporation (KNOC)

Figure 1. The Dubai crude oil spot price movements 2007~2011

The empirical model in this paper to estimate the effect of oil price on regional portfolios of Korean SMEs is based on Sadorsky (2008) as the following:

$$R_{it} = \beta_{0i} + \beta_{1i} \times \Delta DO_t + \beta_{2i} \times R_{mt} + \beta_{3i} \times \Delta EX_t + \varepsilon_{it} \quad (1)$$

where: - R_i - represents the weekly rate of return on i 's portfolio; - ΔDO - represents the weekly change in the Dubai oil price; - R_{mt} - is the weekly return s of the KOSDAQ market, where small and medium firms are listed; - ΔEX - is the weekly changes in exchange rate of Korean Won against USD.

The reason to include the KOSDAQ is for eliminating the spurious effect on each portfolio's oil price exposure parameter, β_{1i} , which is the purpose to be estimated to find oil price exposure of regional portfolios of Korean SMEs. The difference from the model of Sadorsky (2008) is inclusion of an exchange rate variable since this paper needs reflect a special characteristic of Korean SMEs which should import crude oil for input use. In particular, Korean Won / USD is used in the model since the rate is regarded as a representative exchange rate for explaining the value of Korean Won in global markets (Choi, 2012) as well as USD is invoicing currency of the oil (Choi, 2010).

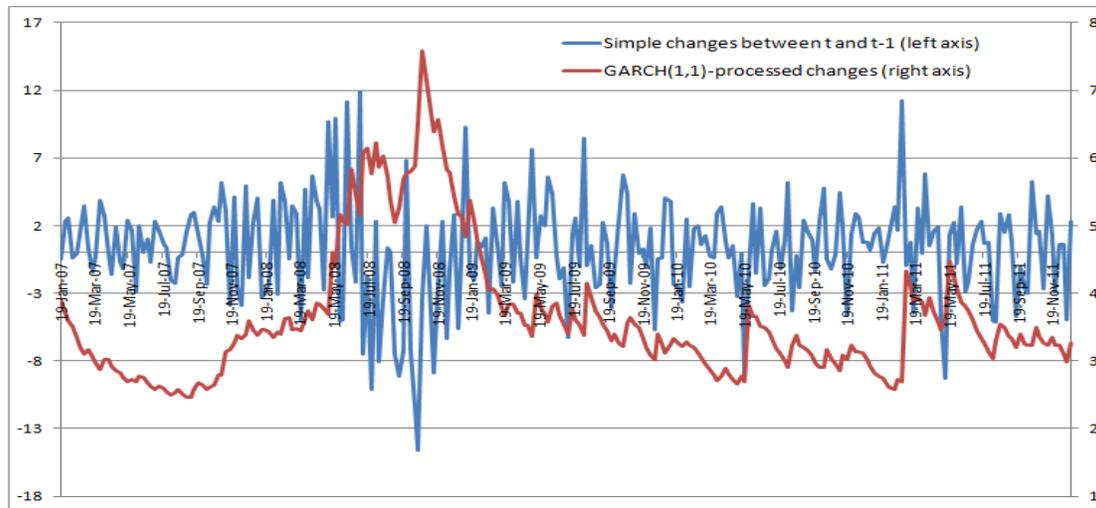
For the variable ΔDO , two types of oil prices changes are considered: (1) a simple change in Dubai prices between time t and $t-1$ (2) GARCH (1,1) - processed changes of Dubai oil prices. The first type is based on the assumption that oil price changes follows random-walk property with belief that oil price are no predictable by modelling, and the second type is based on an assumption that oil price changes can be modelled and predictable since the error terms of time-series data on crude oil prices have a characteristic variance. Among many GARCH(p,q) class models, this paper selects the most commonly-used GARCH(1,1). Thus, this paper eventually tests whether regional portfolios of Korean SMEs are differently exposed to oil prices changes by type of oil price changes in eq. (1). The GARCH (1,1) in this paper is defined by the following equation (2):

$$h_{t+1} = w + a_1 \times (\mu_t)^2 + a_2 \times (h_t) \quad (2)$$

where: - h - is variance of the Dubai oil prices;
- $(\mu_t)^2$ is the oil prices residual squared, t denotes time.
- w, a_1, a_2 are empirical parameters determined by maximum likelihood estimation.¹⁰

The obtained standard deviations through GARCH (1,1) process from eq. (2) is illustrated in Figure 2, where the simple changes are compared with also.

¹⁰ It is obtained that unconditional variance is 14.31, w is 0.6523, α_1 is 0.094, α_2 is 0.8577.



Source: Korea National Oil Corporation (KNOC)

Figure 2. Simple changes vs. GARCH (1,1) changes in Dubai oil prices 2007~2011

4. Empirical results

Using the ordinary least squares (OLS), the oil price exposure parameter, β_i , in eq. (1) is estimated for each regional portfolios during the entire 5 years, 2007~2011. As Table 2 shows, two regional portfolios (*Busan* and *Gyeongsangnam-do*) are significantly exposed to the oil price changes based on random-walk assumption while other five regional portfolios are not significantly exposed. When regrouping *Seoul*, *Gyeonggi-do-do*, and *Incheon* into the ‘capital-area’ portfolio and the rest four into the ‘non-capital-area’ portfolio, the non-capital-area portfolio returns are significantly exposed to oil prices. But, with the type of oil price changes based on GARCH (1,1), no significant results are made, implying that the oil price changes based on random-walk assumption is better for capturing significant oil price exposures for the case of Korean SMEs portfolios. Lastly, the signs of oil price exposures are estimated to be either positive or negative, which is consistent with conclusions by Kilian and Park (2009) suggesting that oil price increases may not only pressure demand sectors (= negative effect) but also encourage supply sectors (= positive effect).

Table 2 Empirical results for the entire sample period, 2007~2011

Regional Portfolio	Estimated β_i in eq. (1)	
	When ΔDO in eq. (1) is simple changes based on the ‘random-walk’ assumption	When ΔDO in eq. (1) is the changes based on ‘GARCH(1,1)’
(1) Seoul	-0.0001 (0.72)	-0.0001 (0.92)
(2) Incheon	0.0001 (0.72)	-0.00064 (0.54)
(3) Gyeonggi-do	0.000494 (0.31)	0.0009 (0.62)
(4) Daegu	0.000709 (0.25)	0.0018 (0.43)
(5) Gyeongsangbuk-do	-0.0001 (0.89)	-0.0011 (0.72)
(6) Busan	0.0011*** (0.05)	0.0006 (0.78)
(7) Gyeongsangnam-do	0.00105* (0.07)	0.0016 (0.65)

Capital Area (1)+(2)+(3)	0.0001 (0.52)	5.52E-05 (0.95)
Non-Capital Area (4)+(5)+(6)+(7)	0.0012* (0.09)	0.0006 (0.69)

Note: Numbers in parentheses are p-values and asterisks indicate significance level: *** is at the 1%, ** is at the 5%, and * is at the 10% level

As described in Figure 1, the entire sample period can be divided into 5 sub-periods. From Table 3 to Table 7, the estimated oil price exposure parameters ($\beta_{i,t}$ s) are summarized for each sub-period. The noticeable finding is that portfolios tend to be significantly exposed to oil price changes for the periods with greater volatility, i.e., states: [1], [2], and [4], rather than for the periods with stable changes, [3] and [5]. This finding implies that vulnerability of Korean SMEs to oil prices changes increases as uncertainty in the global oil market is greater. In addition, simple oil price changes based on the ‘random-walk’ assumption is better for capturing significant exposures, too.

Table 3 - Empirical results for the sub-period: [1] Dramatic Rise Period, January, 2007 - June, 2011

Regional Portfolio	Estimated β_i in eq. (1)	
	When ΔDO in eq. (1) is simple changes based on the ‘random-walk’ assumption	When ΔDO in eq. (1) is the changes based on ‘GARCH(1,1)’
(1) Seoul	-0.001** (0.04)	-0.0011 (0.67)
(2) Incheon	-0.001 (0.17)	-0.00048 (0.86)
(3) Gyeonggi-do	0.0001 (0.98)	0.0111* (0.55)
(4) Daegu	-0.001 (0.30)	0.0033 (0.51)
(5) Gyeongsangbuk-do	-0.002 (0.16)	-0.01326 (0.11)
(6) Busan	0.003* (0.08)	-0.01129 (0.11)
(7) Gyeongsangnam-do	-0.0001 (0.48)	0.0018 (0.71)
Capital Area (1)+(2)+(3)	-0.0001 (0.11)	0.00316 (0.23)
Non-Capital Area (4)+(5)+(6)+(7)	0.001* (0.09)	-0.00485 (0.19)

Note: Numbers in parentheses are p-values and asterisks indicate significance level: *** is at the 1%, ** is at the 5%, and * is at the 10% level

Table 4 - Empirical results for the sub-period: [2] Collapsing Period, Jan.2008~Jan.2009

Regional Portfolio	Estimated β_i in eq. (1)	
	When ΔDO in eq. (1) is simple changes based on the ‘random-walk’ assumption	When ΔDO in eq. (1) is the changes based on ‘GARCH (1,1)’
(1) Seoul	0.001* (0.08)	-0.0105 (0.12)
(2) Incheon	0.001* (0.09)	-0.0111* (0.10)
(3) Gyeonggi-do	0.0001 (0.87)	0.0033 (0.72)
(4) Daegu	0.005***	-0.01569

	(0.01)	(0.35)
(5) Gyeongsangbuk-do	-0.003 (0.11)	-0.03925** (0.02)
(6) Busan	0.002* (0.07)	0.00724 (0.52)
(7) Gyeongsangnam-do	0.002** (0.05)	-0.00325 (0.77)
Capital Area (1)+(2)+(3)	0.001* (0.08)	-0.0069 (0.27)
Non-Capital Area (4)+(5)+(6)+(7)	0.003** (0.04)	-0.00405 (0.67)

Note: Numbers in parentheses are p-values and asterisks indicate significance level: *** is at the 1%, ** is at the 5%, and * is at the 10% level

Table 5 - Empirical results for the sub-period: [3] Stable Period-1, Jun.2009~Aug.2010

Regional Portfolio	Estimated β_i in eq. (1)	
	When ΔDO in eq. (1) is simple changes based on the 'random-walk' assumption	When ΔDO in eq. (1) is the changes based on 'GARCH(1,1)'
(1) Seoul	0.0001 (0.94)	0.0011 (0.74)
(2) Incheon	0.0001 (0.77)	-0.0036 (0.35)
(3) Gyeonggi-do	0.002 (0.10)	-0.0029 (0.65)
(4) Daegu	0.0001 (0.78)	-0.0092 (0.46)
(5) Gyeongsangbuk-do	0.002 (0.19)	-0.0211 (0.24)
(6) Busan	-0.0001 (0.89)	0.00388 (0.73)
(7) Gyeongsangnam-do	0.0001 (0.67)	-0.00947 (0.58)
Capital Area (1)+(2)+(3)	0.0001 (0.89)	-0.0018 (0.54)
Non-Capital Area (4)+(5)+(6)+(7)	0.0001 (0.74)	-0.00898 (0.31)

Note: Numbers in parentheses are p-values and asterisks indicate significance level: *** is at the 1%, ** is at the 5%, and * is at the 10% level

Table 6 - Empirical results for the sub-period: [4] Re-rising Period, Sep.2010~Apr.2011

Regional Portfolio	Estimated β_i in eq. (1)	
	When ΔDO in eq. (1) is simple changes based on the 'random-walk' assumption	When ΔDO in eq. (1) is the changes based on 'GARCH(1,1)'
(1) Seoul	-0.0001 (0.94)	-0.0006 (0.85)
(2) Incheon	0.0001 (0.78)	-0.0001 (0.97)
(3) Gyeonggi-do	0.001 (0.38)	-0.00247 (0.77)
(4) Daegu	0.003* (0.06)	0.009458 (0.31)

(5) Gyeongsangbuk-do	0.001 (0.77)	0.0234 (0.21)
(6) Busan	0.003* (0.06)	0.0026 (0.76)
(7) Gyeongsangnam-do	0.002 (0.33)	0.0217* (0.10)
Capital Area (1)+(2)+(3)	0.0001 (0.90)	-0.0011 (0.76)
Non-Capital Area (4)+(5)+(6)+(7)	0.001* (0.09)	0.0143** (0.05)

Note: Numbers in parentheses are p-values and asterisks indicate significance level: *** is at the 1%, ** is at the 5%, and * is at the 10% level

Table 7 - Empirical results for the sub-period: [5] Stable Period-2, May.2011~Dec.2011

Regional Portfolio	Estimated β_j in eq. (1)	
	When ΔDO in eq. (1) is simple changes based on the 'random-walk' assumption	When ΔDO in eq. (1) is the changes based on 'GARCH(1,1)'
(1) Seoul	0.0001 (0.68)	-0.00588 (0.56)
(2) Incheon	0.001 (0.48)	-0.00678 (0.36)
(3) Gyeonggi-do	0.001 (0.65)	0.015934 (0.28)
(4) Daegu	0.002 (0.17)	0.003196 (0.83)
(5) Gyeongsangbuk-do	-0.0001 (0.97)	0.0103 (0.41)
(6) Busan	0.001 (0.63)	0.00079 (0.95)
(7) Gyeongsangnam-do	0.001 (0.53)	0.0187 (0.11)
Capital Area (1)+(2)+(3)	0.0001 (0.66)	0.0011 (0.84)
Non-Capital Area (4)+(5)+(6)+(7)	0.001 (0.55)	0.0083 (0.31)

Note: Numbers in parentheses are p-values and asterisks indicate significance level: *** is at the 1%, ** is at the 5%, and * is at the 10% level.

Concluding remarks

This paper examines oil price exposure of region-based portfolios of Korean SMEs while the research interest in the effect of oil prices on economy grows as the oil prices dramatically changes. With 7 regional portfolios constructed by matching the information on major foreign trade locations in Korea and firm's headquarters (or primary production facility), the multifactor market model suggests the results as the followings.

First, among the 7 major regional portfolios, the portfolios grouped by the SMEs located in the capital area ('Seoul', 'Gyeonggi-do-do', 'Incheon') are less likely to be exposed to oil prices rather than the portfolios grouped by SMES located in the 'non-capital-areas' ('Daegu', 'Gyeongsangbuk-do', 'Busan', 'Gyeongsangnam-do'). In particular, within the 'non-capital-areas' portfolios, 'Busan' and 'Gyeongsangnam-do', are more likely to be significantly exposed. Second, regional portfolios are more likely to be significantly exposed to oil prices for the sub-periods when oil prices changes are much volatile rather than the sub-periods when oil prices changes are relatively stable. Third, regional portfolios

of Korean SMEs are more likely to be significantly exposed to the simple changes in oil prices rather than GARCH(1,1)-processed changes in oil prices.

These results provide implications to academic scholars as well as industry practitioners that Korean SMEs located in the non-capital areas need to make more efforts for improving the capability of risk-managing on oil price fluctuations. In particular, the capability needs to be improved as soon as possible before the global oil market is unstable again since their exposure to oil prices tends to be more significant as the market state becomes unstable. Also, when estimating oil price exposure of Korean SMEs, the simple changes in oil prices based on 'random-walk' assumption are useful for capturing significant exposures rather than the most common GARCH (1,1).

Although the empirical analyses of this paper provide informative results on Korean SMEs' oil price exposures, but further works still remain for the next research. First, in order to divide 5 sub-periods, it is better in terms of scientific treatment to employ a statistical discernment method, for instance, Markov-switching model. Second, it needs to undertake decomposition analysis for finding factors of sensitivity of Korean SMEs oil price exposure. Rather than using the exchange rates as an exogenous variable in eq. (1), it would be more interesting to consider the rate as an endogenous factor of Korean SMEs oil price exposures since it is known that they heavily depend on imported crude oil. Other firm-specific factors, such as, R&D, oil intensity, and so on, are also considerable.

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APPENDIX

The map of Republic of Korea: Administrative Regional Segregation



Source: Dreamstime (<http://www.dreamstime.com>)

INDEBTEDNESS OF MUNICIPALITIES AND ITS INFLUENCE ON FINANCING OF SPORT: CASE STUDY OF SLOVAKIA

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Abstract:

Indebtedness of public administration has become a key issue of the economic debates and discussions in recent years. Growing public debt negatively influences the economic development and causes serious troubles to every country and its inhabitants. In a paper we analyze and examine the influence of growing indebtedness on municipalities' decision to finance sport. For our purpose, we chose eight capital cities of the Slovak high territorial units. We analyzed the development of indebtedness and financial health indicators within period 2009-2012. From obtained data we examined how indebtedness influences the decision of selected municipalities to finance and provide sport activities and services. Methodology and methods for data analysis are described in Section 2. We stated hypothesis that indebtedness in selected municipalities causes decreased financing of sport activities. We found out that indebtedness development has direct connections, impacts, and correlation on decision of municipality representatives. Further conclusions and discussion are part of Section 4. Paper is elaborated within national scientific research project VEGA 1/1195/12 Strategic interactions of the Slovak local municipalities in determining the tax rates.

Key words: indebtedness, municipalities, financing of sport, economic development.

JEL Classification: H72, H76, H63

1. Introduction

New position and functions of municipalities, obtained independence and sovereignty in 1990, opportunity to manage financial capital and own property motivated municipalities to new development. Needs of municipalities to invest and renew own infrastructure and to widen provided number of local public goods and services were so huge that municipalities suffered from lack of current revenues to cover all of them. Municipalities turned to capital markets.

Nowadays, when indebtedness of all levels of public budget structure became a vital problem of developed economies, it is important to focus attention and analyze causes of indebtedness and its influence on municipalities. While bigger municipalities are usually more capable to repay debt because of bigger budget size, smaller ones with lower budget volumes have become more risky. The higher indebtedness with decreasing current revenues causes insolvency and thus municipalities are not able to provide desired volume and quality of public goods and services.

For the purpose of our analysis in a paper, we chose eight regional municipalities in Slovakia which are the heads of higher territorial units in Slovakia. Not only that we analysed indebtedness and financial health indicators' development, we also searched the correlation between indebtedness of selected municipalities and their decision to finance sport in municipality. We chose the analysis of municipality indebtedness because it is a subject of the national research project VEGA 1/1195/12 Strategic interactions of the Slovak local municipalities in determining the tax rates.

Not only that we analysed the development of indebtedness within 2009-2012, we also aimed to determine whether high levels of municipalities' indebtedness have direct influence and impact on their decision to finance and provide sport activities and services.

We stated the following *hypothesis*: Indebtedness in selected municipalities causes decreased financing of sport activities.

Paper is divided into five Sections. Objectives and methodology are defined in Section 2. Section 3 deals with the Literature overview of focused topic. Analyses of indebtedness and financial health indicator development as well as discussions and conclusions are part of Section 4. We examined and calculated how indebtedness influences decision of municipality representatives to finance sport within the period of 2009-2012 in selected municipalities. We stated conclusions for analysed municipalities with both similar and specific trends in each of them. Final Section 5 summarizes facts and gives outcomes for future discussion.

2. Objectives and methodology

The main *objective* of a paper is to prove or decline stated hypothesis that indebtedness of selected municipalities' causes decreased financing of sport activities.

In order to fulfil stated objective we used the following *methods*:

1. Synthesis of information and available data to give overview of the theoretical background of focused topic. We collected information from scientific and expert domestic and foreign literature sources, the Slovak Statistic Office, from budgets and internal financial statements of selected municipalities, web portal of the Slovak municipalities, as well as from Internet sources.
2. Analytical methods were applied in Section 4. We analysed data from budget incomes and expenditures in order to calculate municipality indebtedness and financial health indicators.

Act No. 583/2004 on budgetary rules of local municipalities defines in § 17 two conditions to be fulfilled at once by municipality in order to be allowed to borrow further returnable sources:

- total municipality debt does not exceed 60 % of real current incomes of former fiscal period,
- the annual repayment of financial returnable sources (repayment of principal and interests) does not exceed 25 % of real current incomes of former fiscal period.

Municipality indebtedness indicator – debt service is calculated as follows:

$$\frac{\text{principal and interest repayments}}{\text{current revenues of former fiscal period}} \quad (1)$$

Financial health indicator was calculated using special methodology in several partial steps.

At first, we calculated partial score for each of five main focused areas: total debt, debt service, commitments at least 60 days after maturity, immediate liquidity, and basic balance. Total score describing financial health of municipalities represents a weighted average of obtained partial scores for five given areas.

Should total municipality debt be 0%, it is given +3 score. With growing debt given score linearly decreases reflecting rising municipality risk. As debt equals 60 %, the score is zero and if debt equals or exceeds 120%, the score levels -3.

Should municipality debt service equal 0%, it is given +3 score. With growing debt service given score linearly decreases reflecting rising municipality risk. As debt service equals 25%, the score is zero and if debt service equals or exceeds 50%, the score levels -3.

In case of commitments 60 days after maturity, the score is calculated for each year, so that if the sum of commitments 60 days after maturity is 0 euro or 0% respectively, the municipality receives +3 score. Should the share of the sum of these commitments to incomes oscillate between 0% and 3%, the

given score is 0 to -3 (linearly), while the score is -3 if the value of the share of the sum of these commitments to incomes exceeds 3%. Consequently, the score for commitments 60 days after maturity for the whole period is calculated as a weighted average of the score of commitments 60 days after maturity indicator for the most recent available year (2012) and for three former years (2011-2009), with weights consistently 4, 3, 2, and 1.

Should the municipality immediate liquidity be 0%, it is given -3 score. With growing liquidity the score linearly increases reflecting lower municipality risk. Should immediate liquidity be 100 %, the score levels 0 and the score is +3 if the immediate liquidity reaches or exceeds 200%.

Basic balance is calculated using data from both current and capital budget:

$$\frac{\text{incomes of current and capital budget} - \text{expenditures of current and capital budget}}{\text{incomes of current and capital budget}} \quad (2)$$

The more positive basic balance is the more positive points up to +3 the municipality receives linearly and vice versa.

Finally, the overall financial health score is constituted as a weighted average of five partial scores using weights 1/3, 1/6, 1/6, 1/6, and 1/6 (constantly total debt, debt service, commitments at least 60 days after maturity, immediate liquidity, and basic balance). Total debt has the highest weight because it potentially represents the highest risk for the municipality financial stability.

On a basis of provided methodology, the selected municipalities may reach score between -3 up to +3 where positive values reflect rather healthy position and financial stability. The more positive number, the higher assumptions that municipalities finance the bigger amount and volume of public services, mainly the one we analysed in a paper: sport activities. On the other hand, if the score is more negative, it indicates problems of analysed municipalities with financial stability and with fulfilment of legislative criteria of maximum total debt and maximum debt service. At once, we suppose that worsen indebtedness, hand in hand with worsen financial stability, will lead to decreased financing of analysed public service: sport activities.

1. Comparison of obtained figures, data and shares within the indebtedness and financial health indicator with the expenditures on sport activities within the period of 2009-2012. Analysis of correlation between indebtedness level and spending on sport.

Figures and data were collected from local budgets and internal accounting statements of analysed municipalities. Provided comparison and correlation will enable us to prove or decline stated hypothesis.

3. Literature overview

Public debt and public administration debt according to ESA 95 methodology defined by Eurostat (2011) is a sum of public sector commitments on all levels of public government and public funds. Semmens (2012) defines debt as an obligation the repayment of which extends beyond the then existing budgeting and appropriation period.

Nothdurft and Weinberg (2013) argue that as if state debts weren't enough, there also is the growing mountain of county and municipal government debt. Self-government's debt represents such part of public administration debt that is made on local level, it means on sub-government levels. These lower levels are constituted from both local and regional governments. Indebtedness of self-government units in Slovakia is mostly related to municipalities, since higher territorial units exist for a shorter period (since 2002). Municipalities regularly borrow money for a variety of purposes. Ordinary borrowing purposes include satisfying cash flow needs, financing the acquisition of capital assets and paying for the construction and repair of municipal infrastructure. State law strictly regulates both the purposes for which cities and towns can borrow and the time periods for which these borrowings can occur. Semmens (2012) specifies that municipal indebtedness may be in the form of a bond, a note, a loan agreement, and lease purchase agreement. As he points out, municipal debt falls into three categories: general obligation indebtedness, revenue indebtedness and special assessment indebtedness.

Growing indebtedness is influenced mostly by the economic crisis. Development of indebtedness reacts on development of both income and expenditure items of municipal budgets.

Reasons for borrowing capital result from two realities. The first reason is connected with chosen financing of local municipalities in each country. If sub-governments are mostly financed by taxes sensitive on economic development (case of Slovakia, where sub-governments are mostly dependent on shared Income tax from natural persons), in times of the economic recession this source of income becomes insufficient to finance all common public needs of municipalities. As Horváthová (2010) points out, the share on Income tax from natural persons represents the main source of taxation incomes in municipal budgets and is thus one of the most important incomes alongside with purpose grants. Present time shows that many small municipalities found themselves unable to finance common needs and provide basic public goods such as public lighting, road maintenance, waste disposal, etc.

Provazníková (2007) discusses the second reason for growing indebtedness: It is related to their capital expenditures. Municipalities turn to capital market in order to finance costly investment projects. Examples of such projects is renewal of infrastructure, building of gas network, city sewage system and plants, water pipes, sport and cultural facilities, etc. Blake (2013) adds that municipalities use debt to finance their capital budget. Each generation that benefits from an asset must pay or be financially responsible for an equitable share based on benefits derived or received.

On the other hand, Horváthová, (2009) argues that fulfilment of original competences such as maintenance and reconstruction of buildings in municipality ownership is also included into investment expenditures.

As Provazníková (2007) points out, the high capital expenditures for investments mainly to infrastructure and renewal of property cause high rates of debt growth. The most of capital expenditures are spent on non-profit projects generating either small or even no profit to repay debt. Such debt is therefore repaid from current revenues and it may negatively influence basic public functions in small municipalities. Allocation of grants and criteria for dividing of investment grants where common requirement for municipality is to participate on financing also increases indebtedness. Municipalities usually take bank loans to cover these costs.

Djurović, Jelić, Radojičić (2013) point out three primary reasons why the access to financial markets is concerned as municipalities: Financing capital expenditures because municipalities are often responsible of public investments which are inherently difficult to handle. Adjustment of expenditures and tax flows, the access to financial markets offers a possibility to reconcile discrepancies as arising expenditures and intake of taxes do not have to be completely synchronized. Giving encouragement to political responsibility – price determination of the capital by the market can provide an independent mechanism for encouraging political responsibility.

Horváthová (2010) also argues that municipalities used to guarantee debts of third parties that also meant potential municipality commitments. Malíčká (2012) explains that the incorrect evidence and statistics of potential commitments means a serious problem if there is no system of early warning reflecting the risk rate. This fact is caused by lack of qualification and administrative skills of municipality representatives and missing rules for exact definition what financial guarantees and aid can be provided by municipalities. On the other hand, in the opinion of Nothdurft and Weinberg (2013), not every sub-government faces the same problems – for example, some have been much better about transparency and using proper accounting methods than others, and not all have incurred debt by creating tax increment finance districts.

4. Analysis of indebtedness in selected municipalities and its influence on financing of sport activities

The Section 4 deals with the analysis of influence of indebtedness and financial health in eight capital cities of high territorial units in Slovakia on financing of sport activities. For our purposes, we chose municipalities of Bratislava, Trnava, Trenčín, Nitra, Žilina, Banská Bystrica, Prešov, and Košice. We obtained required data from internal accounting statements of municipalities as well as from their budgets. We calculated indicators in the way described in Section 2 – Objectives and Methodology.

4.1 Description of municipalities

The Section 4.1 gives a brief description of selected municipalities. We provided readers with basic demographical and economic indicators.

Table 1 - Characteristics of selected municipalities

Municipality	Inhabitants (thousand)	Acreage (km ²)	Average unemployment (%)	Average salary (€)
Bratislava	414	367,58	5,20	1 220
Trnava	67	71,54	7,22	865
Trenčín	57	82	8,65	857
Nitra	81	100,50	9,84	839
Municipality	Inhabitants (thousand)	Acreage (km ²)	Average unemployment (%)	Average salary (€)
Žilina	85	80,03	10,07	863
Banská Bystrica	79	103,37	9,86	818
Prešov	92	70,4	18,15	756
Košice	241	244	11,25	880

Source: Statistic office and internal municipality financial statements.

4.2 Analysis of indebtedness of selected municipalities and its influence on financing of sport

Section 4.2 provides information about the development of indebtedness and financial health indicators within period of 2009-2012. This period was chosen because of the economic crisis launch in Slovakia. As discussed in Section 3, the influence of debt rise and revenues drop on behaviour of municipalities in Slovakia can be clearly seen also from presented data in the following tables. Tables 2 – 9 provide information about the indebtedness level of eight selected municipalities in Slovakia. The final column of each table indicates their financial health. This indicator is calculated only for 2011-2012 because of the change in legislation and thus also of methodology of what is included in the total debt and debt service indicators. Therefore, it is not possible to compare four analysed years in the sense of financial health indicator. The results would be thus misleading.

Finally, Table 10 shows data about spending on sport activities in analysed municipalities. These spending include both the current and capital expenditures. Current expenditures were mostly used to cover the salaries, travel costs, basic equipment purchase, maintenance and small repairs of sport facilities, e.g. of municipal sport halls or swimming pools as well as for organising the sport events. Capital expenditures represent mostly grants for building of new or reconstruction and modernisation of present ice-hockey and football stadiums, or sport halls and facilities.

Table 2 - Indebtedness and financial health of Bratislava

Year	Total debt (%)	Debt service (%)	Comm. over 60 days of maturity (%)	Immediate liquidity (%)	Basic balance (%)	Financial health score
2009	64,57	4,56	N/A	32,62	- 35,8	N/A
2010	62,57	3,09	0,006	33,49	- 7,53	N/A
2011	66,49	39,70	0	40,19	2,15	0,79
2012	59,71	3,69	0	50,20	2,91	0,26

Source: Own calculation

The capital city of Slovakia, Bratislava, is influenced by indebtedness significantly. Its debt position is rather risky. It exceeds legislative limits in both indicators: total debt is over 60% of former current revenues (2009-2011) and debt service is over 25% of former current revenues in 2011. As seen, the financial health indicator is also decreasing. Such level of indebtedness is likely to influence negatively decision on quality and amount of provided public services. Immediate liquidity is rather low

what has a negative influence on repayment of commitments when they become due and on stable financial position of municipality. On the other hand, these figures together with improving basic balance indicate high capital spending for construction and modernisation of public facilities. We conclude that such level of indebtedness will cause decrease in spending on sport activities.

Table 3 - Indebtedness and financial health of Trnava

Year	Total debt (%)	Debt service (%)	Comm. over 60 days of maturity (%)	Immediate liquidity (%)	Basic balance (%)	Financial health score
2009	34,62	4,42	N/A	528	- 4,31	N/A
2010	38,03	5,10	0	235	- 5,39	N/A
2011	37,85	5,93	0	113	4,54	1,76
2012	34,92	5,76	0	238	- 2,66	1,64

Source: Own calculation

The indebtedness of the seventh biggest city in Slovakia is balanced. Municipality does not exceed any indebtedness limit and also the financial health indicator places it amongst the healthiest municipalities in Slovakia. Such data indicate responsible fiscal policy of its representatives when revenues decrease. We conclude that such level of stable and low indebtedness will have positive impacts on decisions to finance the sport activities.

Table 4 - Indebtedness and financial health of Trenčín

Year	Total debt (%)	Debt service (%)	Comm. over 60 days of maturity (%)	Immediate liquidity (%)	Basic balance (%)	Financial health score
2009	76,85	4,52	N/A	39,99	- 4,34	N/A
2010	87,47	7,19	2,98	5,38	- 11,19	N/A
2011	79,83	12,25	0,05	43,11	18,72	- 0,55
2012	30,07	28,13	0	20,32	- 0,13	0,50

Source: Own calculation.

Fiscal position of the third analysed municipality is not healthy. Within the focused period, the indebtedness reached high levels over the legislative limits except of last year 2012. On the other hand, due to big amount of bank loans repayments, the municipality did not fulfil the second legislative criterion in 2012. As we can see, the financial health indicator also reached negative values in 2011 and low improved positive value in 2012. Basic balance is also negative what indicates problems in financial position of the city and tendency to lower spending on sport activities due to big financial load from borrowed sources. That will be subject of further analysis in a paper.

Table 5 - Indebtedness and financial health of Nitra

Year	Total debt (%)	Debt service (%)	Comm. over 60 days of maturity (%)	Immediate liquidity (%)	Basic balance (%)	Financial health score
2009	29,43	6,9	N/A	445	2,42	N/A
2010	36,70	6,27	0	153	- 20,87	N/A
2011	37,20	7,69	0	162	- 2,07	1,71
2012	29,13	7,44	0	178	4,66	1,63

Source: Own calculation.

Fiscal position of Nitra seems positive. Tendency to deal with increasing indebtedness is clear in 2012 as representatives of the city succeeded to lower it and also to improve the overall basic balance at once. Though the financial health indicator slightly decreased, we can conclude that during the financial

crisis financial stability of the municipality is secured. City of Nitra did not have to decrease spending on sport activities just because of indebtedness level.

Table 6 - Indebtedness and financial health of Žilina

Year	Total debt (%)	Debt service (%)	Comm. over 60 days of maturity (%)	Immediate liquidity (%)	Basic balance (%)	Financial health score
2009	152,4	8,38	N/A	164	0,42	N/A
2010	148,95	4,10	0,13	57,16	0,18	N/A
2011	102,36	52,79	0,006	75,94	- 0,04	- 0,94
2012	85,6	7,85	0	89,21	7,62	- 0,09

Source: Own calculation.

Fiscal position of municipality Žilina seems to be weakening comparing to the others. High financial load by borrowed sources is caused by obtaining of state loan for construction of automobile factories and purchasing of lands. Without it, the indebtedness would reach legislative criteria. On the other hand, development of the area because of new production capacities will be worth borrowing. We can see the improvement of all calculated indicators in 2012. It means that Žilina is able to repay all bank loans and constantly improve financial stability and health. On the other hand, with such high indebtedness we anticipate decreased financing of sport.

Table 7 - Indebtedness and financial health of Banská Bystrica

Year	Total debt (%)	Debt service (%)	Comm. over 60 days of maturity (%)	Immediate liquidity (%)	Basic balance (%)	Financial health score
2009	28,68	4,92	N/A	197	- 2,64	N/A
2010	30,32	2,95	0	120	- 6,29	N/A
2011	27,48	5,64	0	26,84	1,25	1,74
2012	25,72	27,64	0	49,49	0,84	1,13

Source: Own calculation.

Data obtained from the analysis of Banská Bystrica indicate acceptable level of indebtedness with an effort to constantly decrease it. The exception is the last year 2012 when municipality loan repayments exceeded limit (25%). When looking at basic balance, fiscal position has also improved within 2009-2012 as loans are spent mostly on capital assets. Financial health score decreased in 2012, though. It was caused by higher capital spending from borrowed sources not from reserved funds. Therefore, we anticipate lower spending on sport facilities.

Table 8 - Indebtedness and financial health of Prešov

Year	Total debt (%)	Debt service (%)	Comm. over 60 days of maturity (%)	Immediate liquidity (%)	Basic balance (%)	Financial health score
2009	46,49	2,98	N/A	66,43	- 19,41	N/A
2010	47,03	2,88	1,25	61,08	- 7,05	N/A
2011	44,81	5,59	0,99	49,27	1,79	0,63
2012	41,91	4,55	1,12	55,72	2,63	0,25

Source: Own calculation.

The indebtedness level of municipality Prešov is rather high. Representatives should be more caution where they are borrowing and under which conditions. There is clear tendency from city representatives to decrease the indebtedness and at once to maintain capital spending on deserved level. Debt service is small enough to keep investments to capital assets. Basic balance improved within 2009-

2012. Financial score indicator remains low due to high indebtedness level and must be improved in the future. From given facts we suppose low support of sport activities.

Table 9 - Indebtedness and financial health of Košice

Year	Total debt (%)	Debt service (%)	Comm. over 60 days of maturity (%)	Immediate liquidity (%)	Basic balance (%)	Financial health score
2009	30,42	3,09	N/A	75,12	- 1,97	N/A
2010	41,24	5,75	1,77	34,01	- 14,03	N/A
2011	38,29	19,75	0,02	46,37	5,63	0,59
2012	28,08	5,76	0,01	24,49	0,6	0,59

Source: Own calculation.

The final analysed municipality is the second biggest city in Slovakia and is situated in the Eastern Slovakia. Its fiscal position is changing. Though the municipality decreases the indebtedness level, it is not able to keep positive development in both basic balance and financial health indicator. These problems are caused by compulsory repayments of lost court cases from past. On the other hand, the municipality won the title of the European Capital of Culture 2013, so it invested huge capital to brand new assets and to reconstruction and modernisation of remaining ones. That is why we can anticipate decreased volumes to sport investments.

Table 10 - Expenditures on sport activities in selected municipalities

Municipality / Year	2009	2010	2011	2012
Bratislava	25 344 718	48 747 668	5 827 290	5 471 033
Trnava	1 516 982	1 481 036	1 214 409	1 257 756
Trenčín	2 417 275	2 751 241	1 211 510	2 559 815
Nitra	2 347 607	2 305 568	1 457 322	1 680 593
Žilina	1 848 140	1 965 676	1 690 073	1 367 914
Banská Bystrica	2 229 261	2 018 399	1 807 515	1 586 695
Prešov	1 127 127	602 522	558 955	530 173
Košice	2 148 575	1 141 206	715 000	753 163

Source: Municipality budgets 2009-2012 and Closing reports 2010-2013.

Table 10 analyses the development of spending on sport activities. These spending include both current and capital expenditures as described in Section 2. Six municipalities Bratislava, Trnava, Trenčín, Nitra, Žilina, and Banská Bystrica have separate budget program called “Sport”. Municipality Prešov includes financing of sport into program called “Recreation, culture and religion” and municipality Košice includes financing of sport into program called “Health municipality”.

From provided figures we see big investments to sport activities in Bratislava in 2009-2010. These capital investments were transferred to reconstruction and modernisation of the municipal ice-hockey stadium for the IIHF Ice-hockey World Championship held in Slovakia in 2011. On the other side, municipalities of Košice and Prešov invested the smallest amount into sport activities. The primary reason for lower financing of sport in Prešov is high indebtedness and low financial health indicators, and also decision to invest during analysed period to modernisation of local public transport. Decision of Košice representatives to decrease financing of sport was not influenced only by the indebtedness level and low financial health indicator. They directed capital investments towards building of new cultural facilities, their modernisation and reconstruction connected with the European Capital of Culture 2013 title. Furthermore, Košice invested big amounts to renewal of local transport and to repayments of lost court cases from past. Košice also constantly decreased financing of professional football club (50 % partnership was ended in 2013).

4.3 Discussions

We see that high indebtedness level and lower financial health indicator have direct influence on decision of municipality representatives to decrease financing of sport. We found a strong correlation between the indebtedness level and financing of sport as discussed below in a paper.

From obtained figures and data we state the following conclusions:

- Financing of sport activities decreased in all analysed municipalities due to the economic crisis and drop in revenues during the analysed period. Without having the Ice-hockey World Championship, the similar tendency would occur also in Bratislava (capital investments to the ice-hockey stadium are involved in “Sport” program budget in 2009-2010).
- Spending on sport activities decreased due to the indebtedness level within 2009-2012 in almost all municipalities. *We conclude that the level of indebtedness has a direct influence on decision to finance sport in municipalities. We confirm our hypothesis that indebted municipalities decreased the budget for sport. We found strong correlation between the indebtedness level and financial health indicator of analysed municipalities and the decision of their representatives to finance sport.*
- When the indebtedness level *decreased*, the municipalities in specific periods decided to spend *more* on sport activities: Trenčín (2010, 2012) – reconstruction of the ice-hockey stadium, Trnava (2012), Nitra (2012), Košice (2012) – support of the women basketball team Good Angels in Euro league due to the promotion of ECC 2013 title, and Žilina (2010) – capital investment to football stadium. Therefore, if the indebtedness of municipalities was *lower* they would spend *more* on sport activities than they do nowadays. Again, we confirm strong correlation between indebtedness level and financing of sport.
- The indebtedness level is not the only indicator that influences decision of municipality representatives whether to invest to sport or not. There are also other economic indicators that are taken into account: basic balance and financial health indicator. We conclude that *the lower financial health indicator, the lower spending to sport activities* except the case when the indebtedness level significantly decreased at once: Trnava, Trenčín, Nitra (2012). It is important that municipality representatives consider also further economic indicators before they agree on final decision.
- The municipalities aim to invest more to capital assets and sport facilities if big international sport events take places with lack of consideration of their impact on indebtedness level (Bratislava 2009-2010), Košice (2009-2010), Žilina (2010). In this case the economic factors are not the key items influencing the final decisions affecting future income development of the municipality. These spending contributed to increased indebtedness. Despite these investments to capital assets, the current expenditures representing salaries, wages, levies, organising of sport events, and basic maintenance of sport facilities did not increase.
- Decision making process in analysed municipalities is also based on political agreements not only on sole economic indicators’ analysis. Therefore, the priorities and preferences of both mayor and members of local parliament were considered and implemented. The concrete examples are municipalities of Prešov and Košice (2010-2012; see reasons in upper text). Representatives agreed to spend more on different public goods and services than sport and thus they transferred more capital to public transport, cultural facilities or to repayment of debt.

Conclusion

In a paper we focused on the indebtedness of eight Slovak municipalities and its influence and impact on financing of sport activities. We found that general tendencies are equal in every municipality with no matter its economic performance, economic development or geographic and demographic position. The economic crisis hand in hand with drop of shared income tax from natural persons as a key income for municipalities alongside with purpose state and EU grants caused decreased finances to sport activities. Only few huge capital investments in specific periods due to organisation of big international competitions and events convinced municipality representatives to spend more on capital assets and thus to bring more capital to sport. These spending contributed to increased indebtedness. On the other hand, it did not mean the increase of current expenditures as explained in Section 4.

Stated hypothesis was confirmed. Indebtedness level and financial health of municipalities have direct impact on spending on sport (see few exceptions in Section 4). Growing indebtedness and the one attacking the legislative limits causes smaller support of sport. Worsen financial health indicator also contributed to lowered sport support. Therefore, the municipal representatives should be very caution about future borrowing. The level of indebtedness should decrease significantly. Sport is one the original competence belonging to municipalities. Its financing should not be only the matter of public capital; it is dependent on private one, too. But without municipality interest and contribution to its development, without capital investments to building of new or to reconstruction and modernisation of persisting sport facilities, there will always be lack of private capital and lack of sport interest from local inhabitants.

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PERSISTENCE OF PROFITABILITY IN TURKEY: EVIDENCE FROM INSURANCE SECTOR

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Abstract

In recent years, the investigation of persistency of profit for insurance sector has become a significant subject of research with its increasing importance in economy. With this respect, by using the data of return on assets (ROA) and return on equity (ROE) of 7 insurance companies quoted in BIST (Stock Market of Istanbul) in the period from March 2005 till September 2013, the profit of these companies was investigated whether persistent or not via IPS (2003) without break and Panel LM (2005) with structural break unit root tests. As a result of study, by eliminating the findings via panel LM test that profit was observed persistent from model without break, profit was determined non-persistent in situation taken into account structural breaks. The reason of this situation can be competitive economic structure and effects of 2008 global financial crisis in the scope of being developing country of Turkey. Furthermore, these findings are supported by accomplished previous literature for Turkey.

Keywords: Turkish insurance sector, persistence of profitability, firm performance, Panel Unit Root Test.

JEL Classification: G22, L25, C23

1. Introduction

According to competitive hypothesis, the gained profits and suffered losses of businesses are temporary in the highly competitive environments (Agostino *et al.* 2005). In other words, competitive process eliminates all economic profits and losses in the long term. So, if one company is obtaining excessive profits, these mentioned profits encourage new competitors to enter the market and new competitors cause decrease in profits by offering same product in lower price. This also causes the decrease in profit margin. This process continuous until market profitability gets equal to competitive rate (Cuaresma and Gschwandtner, 2006). Similarly, companies profiting below average are either eliminated from market by activities of investor or taking precautions in order to reach average market profitability (McMillan and Wohar, 2011).

Starting with Mueller (1977), a series of contributions aiming to analyze the permanence of profitability has appeared. In literature, while there are many studies aiming to determine the permanence of profits on manufacturing enterprises and banks, there are a few numbers of studies about insurance. However, insurance companies, which are one of the largest institutional investors for stock, bond and real estate markets, have an increasing significance because of increase of risks and uncertainties in most societies and being part of the general development of financial institutions (Outreville, 2013). Insurance companies, which are an important funding source for economy in especially developing countries, may affect economic growth through channels of marginal productivity of capital, saving rate, technological innovations and the cost of the intermediation (Pervan *et al.* 2013). Insurance companies are necessary

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elements of economic growth (Outreville, 2013). In many studies, the relationship between insurance market activities and GDP were tried to be revealed (Outreville, 1990; Haiss and Sümegi, 2008; Kugler and Ofoghi, 2005; Ward and Zurbruegg, 2000; Arena, 2008; Vadlamannati, 2008; Lee and Chiu, 2012; Chang *et al.* 2013; Akinlo, 2013).

There haven't been any studies about persistency of profits on insurance companies which developed rapidly by 25% compound annual growth rate (invest.gov.tr) between years 2002-2010 in Turkey and had importance place among finance sector. Besides, there haven't been any encountered studies about permanency of profit in literature of insurance sector except the study of Pervan *et al.* (2013) examining Croatia. In this respect, this paper will take significant place to fill the gap in this area.

2. Conceptual framework and literature review

According to Competitive Process hypothesis, the presence of persistently (POP) excessive profits is considered as an indication of the lack of contestability (Maruyama and Odagiri, 2002). Since, Competitive Process eliminates excessive profits (McMillan and Wohar, 2011). However, Muller observed from his study that in most markets firms may earn excessive profits, because barriers of entry and/or the markets are affected by external chocks and/or dominant firms have created mobility barriers of internal market. This idea underlies the literature of persistence of profit.

Actually, the fundamentals of POP literature were created by the empirical investigation of the persistence of profit rate differentials and later, many studies on profit persistence for different economies, different time periods and different sectors were made. Also, the factors effecting POP were investigated in these studies.

These factors were generally described in studies as size & growth, market share, market share growth, productivity, firm concentration ratio, replacement value capital stock, barriers to entry, stock of advertising, stock of research and development and minimum efficient size measure (Ruiz, 2003).

In their study, Odagiri and Yamawaki (1986) expressed the persistency of profits of Japanese manufacturing firms. Similarly, Marayuma and Odagiri (2002) have investigated the structure preferring the average profitability instead of high profitability in long run of firms determined on previous study. Later, they examined the profitability ratios of companies obtained in long-run. They have divided the period of their study into two and called the periods spanning 1964-1982 as first period and 1983-1997 as second period. The profit performance of the firms was found to be positively related to measures of market share. Furthermore, they expressed that another factor of sustainability of profits is entry barriers to the sector.

Geroski and Jacquemin (1988) have used an autoregressive model with three parameters of interest describing long-run profitability on UK, France and Germany in order to clarify the role of factors including long-run profit differences on persistency of profits.

In contrast to France and Germany, the UK stands out as a country in which profits above and below norm persists in a relatively large number of cases. Furthermore, the variation in profits in UK firms is much lower compared to their French and German counterparts. In study, they determined the systematic relationship between persistency of profits and the structural features of firms & character of industry.

Kambhampati (1995) concluded their study on India as the higher persistency in industries which had higher entrance barriers and were rapidly developing.

Glen *et al.* (2001) have analyzed the persistency of profit on India, Malaysia, South Korea, Brazil, Mexico, Jordan and Zimbabwe as developing countries. Furthermore, the intensity of competition and its effects on profitability dynamics also were included into the study. There was found negative relationship between competition intensity and persistency of profit of firms in investigated developing countries. Moreover, the causes of low persistency of profits in developing markets can not only be competition but also other factors (like exchange rate volatility arising from macroeconomic effects, etc.)

Ruiz (2003) investigated the persistency of profits on manufacturing sector in Colombia. He emphasized that the explanation of relationship between structure of market and profits of industry is

necessary to evaluate the persistency of profits, and the profitability of one firm can only be interpreted according the industry where it belongs.

Yurtoğlu (2004) have used time series analysis in his study on Turkish manufacturing businesses in order to investigate persistent profitability differences across firms. The differences in permanent profits can be expressed by properties of firm rather than effects of industry. Moreover, he found that the intensity of competition in Turkey was not less than developed and developing countries.

Gschwandtner (2005) found in his study on USA that profit can be persistent even after 50 years. The growth rate of sector and strategic entry barriers can support persistency when avoided from price competition. Moreover, the weak relationship between budgeted profitability ratio and return on assets in long-run was detected.

Gschwandtner (2013) again in his study made with Hirsch, have analyzed persistency of profit in food industry in Europe and observed that the persistency level of profit in food industry is lower compared with other manufacturing sector. The reasons of this are the competition in food industry and the importance of retailing. Furthermore, he shown that the size of a firm had importance on persistency of profits and age of firm, risk and R&D intensity were affecting the persistency of profits negatively. (Hirsch and Gschwandtner, 2013)

There are many studies in the literature including different years and countries covering financial sector, especially banks, about persistency of profits. Levonian (1993) specified that abnormal profits tend to be persistent despite the limitations of competition brought by bank regulations.

Rolan (1997) have investigated the persistency of profits in American Banks in the period of 1986-1996 with the quarterly data. He found that persistency of profit is strong in banks with the below average performance (Goddard, 2011). In another study, Goddard *et al.* (2004) observed that persistency of profits is lower than company savings in commercial banks. Agostino *et al.* (2005), in order to examine the effect of ownership structure on persistency of profits, studied the Italian Banks in the period 1997-2000 and observed that this factor affected the persistency of profits; moreover, intensive profitability decreased in situations where market allow external intervention.

In other study searching the factors having effect on persistency of profits, Flamini *et al.* (2009) found that persistency is related with variables like credit risk, private ownership, bank size. Again, in their study stated that macroeconomic factors have an effect on bank profits; persistency of profits was observed moderate.

In studies on Turkish Banks, Bektaş (2007), Kaplan and Çelik (2008), İskenderoğlu *et al.* (2011), Aslan and İskenderoğlu (2012) found the non-persistency of profits in long-run and justified that the competitive structure of sector eliminates the profits above average in long-run.

In their study analyzing insurance sector, Pervan *et al.* (2013) first divided the number of profits in to the levels, and then observed the persistency of profits for the mid-level but this situation may change during the crisis periods.

3. Data and econometric methodology

In this study, in order to investigate the persistency of profits of firms in insurance sector, the quarterly data in the period Mar-2005 till September, 2013 of 7 insurance companies quoted to market and operating in Turkey were examined. The data of return on assets (ROA) and return on equity (ROE) were used to measure profit (Bayus *et al.*, 2003; Ruiz, 2003; Agostino *et al.*,2005; Athanasoglou *et al.* 2008; Ramadan *et al.* 2011; İskenderoğlu *et al.*, Canarella *et al.*, 2012, 2011; Lee and Hsieh, 2013). The each of these numbers was taken from quarterly balanced sheet and income statement from official websites of relevant firms. These numbers are calculated as following:

$$ROA = \text{Net profit} / \text{Total Assets}$$

$$ROE = \text{Net profit} / \text{Equity}$$

Since our accessible data range was 35 which was thought insufficient for time series analysis, using panel unit root tests was thought more appropriate.

Being suitable to random walk hypothesis, profits of firms are unpredictable (Canarella *et al.*, 2012). Also, random walk hypothesis is valid only when series have unit roots (Gujarati, 2011). Thus, having unit root test of series shows persistency of profits, being stationary at level shows temporariness of profits (Aslan and İskenderoğlu, 2012).

Panel LM test developed by Im *et al.* (2005) can be expressed as improved version of Lee & Strazichich (2003) unit root test for panel. The most significant advantage of this test is endogenously determination of break dates. According to this test, panel suits for normal distribution and therefore, critical values for all analysis are accepted as 2.32, 1.64 and 1.28 for 1%, 5% and 10% of significance levels, respectively. Here, the main hypothesis is that panel has unit root and alternative hypothesis is that at least one series of panel is stationary. Im *et al.* (2005) developed two different models allowing one and two breaks.

Panel LM statistic can be calculated by taking the average of individual LM unit root test statistics:

$$LM_{barNT} = \frac{1}{N} \sum_{i=1}^N LM_i^T$$

Panel LM unit root test statistics which were standardized by expected value of t-test statistics and variance of each horizontal section can be expressed as following:

$$\Psi_{LM} = \frac{\sqrt{N}[LM_{barNT} - E(L_T)]}{\sqrt{V(L_T)}}$$

Numerical values for $E(LM_i)$ and $V(LM_i)$ were given in the study of Im *et al.* (2005).

4. Empirical results

In this part, the ROA and ROE values were investigated via first IPS (2003) panel unit root test, then panel LM unit root test taking into account one and two breaks. In study, suitable lag length was determined from general to specific by t-significance method. In tests Model C was taken into account (Yılancı *et al.*, 2013).

Table 1: Results of non-break IPS Panel Unit Root Test

Profit Measures	Test Statistic	Prob.
ROA	1.74	0.95
ROE	0.61	0.73

Note: T-statistics was used as lag length criteria.

According to results of IPS panel unit root test, whole panel has unit root. Namely, the hypothesis of persistency of profits in insurance companies is valid. However, due to not taking account structural breaks, IPS test is being considered weaker than panel LM test. Therefore, when looked at the following results of panel LM test with 1 and 2 breaks, profits in insurances companies are seen not persistent.

In model with 1 break, the panel test statistics of -9.50 for ROA and -9.79 for ROE are greater than critical values suitable for normal distribution. This situation shows at least one series is stationary. These findings can be seen in the following:

Table 2: Results of Panel LM Unit Root Test (one break)

Profit Measures	Test Statistic	Break Date
ROA	-9.50***	June 2009
ROE	-9.79***	March 2009

Note: 1, 5 and 10 % critical values for the panel LM test are are 2.326, 1.645 and 1.282 respectively; (***) denotes statistical significance at 1% levels.

Which of series in the panel are stationary and which one has unit root can be seen below. While the profits of Anadolu Emeklilik, Ray Sigorta and Yapı Kredi are not persistent according to ROA values, the profits of Aksigorta, Anadolu Sigorta, Aviva and Güneş Sigorta are non-persistent according to ROE values.

Table 3 - Results of Panel LM Unit Root Test (one break) (Cont'd)

Firms	ROA		ROE	
	T value	Break Date	T value	Break Date
Anadolu Emeklilik	-4.92**	June 2009	-3.66	Sep 2007
Aksigorta	-3.67	Sep 2009	-4.44*	Sep 2009
Anadolu Sigorta	-3.57	Dec 2010	-4.27*	Sep 2008
Aviva	-3.84	June 2009	-3.95	June 2009
Güneş Sigorta	-4.10	Dec 2008	-4.64**	Mar 2010
Ray Sigorta	-4.58**	Sep 2009	-3.97	June 2009
Yapı Kredi	-4.69**	June 2009	-4.77**	Mar 2009

Note: The critical values for LM test with one break are in Lee Strazicich (2004). ***, **, * shows 1%, 5% and 10% significance level respectively.

When looked at the model with 2 breaks, test statistics are further increasing and strengthening the stationary of panel.

Table 4 - Results of Panel LM Unit Root Test (two breaks)

Profit Measures	Test Statistic	Break Date (1 st)	Break date (2 nd)
ROA	-20.56***	December 2008	September 2009
ROE	-17.17***	June 2009	June 2011

Note: 1, 5 and 10% critical values for the panel LM test are are 2.326, 1.645 and 1.282 respectively. (***) denotes statistical significance at 1% levels.

Table 5 - Results of Panel LM Unit Root Test (two breaks) (Cont'd)

Firms	ROA		ROE	
	T value	Breaks date	T value	Breaks Date
Anadolu Emek.	-8.25***	June 2008 June 2009	-8.72***	June 2009 June 2011
Aksigorta	-15.08***	Sep 2009 Sep 2010	-10.92***	Sep 2009 Sep 2012
Anadolu Sigorta	-7.95***	June 2009 June 2010	-5.82**	June 2009 Dec 2011
Aviva	-6.28**	Mar 2009 June 2012	-6.19**	Mar 2009 June 2010
Güneş Sigorta	-7.31***	Sep 2009 Sep 2012	-6.32**	Dec 2008 June 2011
Ray Sigorta	-6.25**	Dec 2008 June 2010	-6.86***	June 2009 Mar 2012
Yapı Kredi	-5.81**	Dec 2008 Sep 2009	-6.66***	June 2009 June 2011

Note: The critical values for LM test with two breaks are in Lee Strazicich (2003). ***, **, * shows 1%, 5% and 10% significance level respectively.

Compared with IPS panel unit root test, some the series in the model with one break had become stationary. In model with two breaks, all series are seen becoming stationary. So, the hypothesis of non-persistence of profits for all insurance companies is valid. Another noticeable situation is that break dates for ROA and ROE are intersecting with global financial crisis periods. This also shows the advanced part of the panel LM test.

Conclusion and discussion

In economies where the competition is intense, reached both profits and loss are temporary. On the other hand, it is possible to talk about the persistency of profits if there can be seen profits other than average in long-run. With globalized world, the significance of insurance sector in economy has increased. Thus, the place of insurance companies among financial markets is becoming important.

In this study, the persistency of profits of 7 insurance companies in BIST (Stock Market of Istanbul) is investigated via ROA and ROE as two well-known profitability indicators in the literature. The period spanning Mar-2005 till Sep-2013 was investigated by quarterly data. In study, first the profits for these companies were observed persistent by using IPS panel unit root test (2003).

Second, panel LM unit root test (2005) taking into account structural breaks was used, the findings of IPS test was shown after elimination. While some of series became stationary by Panel LM test with one break, whole panel became stationary by Panel LM test with two breaks. The hypothesis of persistency of profits is not valid for all companies examined in the study. This situation can be due to the competitive structure of markets of Turkey which is described as developing country, and global financial crisis occurred in the period of 2008. In fact, the break dates detected in panel LM test, intersect with the period of global financial crisis as supporting these findings.

In studies on Turkish banking sector, Bektaş (2007), Kaplan and Çelik (2008), Aslan and İskenderoğlu (2012) observed non-persistency of profits. Compared with these studies, the results of our study examining different sector also support the previous literature. Furthermore, in the study made by Pervan *et al.* (2013) on persistency of profits in insurance sector, they detected that the profits were persistent, but they became temporary during economic crisis periods. Thus, this paper concluded with more advanced results by taking into account structural breaks during economic crisis periods and criticizing the findings of this study.

As a result, it is more appropriate to hypothesize the non-persistency of profits in finance sector. However, in order to confirm the assumption, new comprehensive investigations containing other sectors in finance area must be the focal point of the following studies.

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THE TRENDS IN DEVELOPMENT OF FULL LOGISTICS SERVICES

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Abstract:

The article presents the results of a research focused on identifying, understanding and synthesizing the current trends in the field of full logistics services. The character of the article is empirical and descriptive. The research was dealing with the activities of providers of full logistics services operating in the Czech Republic and working in the B2B segment. The searching was based on a combination of qualitative methods (monitoring, analysis of documents, interviews) with simple statistical methods. About 300 providers of full logistics services were identified in the Czech Republic. Their classifications according to size, ownership, scope of activities and transport modes used in their services were performed. More detailed findings about sample of 13 large providers were obtained. These findings were related to competition in the branch of full logistics services, approaches to solve the problems generated by crisis, empowering the integrated logistics solutions and exclusive partnership with customers as well as the organizational concentration within the branch of logistics services. In conclusion of the article the areas for further research are formulated.

Key words: third party logistics, fourth party logistics, full logistics services providers, contract logistics, supply chain management, outsourcing.

JEL Classification: M110

1. Introduction

The aim of this article is to present the results of a research focused on identifying, understanding and synthesizing the current trends in the field of full logistics services. The research was focused both on identifying the new requirements and challenges for logistics services providers, and on the directions, forms and practices that the providers apply to respond to this situation. The objects of the research were organizations providing full logistics services and operating in the Czech Republic. Their activities were studied in a global context.

We were looking for answers to the following research questions: What are the typical features of the providers of full logistics services operating in the Czech Republic? How do the requirements and conditions for the provider of full logistics services change? What shifts have been visible in the strategies and activities of the providers of full logistics services, related to the current crisis and competitors fight? How contribute the logistics providers to grow of integration in the supply chains?

The research process has combined qualitative and quantitative procedures. The main methods applied during the research included a content analysis of public databases, documents of the examined companies, press releases, as well as monitoring, interviews and simple statistical analysis.

Chapter 2 of this article provides a terminological definition of the subject-matter of this research. The 3rd chapter describes how the data were gathered and processed throughout the research. The research outcomes are presented in the 4th chapter. In the fifth chapter, you will find the synthesis and discussion of the obtained knowledge and also the suggestions for further research.

2. Terminological definition of the subject-matter of research

Organizations offering logistics services are entities involved in providing for other entities within the supply chain such activities that do not directly create the physical nature of the products. Typical activities within the frame of logistics services include transportation, storage, handling, packaging, insurance, customs operations and a number of other activities that belong to the areas of inbound logistics and outbound logistics, as well as to the area of internal logistics of clients. Organizations providing

logistics services typically operate in the business-to-business markets, where their clients are manufacturing and trade organizations. The market engaged in services to end-customers (B2C), consisting of courier, mail and parcel services, is a specific segment which is not studied in this article.

Providers of logistics services are usually divided into the levels of 2PL, 3PL and 4PL, according to the range of services they provide. Providers of logistics services at the level of 2PL (second party logistics) are strictly focused on one type of service only. They are especially carriers. These organizations are not the subject of our research. Providers of logistics service at the level of 3PL (third party logistics) generally include entities performing a wider range of logistics services. Providers of 4PL level (fourth party logistics) are those organizations which, according to the definition of Win (2008), play the role of "independent, singularly accountable, non-asset based integrators of clients' supply and demand chains."

The most intensive terminological debate, both in literature and in practice, is related to the definition of the term of third party logistics. Marasco (2008) made a comparison of the different interpretations of the term third party logistics and stated that a simple consistent definition of this term is missing. He noted that the definitions range from a narrow concept in terms of provision of transportation and/or storage by an external entity, to a wide approach in terms of outsourcing of more complex character that can encompass the entire logistics process. Companies meeting this wider concept of logistics services are also referred to as full logistic service providers. Many authors see the most important shift from services of 2PL type to services of 3PL type in the fact that they move from services having the character of individual transactions to services that are provided to a client in longer term, on a contractual basis and on the basis of mutual benefits. That is why the services having these characteristics are commonly known as contract logistics (in German Kontraktlogistik).

Wrobel & Klaus (2009) state that contract logistics is characterized by an integration of multiple kinds of logistics performances, a high degree of individualization of the performance package, a defined minimum volume of orders, as well as a long-term contractual definition of the economic relations. In the contract logistics the multiple types of logistics functions are integrated in the form of packages of performances with increased complexity and ability to solve problems. Unlike the economic relations based on "transactions" that may be prematurely terminated at any time, contract logistics, according to Wrobel & Klaus (2009), involve a partnership and rights and obligations of both partners associated with their partnership stipulated in a written contract concluded for at least one year, in practice, usually for 4-5 years.

Providers of logistics services offering services by means of their own technical equipment (vehicles, warehouses) are called asset based providers. Non asset based providers are focused on providing services that are then performed by subcontractors, especially carriers.

Our research is not limited solely to organizations performing contract logistics only. It focuses on organizations beyond the scope of 2PL, whose services are provided mainly in the segment of business to business. We assume that the portfolio of these organizations includes not only contract logistics services, but also services having the character of individual transactions, and that some of these organizations may also make the steps to become logistics integrators. In this article we use for these kinds of entities the name "providers of full logistics services", and we deliberately avoid the terms such as third party logistics, fourth party logistics and contract logistics.

3. Research methodology

The research was conducted in two stages. The first stage was focused on identifying the organizations providing full logistics services operating in the Czech Republic and on analysing the obtained file. In the second stage the more detailed research focused on a sample of selected large providers was performed. It was oriented on tendencies of logistics services development and on factors that influence them.

3.1 First stage of the research

The identification of providers of full logistics services took advantage of several databases and their data were cross-checked and added to each other. The databases included Albertina, the European

Databank, the Logistics Book of Lists elaborated by ATOZ Company (Atoz Logistics, 2012), and ARES database (Administrative Register of Business Entities). The data presented in these databases were further verified through Internet portals Bizbiz and Justice (verifying the existence of companies) and by means of Internet home pages of the individual providers (verifying and adding the scope of activities). The data covered the period of March - April 2013.

In addition to transportation and storage, the basic criterion of selection and inclusion into the category of providers of full logistics service was that they also provide other services. The following key words were used when searching through the databases: logistics services, logistic provider, third party logistics, fourth party logistics, and contract logistics. The list does not include the organizations whose main activity is parcel and courier service. The information we were looking for with regards to the subjects included in the list of providers were their name, registered office, legal form, ownership, headcount, and the range of services they provide.

According to the number of employees, the organizations were divided into small (up to 49 employees), medium (50 - 249 employees) and large (250 or more employees). As for the foreign companies, the figure we took into account was the number of employees in the organizational units located in the Czech Republic.

An analysis of the structure of providers was conducted according to the following aspects: according to company size in terms of the number of employees, according to the period of foundation in the Czech Republic, according to the prevailing ownership, and according to the range of services and types of clients. The structure was expressed as a share of each category in the overall figure.

3.2. Second stage of the research

More detailed data about thirteen selected leading large providers (from group of 250 and more employees) were collected. Following companies were surveyed: *CS CARGO, Dachser Czech Republic, DHL Czech Republic, DSV Road, ESA, Gefco Czech Republic, Geis CZ, HOPI, Kühne+Nagel, Maurice Ward & Co., PST CLC Mitsui-Soko Group, DB Schenker Czech Republic, Yusen Logistics (Czech)*.

The collected data for the last three years about these companies were associated with the economic results of the companies, the perception of customer requirements, applied strategies, the trends in development of the service portfolio, as well as the mergers and acquisitions that took place among the providers of logistics services. Data were obtained from public documents (annual reports, websites, corporate newsletters, press releases, magazine articles), and, in several cases, also from excursions and partly from semi-structured interviews with the company representatives.

The collected data were recorded in forms called passports. The matters recorded in passports are presented in Annex. A content analysis of the acquired data was carried out in steps. The specific features of each organization were evaluated first, and the organizations were compared afterwards. The final step was a synthesis of the partial knowledge and a generalization of the knowledge related to the visible trends, applied approaches, and other phenomena in the area of provision of full logistics services.

4. Data analysis outcomes

In this chapter the outcomes of the performed analyses are presented according to two stages of the research.

4.1 Frequency and structure of providers of full logistics services

The research identified 271 entities operating in the Czech Republic and meeting the criterion of a provider of full logistics services, i.e. the integration of multiple kinds of logistics activities.

Almost 60% of the providers of full logistics services are small organizations with up to 49 employees (Table 1). With increasing size category, the number of companies decreases. There are almost forty (39) large providers of full logistics services operating in the Czech Republic at this time. It is nearly one half of total number of large companies in the sector of transport and warehousing in the Czech Republic (89) that stated Ludvík and Peterková (2013). Out of the 39 major providers, there are 3 companies with 1 000 or more employees (DHL Czech, HOPI, DB Schenker Czech Republic).

Table 1 - Structure of providers of full logistics services in the Czech Republic according to the number of employees

Size of organizations according to the number of employees		Number of providers	Ratio of providers in %
Up to 49	Small	162	59.8
50 - 249	Medium	70	25.9
250 and more	Large	39	14.3
		271	100.00

The massive development of organizations providing logistics services in the Czech Republic took place after the year 1990, in connection with the change of the social situation that liberalized the conditions for entrepreneurial activities. Certain continuity from the period before 1990 was witnessed only in three organizations. After 1990, the subjects providing logistics services were established in the following ways: establishment of branches of foreign logistics firms or establishment of new firms with foreign owners, the emergence of new Czech logistics companies, often family ones, splitting-off and privatization of transport departments of large manufacturing firms, splitting-off and privatization of public automobile transportation companies.

Subjects with predominantly domestic ownership, with the share of 69.4 % (Figure 1), occupy a dominating position among the providers of logistics services. A more detailed analysis according to size groups has revealed that domestic owners usually own small companies (62% of domestic companies have up to 49 employees).

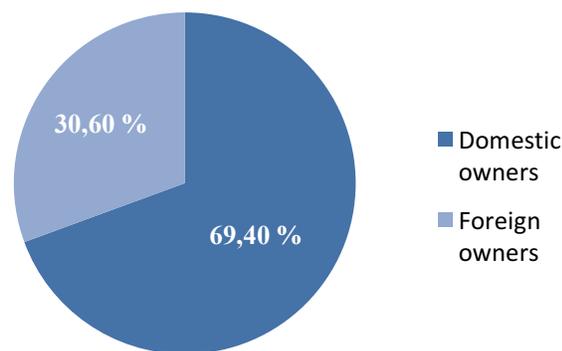


Figure 1- Structure of providers of full logistics services according to their predominant ownership

A number of leading multinational companies operating globally or throughout Europe have their business units in the Czech Republic. They include, in particular, DHL, DB Schenker, Dachser, Gefco, Kühne+Nagel and others.

As for the kinds of logistics services the surveyed organizations perform, the following set of sub-types of services occurring with varying frequency has been identified¹²: national and international transport, forwarding, warehousing, interim storage, packaging, insurance, customs services, logistics outsourcing, logistics consulting, courier services, special transportation (such as transportation in a controlled temperature mode), handling services, sorting, transshipment, loading, unloading, tracking & tracing, transport in just in time mode, containerization, palletizing and labelling, collection service, vehicles utilization, reverse logistics, integrated logistics, full bespoke logistics, complex logistics of supply chain solutions, and city logistics.

¹² Presented under the names the companies use in their offers.

The ability of full logistics providers to offer the services based on particular transport types is evident from Figure 2. The predominance in the number of subjects offering road transport is understandable, since starting business in this field of services is relatively easy and, also, road transport is the prevailing type of transport in the Czech Republic. As for water transport, it is almost exclusively involved in the mediation of sea transport, because the possibility of use of rivers in the Czech Republic is very limited.

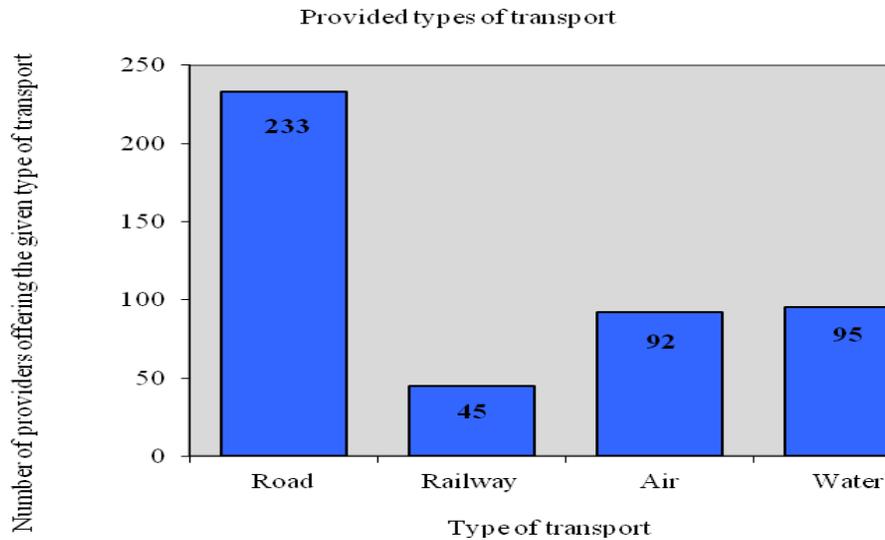


Figure 2. Number of full logistics providers ensuring the given types of transport

The ability to combine several types of transport when providing the services can be evaluated from Figure 3. While nearly half of the providers (48%) specializes in one type of transport only, a rather significant part of the providers can use up to 3 types of transport in their services (20%), and 13% of providers even 4 types.

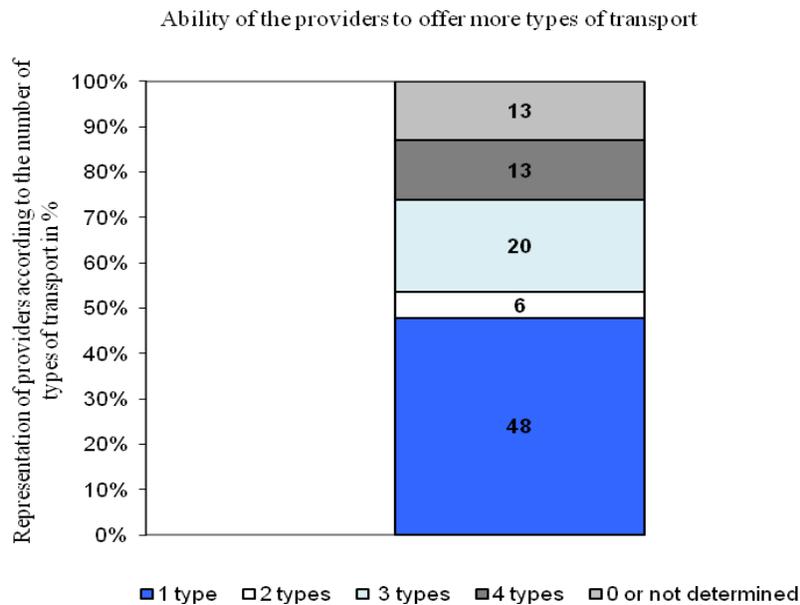


Figure 3. Ability of providers to combine more types of transport when ensuring their services

The providers of full logistics services include both entities with predominant clients from certain field of business in their portfolio (e.g. specialists in logistics services for the automotive industry, such as Gefco, or specialists in logistics of food products, such as HOPI), as well as entities with a wide portfolio of fields of business of their customers. The entities with combined focus prevail and, in addition to a wider portfolio of the fields of business of their customers, some of them even offer an exclusive product. *For example*, Dachser (among other products) is a specialist in supplying DIY products to hobby markets, including the management of reverse flows. Other example is DB Schenker, whose wide portfolio also includes extremely challenging and one-off actions, such as oversized transportation, exhibition logistics or logistics of sports events.

It was discovered that even the providers of logistics services that are equipped with their own fleet of vehicles use external carriers to some extent. The collected data did not allow us to come to a more accurate quantification of the share of full service providers that do not have their own fleet of vehicles and only purvey transport with external carriers.

The full logistics providers use in the Czech Republic many existing, but territorially dispersed logistics parks, where they lease buildings and space. Furthermore the large providers start building of centralized logistics terminals for complex client services in one location, with possible easy integration of multiple types of transport. The good location of the Czech Republic, the facilities of logistics parks and qualified workforce are the factors that also lead to the use of logistics capacities located in the Czech Republic as centres serving clients in other countries (mainly in Germany, Austria, Poland, Slovak Republic and Hungary).

4.2. Current problems and development trends of providers of full logistics services

In this subchapter the results of analysis of surveyed large full logistics providers are presented.

- *Impact of economic crisis*

An analysis of the annual reports and press releases of large providers of logistics services has shown that in the times of the crisis after 2008, the providers face increased pressure to reduce the prices of logistics services, particularly those of transport. A representative of one of the most important companies operating in the Czech Republic has stated that the actual price of transport, especially of railway transport, is often pushed even below real actual costs, and the revenues per 1 kg of transported goods are clearly going down. Some of the representatives of logistics companies call the competitive struggle among companies a price war and the competitive environment as very complicated, because it is also necessary to eliminate the negative development in fuel prices and the increase of other fees in road transport. There were cases of unfair practices of some competitors which acceded to price pandering and managed to win customers from reputable companies. However, many of these customers had been damaged by a low level of services and they returned to their original providers after some time.

Based on an evaluation of the data related to sales and profits found in the annual reports of the thirteen surveyed large companies during the years of 2010 – 2012, it was found that a majority of enterprises in this sample was able to achieve certain annual increase in revenues. The development of the return on sales, however, was not favorable and there were even some companies with negative return on sales.

The examined large providers of logistics services have responded to the crisis by measures aimed at reducing costs, in particular in the form of rationalization of processes and by increasing the standardization of their processes. Some of them had to reduce their fleet of vehicles.

- *Increased requirements of clients*

As a countermeasure against the risk of persistent drop of demand, some providers started to expand their portfolio of services by including other product groups and other types of value-adding services. They have been intensively trying to consolidate their position by responding to the new requirements of the clients which are summarized in Table 2, based on the statements made by the representatives of large logistics companies.

Table 2 - Current requirements of clients to the providers of logistics services

Complex tailor-made services guaranteed by a single provider
Ability to deal with extensive variability and range of requests.
Ability to provide sophisticated solutions saving time and money.
Ensure safety of logistics journey.
Financial strength and stability of provider.
Ability of the provider to follow the growth of the customer.
Ability to operate in other non-traditional territories.
Sense of honesty, business ethics, responsibility and humbleness.

- *Strategies of full logistics providers*

Despite the ongoing economic crisis, many of the surveyed companies have opted for a strategy of a growth. Large logistics providers respond to demand for new logistics solutions for those clients whose chains include the BRIC countries and the territories of Central, Southern and Eastern Europe. Great opportunities for logistics providers can be found, for example, in performance of flows of automotive components and assembly units manufactured in Europe (including the Czech Republic) to the newly emerging assembly plants of global car manufacturers in Russia, China, India and other countries. In the opposite direction, there are more and more significant flows of electronics products and textiles from Asia. Logistics providers are therefore deeply involved in designing and constructing systems of regular container trains to Russia and China¹³ and in providing complex solutions taking advantage of multiple types of transport, following the principle of door to door. The offered full logistics solutions are known under different names (integrated logistics, complex tailor-made logistics, complex logistics supply chain solutions, supply chain management, etc.) and they are offered by most of the surveyed 13 large logistics providers.

Some of the examined companies own an AEO certificate for customs operations (in the highest level F¹⁴) and a TAPA certificate of the safety and protection of packages during their transport and storage. Possession of these certificates represents a significant competitive advantage. In connection with the pressure related to green logistics, it has been noted that some companies provide their clients with tools necessary to calculate the carbon footprint of logistics operations. Other significant trends of the surveyed companies are development of information systems for sophisticated solutions, building their own project teams for complex logistics decisions and development of know-how of the members of these teams.

The effort aimed at cutting the costs of clients and the environmental pressure lead to strengthening of the principle of consolidation of supply. One of the visible signs of this trend is the expansion of cross docking form instead of direct delivery, not only in retail chains, but also in production chains, especially in the automotive industry chain. This tendency is understandable, since the principle of just in time in its pure form faces significant barriers.

The representatives of some of the surveyed companies have expressed their opinion that the economic crisis was "beneficial" for them in the sense that manufacturing companies trying to cope with their problems tend to outsource their internal and external logistics in large numbers. In terms of the subject-matter of their activities, the logistics providers take over an increasingly wider range of processes

¹³ For example, DB Schenker Company (according to DB Schenker, 2013) successfully develops railway container transport from China (Zhengzhou) on a new railway line through Kazakhstan and Russia to Hamburg (shipment time is 15 days). They also provide a full transport service including pre-carriage road transport from Chinese cities within a perimeter of app. 1 500 km from Zhengzhou.

¹⁴ Goods exported or imported via a holder of AEO certificate in level F are cleared preferentially and the customs control is performed in such a way not to jeopardize the delivery term to the recipient, or not to make the transaction more expensive in any way. Each day saved during the customs operations thanks to this certificate is an advantage in the competitive struggle.

and, especially in outsourcing of internal logistics, they integrate their business processes with the processes of the clients. The survey has also recorded ambitions of the providers of logistics services to expand their scope of activities within the sphere of internal logistics of the clients to all its non-technological operations on production lines, or even to realize the acquisition of production companies which they had originally provided logistics services to.

The current tendency of near shoring (i.e. location of business units in nearby countries with experienced and relatively cheap labor force, rather than in distant low-cost countries) leads to a situation where some supply chains executed the projects of logistics postponement. These projects are undertaken by providers of logistics services.¹⁵

There has been a continuous trend to create long-term partnerships with clients, such as, for example, Gefco Company as an exclusive logistics provider for PSA car manufacturer. With them Gefco also cooperates in the designing process of products, packaging and the supply chain. There were also attempts focused on conversion into fourth party logistics.¹⁶ Some logistics companies also create strategic alliances among themselves.¹⁷

- *Organizational concentration in the field of logistics services*

The challenging environment seems to be an accelerator of mergers and acquisitions in the field of logistics services. Table 3 provides an overview of the last few major transactions of this type that were not limited to the Czech Republic only. The frequent motives of mergers and acquisitions initiated by large firms include their intention to use the built relationships with the clients of the partner, to interconnect the transport routes and warehousing networks, to extend the scope to global space, including the use of their own know-how in the larger network¹⁸.

Table 3 - Examples of major mergers or acquisitions among the providers of full logistics services in the sphere of industrial logistics during the years of 2011 – 2013

Names of companies in which organization concentration took place	Year
C.S. Cargo + TFC	2011
DACHSER + AKZAR	2012
DACHSER + PAPP ITALIA	2012
DSV + AWT Čechofracht	2012
GEFCO (PSA) + Russian Railways	2012

¹⁵ A reorganization of one of the major supply chains from electro-technical industry represents an example of logistics postponement. A complex of operations including kitting (testing, final assembling, packaging and labeling of products according to the language mutations and the type of customer), as well as refurbishment and reverse logistics, which are now provided by a special provider of logistics services in the Czech Republic, have been taken out of the scope of activities of Asian manufacturers of complete computer modules.

¹⁶ For example, GEFECO Company has become a provider of 4PL dealing with the management of supply chain of General Motors Company in Europe. It has adjusted the organization and strategy of the company to this fact, as described by Ludwig (2013) in more detailed way.

¹⁷ For example, according to Logistics (2013b), twelve European providers of logistics services in the sphere of foodstuffs established European Food Network in 2013. The network operates in 20 European countries, where it provides common internal standards regarding processes, documents, IT interface and responsibilities. Raben Company is the partner of this network in the Czech Republic.

¹⁸ Dachser company management spokesman provides in Logistics (2013a) clear characteristics of the typical reasons of acquisitions: "We want to capitalize on the synergies among the individual parts of the whole puzzle. We are proud that our network has gone through the deepest possible integration. All acquisitions that we have made so far have materialized in order to provide a thorough integration. The goal was to have a single European system, a single process, a single organization. We do not want to make any acquisitions simply to gain a larger market share. The result would have been nothing more than a big mess and it would have been hard for us to maintain a uniform standard."

PST CLC + Mitsui Soko Group	2012
Raben Logisticeis Czech Republic + Transcam Logistics + Raben Trans European Czech	2012
DACHSER + Transunion S. A.	2013
DSV + Airmar Cargo	2013
DSV + Ontime Logistics AS	2013
Geis Global Logistics + Quehenberger Logistics	2013
Geis + Logwin Solutions Deutschland GmbH	2013

There are evident centralizing efforts in some of the surveyed companies which lead to deliberate mergers of the previously independent units specializing in a particular type of logistics services. Major providers of logistics services continue to build new branches, which they connect into an international network in order to join forces for the execution of complex contracts into a single stream.¹⁹

Conclusions and suggestions for future research

A synthesis of the findings gathered during the research helped us to find out that the foundation of nearly 300 organizations providing full logistics services in the Czech Republic in the last 20 years reflects the significant expansion of the line of business providing full logistics services. It corresponds with the global trend of development in this field. The convenient location of the Czech Republic in the middle of Europe, the modern transport and storage infrastructure, the availability of qualified labour force and the large volumes of flows of goods - these are the factors that attract not only local logistics companies, but especially a number of multinational logistics operators, into this line of business. The logistics providers situated here have the wide territorial action radius. The special phenomenon is that logistics capacities located in the Czech Republic are frequently used as centres serving clients in other countries.

The survey acknowledged a big dynamics and innovation agility within the field of full logistics services and also the fact, that business in this field is becoming more and more difficult. The development trends of full logistics services are born from the conflicts of various factors, including: increasing demand for more complex and more integrated logistics solutions, requirements for acceleration of the flow, price competition intensified by the continuing economic crisis, environmental limits and increasing prices of inputs.

Crucial innovations of the provided services are brought by major providers that have the necessary potential to do so. The survey acknowledged that they have to do the hard work in order to sustain its position and achieve the required profitability. It is expected that a number of smaller logistics service providers can have problems to react effectively on the increased customer requirements and they will be pushed aside to role of subcontractors for major providers.

The most significant identified trends are:

- interconnection of capacities and extension of the territory where the providers of logistics services operate by means of organizational concentration;
- acceptance of long-term responsibility for a large part of the supply chain in order to facilitate an exclusive partnership with customers;
- deeper and deeper penetration of providers of logistics service into the structure of supply chains, takeover of activities which used to be domain of producers or traders, and creation of entirely new activities adding benefits to the supply chains operation.

These signs of integration within the structure and operation of supply chains can increase the potential for achieving synergy effects. Some of large providers have done a big step towards 4PL because

¹⁹ This network, for example, allows DB Schenker Company to run a central vehicle utilization system from one place in Europe. Transport capacities may be "moved over" into a certain territory, or they can take advantage of a network of terminals, warehouses, customs offices, transport corridors of various types of transport, etc. through various territories, where the order flows.

their contract logistics begins to include not only the physical flows ensuring, but also some elements of supply chain management for their clients. However there is a question of when the expansion of the scope of business activities of logistics providers hits on the limits of manageability by a single entity.

The article presents the outcomes of research probe focused on mapping and understanding the current situation and the ongoing trends in the field of full logistics services. Given the nature of the used methods of data acquisition, the presented findings have the character of evidence or signals that will represent the subject of further verification using more demanding methods. The created database containing information on the providers of full logistics services is the take-off platform for this purpose.

The suitable topics for further research can be the development of horizontal cooperation between the providers of logistics services and also the prerequisites of existing providers necessary to take over the role of supply chain integrators.

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ANNEX

List of questions included in passports of large providers of full logistics services:

Name of company
Year of foundation in the CR (entry in the ČR)
References to the data sources
Portfolio of services
Typical customers
Does the company operate globally, only in Europe, or only in the CR?
Does the company own technical equipment (vehicles)?
Does the company offer complex logistics solutions? How does it call them?
What is the more detailed characteristic of the provided complex logistics solutions?
Were any mergers or acquisitions carried out in the last three years?
How does the company characterize new requirements of customers?
What problems was the company dealing with during the period of crisis?
How does the company formulate its strategy? Has it changed the strategy during the last three years?
How did the company change the structure of its portfolio during the last three years?
What specific features or advantages does the company present?

DOES MALAYSIAN GOLD BULLION COIN PRICES FOLLOW MEAN REVERSION OR RANDOM WALK?

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Abstract:

Mainly past studies used security prices to test the random walk theory. Not much attention is given to gold bullion coin prices. Furthermore, past literature emphasised on the developed countries' markets to test the random walk theory for gold prices. However, the evidence for developing countries' markets is lacking. In addition to this, several important events happened in the past decade seem to have affected the gold prices. Therefore, the purpose of this study is to test for the presence of a random walk in the series of Malaysian gold bullion coin (1oz) daily prices, ranging from July 18th 2001 to May 11th 2012, by incorporating the structural break in the series. Past studies on testing the random walk theory of gold prices used tradition unit root tests without incorporating structural breaks. In contrast, this study applies Zivot and Andrews (1992) one-break and Lumsdaine and Papell (1997) two-break unit root tests. Furthermore, we also provided the empirical evidences based on traditional unit root tests to compare the results with the prior studies on this topic.

The main finding is that Malaysian gold bullion coin prices follow mean reversion, implying that the market is inefficient and the impact of shocks is transitory. We also capture important break dates in the series. The finding has implications for econometric modelling, in particular forecasting and structural breaks. The structural breaks captured in the series reflect that investors are responsive to market sentiment. Furthermore, as our empirical results show mean reversion, therefore, investors can exploit past price trend to get abnormal profit. This paper adds to the literature on random walk theory of gold prices, by providing the evidence on Malaysian gold bullion coin prices. In our knowledge, no previous research tested the random walk theory of gold prices on Malaysia, by using structural break unit root tests.

Key words: random walk, mean reversion, structural breaks, unit-root tests, gold bullion coins, developing economy.

JEL Classification: C22, G14.

1. Introduction

The gold investment has become increasingly important aside from others, such as stocks, bonds, unit trusts, and currencies. Gold investment gains its momentum for some reasons: gold can be a store of value in addition to a nation's currency; investors perceive that gold can be used for inflation-hedging; some investors tend to speculate in the gold market for abnormal returns; and long-term investors seek for capital gain from gold investment as they believe gold price will increase with time, because the supply of gold is limited. Current literature has been highlighting the importance of gold investment. For instances, Smith (2002: 671) mentioned that the stock markets in the Unites States, Europe, and elsewhere were badly affected by the catastrophic event of September 11th 2001, and over the same period, gold price surged showing increasing interest among investors in gold as a safe haven; and Narayan *et al.* (2010: 3299) stated that oil price surged instigates gold investment to hedge for inflation.

Gold bullion is a popular investment choice for gold investors. It is known that the return on gold investment is highly dependent on capital gain, in which investors will usually exploit the differences between the buying and selling prices. Gold is unlike stocks, because stocks provide streams of dividend in addition to price fluctuations, indeed, for gold, only price fluctuations are relevant (Smith, 2002: 671). Thus, price trend forecast remains vital from the viewpoint of gold investors. With this concern, it is

crucial to find out whether the gold bullion series follow a process of random walk which neglects the feasibility of price trend forecast, or a process of mean reversion supporting the superiority of technical analysis. By practice, foregoing will imply whether gold investors should commit for a simply buy-and-hold strategy or time the market.

Random walk theory is considerably important for the gold market. According to Smith (2002: 671), the return on gold investment is much depending on price fluctuations. Investors are interested to know whether price trend forecast is useful in this market, which can be indicated by whether the gold bullion series follow a process of random walk. In the model of random walk, it is assumed that price changes are independent random variables, which conform to some probability distribution (Fama, 1963: 420; 1965a: 35). The model implies that the sequence or the order of past returns is of no consequence in assessing the distributions of future returns (Fama, 1970: 387). Samuelson (1965: 41) stated that, "In competitive markets, there is a buyer for every seller. If one could be sure that a price will rise, it would have already risen". In brief, foregoing reflects that future prices are unpredictable based on past price trend. Random walk is consistent with the weak-form efficient market hypothesis (EMH), asserting that market is competitive and current prices fully reflect all available information. Thus, random walk would neglect the superiority of technical analysis in price trend forecast. On the other hand, mean reversion is the tendency for stocks with high returns today to experience low returns in the future, and for stocks with low returns today to experience high returns in the future (Hubbard, 2008: 218). Mean reversion implies that prices will eventually move back towards the historical average in the series. Therefore, investors can utilize historical means to predict future price movement. Thus, mean reversion would support technical analysis. Nonetheless, when market is efficient the impact of shock will be permanent. Conversely, it will be transitory (see Narayan and Narayan, 2007: 241; Munir *et al.*, 2012: 9-10).

The purpose of this study is to test for the presence of a random walk in the series of Malaysian gold bullion coin (1oz) daily prices, ranging from July 18th 2001 to May 11th 2012. The main contributions of this paper are as following: First, very little researches have examined the random walk theory for gold bullion coin series. Mainly past studies used security prices to test the random walk theory (Narayan and Smyth, 2004, 2006; Narayan, 2005, 2006, 2008; Munir *et al.*, 2012; Nayak, 2012). Distinctively, this study examines the random walk theory for gold bullion coin series, which this is rarely been emphasized by existing studies. The rationale is that the testing of random walk hypothesis will give finding showing the right investment strategy for gold investors. If the series follow random walk, the market is efficient, and this neglects the value of technical analysis. Therefore, a simple buy-and-hold strategy is proposed. In contrast, if mean reversion is found in the series, it implies that prediction on future price movement can be performed using past price trend. Thus, it supports the use of technical analysis to obtain abnormal returns. Mean reversion also indicates that the market is inefficient.

Second, most of the previous literature emphasized on the developed countries' markets to test the random walk theory for gold prices (Tschoegl, 1978; Abken, 1980; Selvanathan, 1991; Smith, 2002). There seems to be very little attention is paid on the markets of developing countries. Obviously, literature provides insufficient evidence for developing countries. As a consequence, a comparison on the findings of developed and developing countries cannot be performed. In the light of this, this study contributes to the body of literature using Malaysia as a developing country, to provide an insight of whether the developing country's market is consistent with the developed countries' markets.

Third, several important events happened in the sample period of this study, spanning from July 18th 2001 to May 11th 2012. These events are likely to have affected the prices of the gold bullion coin. For instances, the September 11 attacks (in 2001), the Bali bombings (in October 2002), the Malaysian 11th General Election (in March 2004), the world crude oil price fluctuations (from 2004 to 2006), the magnitude 7.7 earthquake off the south-western coast of Java, Indonesia (in July 2006), the global recession (in 2008), the outbreak of H1N1 influenza (in 2009) and others. Therefore, this study is motivated to analyze whether or not the market of gold bullion coin is affected by particular external shocks, in turns reflecting investors' response to market sentiment. In order to capture the above mentioned structural breaks, this study is applying Zivot and Andrews (1992) one break unit-root test, and Lumsdaine and Papell (1997) two-break unit-root test. Random walk process is supported when the gold

bullion coin series is found nonstationary. If the series exhibits mean reversion, it inversely indicates the feasibility of future price prediction based on past price trend. Lastly, for comparison, we also apply battery of univariate unit root tests without structural break in testing the random walk hypothesis.

The rest of the paper is structured as follows. Section 2 reviews the empirical studies on the random walk theory. Section 3 discusses the empirical methodology used in this study. Section 4 reports the results from Zivot and Andrews (1992), and Lumsdaine and Papell (1997) tests. Section 5 concludes.

2. Literature review

Literature on random walk theory is plentiful, such as Fama (1963, 1965a, 1965b, 1970, 1991), Samuelson (1965), Poterba and Summers (1987), Fama and French (1988), Lo and MacKinlay (1988), Huber (1997), Chaudhuri and Wu (2003), Schwert (2003), Shively (2003), Narayan and Smyth (2004, 2006), Narayan (2005, 2006, 2008), Munir *et al.* (2012), Nayak (2012), and many others. Preceding studies are mostly concentrating on security prices in the capital market. It is very obvious that there is limited attention paid by researchers on the gold bullion coin prices.

Majority of these studies focused on the developed countries' markets. In an early study by Tschoegl (1978), it demonstrated a testing of random walk for the London gold price series. This study applied the data on morning and afternoon fixing measured in USD per troy ounce, covering period of January 2nd 1975 to June 30th 1977. By utilizing serial correlation tests and modelling the changes of first-order Markov processes, this study found evidence of short-run dependence in the London gold price series.

Contrasting to the finding in Tschoegl (1978), the study by Abken (1980) provided additional insight for the London gold prices. The latter found evidence in favour of market efficiency. In this study, the percentage change in gold prices of current period was regressed on, the percentage change in gold prices in preceding period, and the yield on a security of one-month maturity, respectively. The data on first-of-month gold prices quoted at the p.m. of London gold fixing denominated in USD, and first-of-month Treasury bill yields of one-month maturity were applied for regression. The finding implied that market participants responded quickly to new information in the market, supporting market efficiency.

A more recent study of random walk testing for London gold prices can be seen in Selvanathan (1991). An interesting insight provided from this study is that, the London gold prices follow a process of random walk, consistent with the finding in the preceding study by Abken (1980) that the market is efficient. In this study, the models of univariate time-series were developed to obtain gold price forecasts. The models were estimated using the daily data on London gold prices, spanning from August 3rd 1987 to July 20th 1988. The data was expressed in AUD by converting from USD using the forecasts of exchange rates. In order to test the random walk hypothesis, this study utilized the unit- root test based on Dickey and Fuller (1981). Several diagnostic tests were used to provide support for the finding.

However, Smith (2002) showed a rejection of the random walk hypothesis for the London gold price series. The finding seems to offer support for the result provided in Tschoegl (1978) which showed evidence of short-run dependence in the London gold price series. In Smith (2002), the data applied were daily London gold prices including the prices of opening at 10 a.m, afternoon fixings at 3p.m, and closing prices at 5p.m. All prices were expressed in USD per troy ounce. The data covered a time span from January 3rd 1990 to September 27th 2001. This study applied the multiple variance ratio tests based on Lo and MacKinlay (1988). The size of the test is controlled for multiple comparisons. In addition, the test allows for general heteroscedasticity in the data and does not require the assumption of normally distributed returns. It was found that only the closing series followed a random walk, but the series set in the morning and afternoon fixings were autocorrelated. Thus, the random walk hypothesis was rejected in the study.

Meantime, there are past studies contributed to the literature of random walk in gold prices, other than the London gold prices. In Mehrara *et al.* (2010), instead of validating the EMH, it stressed on market inefficiency for gold market, by showing the existence of subtle price patterns exploitable for profitable trading. In this study, the model of Group Method of Data Handling (GMDH) and Multi Layered Feed Forward (MLFF) neural networks were estimated for gold prices. An insight of comparison was provided

from the estimations on the models of traditional technical trading (TA) strategy, buy-and-hold (BH) strategy, random walk (RW) strategy, and the return on Treasury bills (T-bill). This study generated the daily profit and loss expressed as the percentage of returns from different models for each year throughout 2006 to 2009. Then, volatility measured by standard deviation of returns was used to compare the average daily returns. The coefficient of variation was used to measure comparative risk/reward. When the coefficient of variation is low, it implied small risk. Sharp ratio was used to compare the returns relative to risk. The GMDH model was found to be the best to produce profitable trading signals for several years when without transaction costs and disregarding slippage. Overall finding showed evidence of price patterns exploitable for profitable trading. Hence, this study did not provide support for market efficiency.

Li and Wang (2011) demonstrated the random walk hypothesis testing for the gold prices of Shanghai Gold Exchange. The data used were the daily open and closing prices of Gold Au 99.99 and Gold Au 99.95, for the period of October 30th 2002 to December 31st 2010. The gold prices were expressed in the currency unit of RMB. This study utilized variance ratio test based on Lo and MacKinlay (1988), the sub-period test based on Wright (2000), and the Wild Bootstrap method by Kim. The finding indicated that Kim's bootstrap test has more power than other tests, as the results for all sub-samples were unable to reject the null hypothesis of random walk.

3. Econometric methodology

This section considers the data and method of analysis. We briefly describe structural break unit root tests used in the analysis of the random walk hypothesis in the series of Malaysian gold bullion coins prices. The unit root hypothesis explained here are under the assumption of one and two structural break

3.1. Zivot and Andrews structural break test

Zivot and Andrews (1992) presented two versions of the sequential trend break model, Model A and Model C. Model A allows for a change in intercept, while Model C allows for a change in both the intercept and slope. In a recent study, Sen (2003) showed that if one uses Model A, when in fact the break occurs according to Model C, then there will be substantial loss in power. However, if the break is characterized according to Model A, but Model C is used then the loss in power is minor, suggesting that Model C is superior to Model A. In this study, two versions of the Zivot and Andrews (1992) sequential trend break model (Model A and Model C) are used to investigate the random walk hypothesis for the gold bullion coins prices. Model A can be written as:

$$\Delta y_t = k + \alpha y_{t-1} + \beta t + \theta DU_t + \sum_{j=1}^k d_j \Delta y_{t-j} + \varepsilon_t \quad (1)$$

Model C can be written as:

$$\Delta y_t = k + \alpha y_{t-1} + \beta t + \theta_1 DU_t + \gamma_1 DT_t + \sum_{j=1}^k d_j \Delta y_{t-j} + \varepsilon_t \quad (2)$$

Here, Δ is the first difference operator, y_t denotes the gold prices in country i , time $t=1, \dots, T$ is index of time. ε_t is a white noise disturbance term. The ΔY_{t-j} terms on the right-hand-side of Equation 1 and 2 allow for serial correlation and ensure that the disturbance term is white noise. The null hypothesis in Equations 1 and 2 is that $\alpha=0$, which implies that there is a unit root in y_t . The alternative hypothesis is that $\alpha<0$, which implies that y_t is breakpoint stationary. Finally, DU_t is an indicator dummy variable for a mean shift occurring at time TB , and DT_t is the corresponding trend shift variable, where

$$DU_t = \begin{cases} 1 & \text{if } t > TB \\ 0 & \text{otherwise} \end{cases} \quad \text{and} \quad DT_t = \begin{cases} t - TB & \text{if } t > TB \\ 0 & \text{otherwise} \end{cases}$$

In applying the Zivot and Andrews (1992) test, some region must be chosen such that the end points of the sample are not included, for in the presence of the end points the asymptotic distribution of the statistics diverges to infinity. Zivot and Andrews (1992) suggested that the 'trimming region' be specified as $(0.10T, 0.90T)$, which we follow. The break points are selected by choosing the value of TB for which

the ADF t -statistic (the absolute value of the t -statistic for α) is maximized. The test essentially amounts to testing the null hypothesis that the Y_t is an integrated process without a structural break, against the alternative hypothesis that the series Y_t is trend stationary with a structural break in the trend function which occurs at an unknown time.

Although asymptotic critical values are available for this test, Zivot and Andrews warn that with small sample sizes the distribution of the test statistic can deviate substantially from its asymptotic distribution. To circumvent this distortion, ‘exact’ critical values for the test are computed following the methodology advocated in Zivot and Andrews (1992: 262).

3.2. Lumsdaine and Papell structural break test

The Zivot and Andrews (1992) test is, however, quite restrictive since it only allows for one level and trend shift over the entire sample period. To address this shortcoming, we use the Lumsdaine and Papell (1997) unit root test, which extends the two-break version of Zivot and Andrews (1992) unit root test by using sequential Dickey–Fuller test to endogenously determine the break dates. In essence, they extend Zivot and Andrews (1992) Model A and C and call these models AA and CC respectively. Model AA allows for two breaks in the intercept of the trend and Model CC allows for two breaks in the intercept and slope of the trend. Model AA takes the following form:

$$\Delta y_t = k + \alpha y_{t-1} + \beta t + \theta DU1_t + \omega DU2_t + \sum_{j=1}^k d_j \Delta y_{t-j} + \varepsilon_t \quad (3)$$

Model CC takes the following form:

$$\Delta y_t = k + \alpha y_{t-1} + \beta t + \theta_1 DU1_t + \gamma_1 DT1_t + \omega DU2_t + \psi DT2_t + \sum_{j=1}^k d_j \Delta y_{t-j} + \varepsilon_t \quad (4)$$

Where $DU1_t$ and $DU2_t$ are indicator dummy variables for a mean shift occurring respectively at time ($TB1$) and ($TB2$) with $TB2 > TB1 + 2$, while $DT1_t$ and $DT2_t$ are the corresponding trend shift variables. Formally, $DU1_t = 1$ if $t > TB1$ and 0 otherwise; and $DU2_t = 1$ if $t > TB2$ and 0 otherwise. In the same way, $DT1_t = t - TB1$ if $t > TB1$ and 0 otherwise; and $DT2_t = t - TB2$ if $t > TB2$ and 0 otherwise. Where:

$$DU1_t = \begin{cases} 1 & \text{if } t > TB1 \\ 0 & \text{otherwise} \end{cases}$$

$$DU2_t = \begin{cases} 1 & \text{if } t > TB2 \\ 0 & \text{otherwise} \end{cases}$$

and

$$DT1_t = \begin{cases} t - TB1 & \text{if } t > TB1 \\ 0 & \text{otherwise} \end{cases}$$

$$DT2_t = \begin{cases} t - TB2 & \text{if } t > TB2 \\ 0 & \text{otherwise} \end{cases}$$

The null and alternative hypotheses are the same as in the one break case. As in the previous test, the $\Delta Y_{t,j}$ terms on the right-hand side of the above equation allow for serial correlation and ensure that the disturbance term is white noise. T is the number of observations after adjusting for those “lost” by first-differencing and lag length k . The optimal lag length (k) is determined based on the *Akaike information criterion* (AIC). The “trimming region,” in which we have searched for TB_1 and TB_2 , cover the 0.10T-0.90T period. We have selected the break points (TB_1 and TB_2) based on the minimum value of the t statistic for α . By using time series data, LP (1997) have assumed the lag length (k) to vary up to $K_{max}=12$, thus we select $k= 12$. The critical values are generated as in the case of the Zivot and Andrews (1992) test.

4. Dataset and empirical results

4.1. Dataset

In this paper, we use daily data from July 18th 2001 to May 11th 2012, with total 2,791 observations. The data series is daily selling prices. The Malaysian gold bullion coin data are sourced from the Central Bank of Malaysia and quoted in Malaysian Ringgit per ounce. This sample size is dictated by data availability. We take natural logarithm of the data in the analysis. The “Kijang Emas” is the official gold bullion coin series of Malaysia and is minted by the Royal Mint of Malaysia. It was first launched on July 17th 2001. Malaysia is the 12th country in the world to issue its own gold bullion coin series. The gold coins have gold purity with a 99.9 millesimal fineness. The gold coins come in denominations of RM200, RM100 and RM50 which are the nominal face values, and weighs 1 oz, ½ oz and ¼ oz respectively. The buying and selling prices of the gold coins are determined by the gold prices in international market.

4.2. Empirical results

Standard Univariate Unit Root/Stationarity Tests

For the sake of comparison, we also incorporate the ADF, PP (Phillips and Perron, 1988), KPSS (Kwiatkowski *et al.*, 1992), and DF-GLS (Elliott *et al.*, 1996) tests into our study. We employ unit root tests which: (i) have a unit root test as the null hypothesis (ADF, PP and DF-GLS tests); (ii) has stationarity as the null hypothesis (KPSS test).

Table 1 provides the results for these four univariate tests. We observe that the ADF and PP test cannot reject the null of a unit root. From the ADF and PP tests, the null hypothesis of a random walk cannot be rejected even at the 10% level. One of the reasons given in the literature is that the power of the ADF and PP test may be too low to reject the null hypothesis of a random walk if data contains structural break. Next, we consider the result from the KPSS test. Generally, the empirical result is in corroboration with the ADF and PP tests, i.e. the null of level stationarity is rejected in favour of the unit root alternative for the KPSS statistics are larger than the asymptotic critical values. Therefore, the results from these three conventional unit root tests for gold bullion coin are indicating that the gold bullion coin series is nonstationary. This result is consistent with that of the existing literature, and is due to the low power of these three univariate unit root tests when the prices of gold bullion coins are highly persistent. (Elliot *et al.*, 1996) developed a feasible point optimal test that relies on local GLS detrending. This test has much greater power than standard ADF and PP unit root tests. We observe that the DF-GLS test has rejected the null of a unit root. This is because the test statistic is smaller than the critical values at the 1 percent significance level. Thus, the DF-GLS test suggests that there is no unit root in the series.

Table 1 - Traditional Univariate Unit Root Test results

	Lag	Statistics	Critical Values		
			1%	5%	10%
ADF	13	-0.545	-3.432	-2.862	-2.567
PP	6	-0.606	-3.432	-2.862	-2.567
KPSS	7	6.506*	0.739	0.463	0.347
DF-GLS	13	-2.243*	-2.565	-1.941	-1.616

Notes: *denote rejection of the null hypothesis at 1% significant level. For the ADF, PP and DF-GLS tests, the null hypotheses are series contain unit root whereas for the KPSS (1992) test, the null hypothesis is series without unit root. The optimal lag of the ADF test is determined based on AIC whereas for KPSS, the Newey-West Bandwidth is chosen using the Bartlett Kernel as default Spectral estimation method.

Overall, these results tend to suggest that there is no significant evidence of mean reversion in Gold bullion Coins prices. One plausible reason for the non-rejection of the random walk hypothesis is the mis-specification of the deterministic components included as regressors. It is likely that the series under investigation is characterized by a fundamental structural change. Failure to account for such a change may bias the test in favour of the null hypothesis of a random walk.

Unit Root Tests in the presence of structural breaks

Traditional tests for unit roots (such as Dickey-Fuller, Augmented Dickey-Fuller and Phillips-Perron) have low power in the presence of structural break. (Perron 1989) showed that the power to reject a unit root decreases when the stationary alternative is true and a structural break is ignored. In this section, we attempt to nullify this criticism by incorporating a structural break in testing for the unit root null hypothesis. The results of the Zivot and Andrews (1992) sequential trend break model, as explained earlier are presented in Table 2. Our main finding is that we are able to reject the unit root null hypothesis in both Models A and C at the 1% level of significance. Furthermore, in Model A and C the break in the intercept is statistically significant at the 1% level. The structural break in Model A and C is April 5th 2004 (see Figure 1 also). Thus from, Model A and C, we are able to reject the random walk hypothesis for the Malaysian gold bullion coin market, i.e. Model A and C suggest that Malaysian gold coin series is breakpoint stationary.

Table 2 - Zivot and Andrew (1992) structural break unit root test results

Zivot and Andrew (1992)		
	Model A	Model C
TB	5 th April 2004	5 th April 2004
<i>a</i>	-0.026* (-5.966)	-0.026* (-5.995)
<i>θ (theta)</i>	-0.003* (-3.512)	-0.003* (-2.656)
<i>γ (gamma)</i>	—	(0.001) (0.644)
<i>k</i>	4	4
Critical values for t_a		
1%	-5.340	-5.570
5%	-4.800	-5.080
10%	-4.580	-4.820

Notes: *k* stands for the endogenously selected lag order for the minADF test. The lag parameters are selected based on the AIC. Values in parenthesis are t statistics. (*) denote statistical significance at the 1% level.

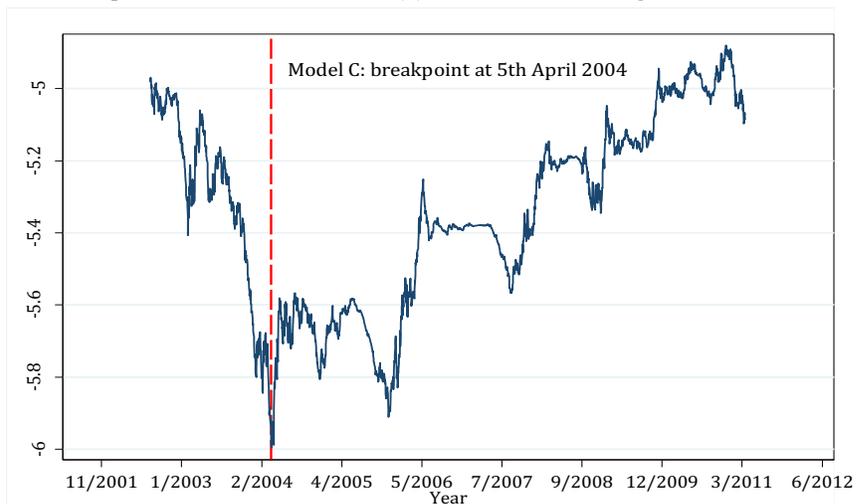


Figure 1. Zivot-Andrews Test for the Gold Bullion Coin Prices (1 oz), 2001-2012

Table 3 reports the empirical results of the Lumsdaine-Papell test using Model AA, which allows for two breaks in the intercept, and CC, which allows for two breaks in the constant and the trend. Overall from Model AA and CC, by allowing for two breaks, we can reject the unit root null hypothesis in favour of the trend-stationary alternative for the gold bullion coin series. This implies that shocks to the Malaysian gold bullion coin series are not permanent in nature and trend-reverting. According to the Model AA, the break in intercept and slope is not statistically significant at any conventional level, while from Model CC, the first and second break are statistically significant at 5% level. The statistically significant break is March 17th 2005 and July 17th 2006. We determine the significance of the breaks using the conventional t-statistic. Comparing Model A with AA or C with Model CC, the two break model should be preferred if the second break is statistically significant (Sen, 2003; Narayan and Smyth, 2007). Thus, we prefer Model CC to Model AA.

Table 3 - Lumsdaine and Papell (1997) Structural Break Unit Root Test results

<i>Lumsdaine and Papell (1997)</i>		
	Model AA	Model CC
TB1	2 nd April 2004	17 th March 2005
TB2	29 th May 2005	17 th July 2006
α	-0.028** (-6.231)	-0.033** (-6.887)
θ (theta)	-0.004 (-3.872)	-0.015** (-6.800)
γ (gamma)	—	0.011** (6.771)
ω (omega)	0.002 (2.025)	-0.016** (-6.922)
ψ (psi)	—	-0.011** (-6.944)
k	4	4
Critical values for t_α		
1%	-6.740	-7.190
5%	-6.160	-6.750
10%	-5.890	-6.480

Notes: - k stands for the endogenously selected lag order for the minADF test. The lag parameters are selected based on the AIC. Values in parenthesis are t statistics.
 - (**) denote statistical significance at the 5% level.

Overall, these findings, while illustrating the importance of allowing for two breaks do not produce results too dissimilar from the tests that assume one structural break. Ben-David *et al.* (2003) pointed out that allowing for additional breaks does not necessarily produce more rejections of the unit root hypothesis, because the critical value increases in absolute value when we include more breaks. The results from Table 3, however, indicate that allowing breaks in both the intercept and the slope of the trend function proves importance.

Figure 2 Lumsdaine and Papell Test (Model CC) for the Gold Bullion Coin Prices (1 oz), 2001-2012

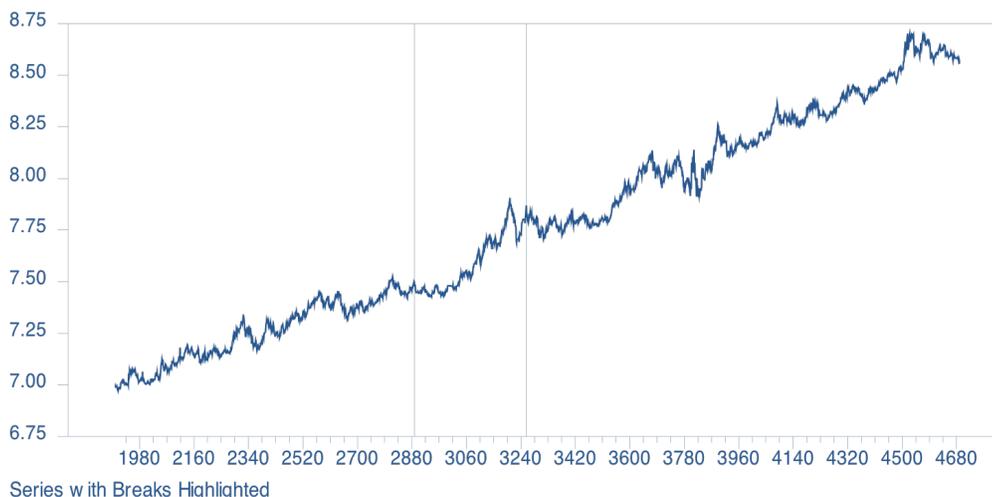


Figure 2 depicts the statistical significant breaks dates, April 2nd 2004, April 5th 2004, March 17th 2005, May 29th 2005, and July 17th 2006. A possible explanation for the breaks found is the changes of world crude oil prices. Wang and Wang (2010) postulated that gold and oil prices are mutually affecting each other in a bilateral way. Oil price surge increases the cost of transportation, in turns increases the prices of goods and services. It may also lead to inflation. Gold prices may exhibit a positive trend follow the oil prices, because gold can be used for inflation-hedging. In addition, some oil producing countries accept gold for oil trading. The period covering the break points was the period of crude oil price fluctuations, following the lowered crude oil production capacity of OPEC, and the increased demand for crude oil from emerging Asian economies. On April 1st 2004, OPEC cut production of crude oil by one million barrels per day causing an oil price surge. This study captured break points on April 2nd 2004 and April 5th 2004 which happened after this event. The price of crude oil kept fluctuating upside and reached the peak around June to July 2006. Other break points found in this study are March 17th 2005, May 29th 2005, and July 17th 2006, which can be seen as following the fluctuations in crude oil prices.

Nonetheless, the break dates found in 2004 (April 2nd 2004; April 5th 2004) can be explained by local political event. Malaysia held the 11th General Election on March 21st 2004. The election might have raised market sentiment because of investors having different expectations on the successfully elected government. Hence, the election might have exaggerated the speculation in the local gold market. Meantime, it is worth to mention another break point captured which is on July 17th 2006. The break date coincides with the force majeure of south-western Java earthquake and tsunamis in which more than 800 people were reported missing or dead. This again shows that investors are responsive to external shocks. However, it should be note that, since mean reversion is found in the series, thus implying the market is inefficient. Therefore, the impact of external shocks is only transitory.

In sum, we have identified significant structural changes in Malaysian gold bullion coin prices. These breaks are searched endogenously without using prior information. When they are incorporated in the tests for a random walk, we find that the null hypothesis of random walk in gold coin prices can be rejected in favour of mean reversion. Furthermore, major economic events seem to provide reasonable explanations for these changes.

The results from Lumsdaine and Papell (1997) two break tests reinforce the conclusion from the Zivot and Andrew (1992) tests that Malaysian gold bullion coin series does not follow random walk i.e. we found support for mean reversion in Malaysian gold bullion coin series. Our results are in sharp contrast to those obtained with traditional tests (ADF, PP and KPSS) where the possible breaks are not considered. As Perron (1989) and others have demonstrated, failure to take into account the breaking points may significantly reduce the power of traditional tests and mistakenly produce evidence in support

of the random walk hypothesis. This finding is somehow consistent with previous studies of the random walk hypothesis for gold prices, as in Tschoegl (1978), short-run dependence had been found in the series of London gold prices for sample period from January 2nd 1975 to June 30th 1977. However, this finding is not consistent with a few other studies that had proven a random walk for London gold prices, as in Selvanathan (1991) for the sample period from August 3rd 1987 to July 20th 1988, and Smith (2002) from January 3rd, 1900 to September 27th, 2001, and also in Li and Wang (2011) that validated random walk hypothesis for the gold prices of Shanghai Gold Exchange for the sample period from October 30th, 2002 to December 31st, 2010.

Conclusion

This study tested the random walk hypothesis for Malaysian gold bullion coin prices, by addressing the issue of structural break. We apply Zivot and Andrews (1992) one break unit-root test, and Lumsdaine and Papell (1997) two-break unit-root test on the daily prices of Malaysian gold bullion coin (1 oz.), for the period of July 18th 2001 to May 11th 2012. Our finding provides support for mean reversion, showing the violation of efficient market hypothesis. Meantime, we identify significant break dates, and capture important events giving significant impact to the gold coin series. Since mean reversion is shown, we suggest that the impact of shock is only transitory. The finding offers considerable support for technical analysis.

The rationale for this paper is that previous studies which have employed unit-root tests without a structural break for gold prices in developing countries have found little evidence for mean reversion (see e.g. Li and Wang, 2011). The results from these studies stand in contrast with evidence from unit root testing of gold prices in developed markets which provides more support for mean reversion (Tschoegl, 1978; Smith, 2002). The failure to find mean reversion in gold prices in developing countries in studies which have not allowed for structural break might reflect the failure to account for an additional structural break. As Lumsdaine and Papell (1997) point out, given the loss of power when ignoring one structural break in standard unit root tests, it is logical to expect a similar loss of power when ignoring two or more breaks in one-break tests. This paper has thus considered the random walk hypothesis employing daily data on Malaysian gold bullion coin (1 oz.) prices over the period 2001 to 2012, using unit root tests with one and two structural breaks in the trend. Overall, our main finding is that we found the support of mean reversion in the gold coin prices from Zivot and Andrews (1992) and Lumsdaine and Papell (1997) structural break unit root tests.

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THE ENTERPRISE ARCHITECT ROLE – AND ITS MISSION IN CORPORATE INFORMATION AND COMMUNICATION TECHNOLOGY – A CZECH STUDY

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Abstract:

The article analyses the relatively new role “Enterprise Architect” in Czech companies. Enterprise Architect is a specific role, which supervises the architecture of the whole corporate system and the design of its parts and methodologies in the ICT area. For these tasks, the people in the role “Enterprise Architect” possess a wide spectrum of knowledge and skills. We then define the scope of the Enterprise Architect role in the companies; we describe its core activities in practice and the concrete jobs that can be carried out by the role. All, that is set against the backdrop of the Czech Republic's labor market. In view of the market structure, we analyze these requirements from multiple aspects, dominated by the company size and dependence of the company on using ICT. The article includes a presentation of our research methodology, including the solution for measuring the knowledge in the different knowledge domains. The principles of the methodology are confronted with the approaches that were used in surveys conducted in other countries. In the end, the identified requirements for this role are formulated as well as their dependence on the monitored impacts of these requirements on the options for educating of experts in universities.

Keywords: enterprise architect, knowledge profile, corporate ICT.

JEL Classification: A23, J01, J21, J24, O15

1. Introduction

With the development of information and communication technologies (ICT), both the requirements for the expertise of all roles in departments and sections of the corporate ICT are changing. In this respect, it is important to answer the questions connected with *the changes to competences and qualifications* of the ICT expert staff (Skrbek and Ehleman 2006). Qualifications and competencies can be investigated from many points of view. One of these is the view of the factors influencing the fluctuation of staff in companies (Joseph *et al.* 2007), the total concept of ICT competencies for some ICT roles are described by (CEPIS 2012b). Other concepts, which rather have the character of executive views, can be found, for example, in (Doucek, Maryska and Novotny 2012; Sudzina, Pucihar and Lenart 2011; Veber 2009; Vodacek and Vodackova 2001).

The aim of this paper is analysis of knowledge required by companies for the role Enterprise Architect that is becoming more and more important in current time (Brown, P.C. 2011; NUS 2009) as one of the roles that significantly interconnect the top management level with the ICT management. (CIO 2007; Roser, Muller and Bauer 2011). Increasing importance of the Enterprise Architect role is proved by the researches among companies (Doucek, Maryska and Novotny 2012; Maryska, Novotny and Doucek 2010) and analysis of surveys realized by labor portal in the Czech Republic (Mediacom 2012) that shown us that there is lack of well-educated Enterprise Architects professionals in the Czech Republic. The analysis presented here is based on the similar research can be realized in the Czech Republic, because authors are familiar with this local labor market. Nevertheless research is possible to realize over the world because we provide detailed methodology, descriptions etc.

In order to be able to investigate the requirements of the market for the role Enterprise Architect, first we had to define this role. The main source for definition of role was, on the one hand, the theoretical information provided in particular by the Council of European Professionals Informatics Societies (CEPIS). In this analysis, CEPIS defines 21 main roles in the ICT area including the role Enterprise Architect which is characterized by a detailed description (CEPIS 2012a). On the other hand we have applied also approach of the Software Engineering Institute, Carnegie Mellon University (SEICMU) that derives the position of the Enterprise Architect role in corporation (SEICMU 2009). As compared with (CEPIS 2012a), the SEICMU describes also hierarchy of roles in the company.

Employees working in the Enterprise Architect role are jointly responsible for the process of investment decisions the objective of which is promotion of achieving the corporate mission and strategy (CEPIS 2012a). This includes both the identification of potential investment programs, i.e., for instance, the development in the area of hardware and software, but also identification of errors in managing the company's ICT platform that cause the company not achieving its mission and strategy. The Enterprise Architect role also provides advices to managers whether and what investment in ICT should be made in the companies, evaluates how investments in ICT could improve the achievement of the corporate strategy etc.

This implies that the Enterprise Architect is responsible both for the area of analysis and the area of design of company's ICT (Opengroup 2012; SEICMU 2009). Opengroup (The Open Group 2009) also specifies the different knowledge and skills for the roles of corporate ICT system architects as follows. They break them down into: Framework Skills Areas; Business Skills and Methods; Enterprise Architecture Skills.

This approach is similar to approach of (ITCP 2012) which divides skills and knowledge into following four groups and 13 subgroups: Skills and Knowledge – “Broad” ICT Knowledge, Specialist ICT Knowledge; Professional knowledge – Ethics and CoP, Security and Privacy, ICT Legal Issues, ICT in Context of Organizations; Competency and Responsibility – Autonomy, Influence, Complexity, Business Skills; Character – References, Publications of Applicants, Serious Convictions.

Our research focused on the group “Skills and Knowledge”. Other important sources of our research were more oriented to the assessment of the ICT knowledge are presented in Core Body of Knowledge (ITCP 2012) and The Skills Framework for the Information Age – SFIA Framework (ACS 2012; SFIA 2012).

Current situation at the Czech local labor market can be described as discrepancy between requirements of enterprises on Enterprise Architect's knowledge with knowledge that offers university ICT study programs. This finding is confirmed by another research made by the team at the University of Zagreb (Varga, Stiffler and Luzar-Stiffler 2004) and by team in Saudi Arabia (Al-Jabri, Fraihat 2005). These teams confirm our findings that there is a big discrepancy between companies' expectations about potential graduates' knowledge and real knowledge of graduates. From our point of view it is really important that (Varga, Stiffler and Luzar-Stiffler 2004) use in their research knowledge structure similar to our research methodology. The reasons and gaps that formed motivation for the research about Enterprise Architect role and that were confirmed by the research were:

- There is felt lack of Enterprise Architect specialists on the Czech labor market;
- There is known what knowledge companies expect from specialists in the role Enterprise Architect;
- New study courses and specializations are prepared by us and these should cover companies' requirements on this role.

The difference between requirements of enterprises on Enterprise Architect's knowledge and university ICT study programs is identified as the gap that should be reduced by universities based on the communication between enterprises' and universities' representatives. Our research should help to close this gap through identification what knowledge companies expect from the Enterprise Architect role.

2. Materials and methods

In order to propose suitable roles of ICT professionals, we had to define who we view as an ICT professional. We consider being an ICT professional any employee whose job requires specific ICT skills and knowledge on development, deployment, operation and utilization of ICT in the application area. Working with ICT forms the main contents of his/her job (OECD 2010). We do not consider ICT professionals to be end-users of ICT, who by their specialized activities do not influence the work of other ICT users. The reason for excluding the end-users from the group of ICT professionals is the fact that more and more professions (physicians, financiers, architects, accountants, etc.) use ICT in their work and results from this survey, focused only on ICT professionals, could be distorted. For the survey to be successful, we had to solve many less significant problems, which, however, had in their consequence key impact on the success of the survey among Czech companies. These were first of all the following: definition of ICT roles which would be based on general and internationally used principles as well as reflecting the specifics of the Czech ICT labor market; definition of the knowledge domains and determining the method for measuring the knowledge in them; specification of the data collection method among economic entities and the method for evaluation of the collected data. The solution of these issues is the subject-matter of the section on data collection and methodology in the following text.

2.1 Definition of roles

According to consultations between the staff of the University of Economics in Prague (UEP) and the staff of professional ICT associations (Czech Society for System Integration, CACIO – Czech Association of ICT Managers, SPIS – Association for Information Society), we formulated for the purposes of our survey the roles of ICT professionals listed in Table 1. The roles thus obtained we compared to the roles defined by CEPIS. Approach defined by CEPIS is also respected by the Institute for Information Technology Certified Professional. This institute for professional education and certification of knowledge in ICT is the national authority in ICT knowledge and skills in New Zealand and by other institutions academic as well. Although the sets intersect in certain roles, this does not apply to all roles. The mapping between both approaches is shown in the Table 1. The most important roles as mentioned above were applied from CEPIS.

Table 1 - Role mapping between University of Economics in Prague and CEPIS

ICT Roles of CEPIS	ICT Roles of UEP
IS Manager	IS/ICT Development and Operation Manager
Information Systems Project Manager	
Business Analyst	
Information Systems Analyst	Business Analyst
IT Systems Architect	
Systems Integration & Testing Engineer	ICT Dealer
Sales and Application Consultant	
Software Developer	ICT Developer
Web & Multimedia Master	
Database Manager	Administrator of Applications and of ICT Infrastructure
Network Manager	
Data Center & Configuration Manager	
X-Systems Engineer	Lecturer in ICT
IT Trainer	
Enterprise Solutions Consultant	Enterprise Architect
IS Auditor	Investigation for these ICT roles was not carried out in the Czech Republic in 2010
Telecommunications Architect	
Security Adviser	
Help Desk Supervisor	
Client Manager	
Logistics & Automation Consultant	

Source: authors, (CEPIS 2012a)

We decided not to carry out the survey in the Czech Republic in 2010 for certain roles. This involves mainly the roles from the lower part of the Table 1, with the note “Investigation for these ICT roles was not carried out in the Czech Republic in 2010”. The reason was the fact that we were primarily interested in the *key roles*, bearing the main burden of *implementing information systems* and *ICT operation* in most economic sectors.

Definition of the roles was then followed by determining their contents. The Table 2 describes the requirements for the key knowledge and main activities of the Enterprise Architect role.

Table 2 - Definition of the Enterprise Architect Role

<p><i>Enterprise Architect Professions:</i> <i>Enterprise architect</i> <i>Solution architect</i></p>	<p>Key knowledge:</p> <ul style="list-style-type: none"> ▪ design of main, control and support business processes; ▪ design of IT support for business processes. <p>Activities:</p> <ul style="list-style-type: none"> ▪ design of the business model and optimally corresponding business processes and their links; ▪ design of links between architectures (business architecture, IT services architecture, application architecture, information architecture and technology architecture) and reviewing their integrity; ▪ definition and reviewing the criteria settings for evaluating the adequacy and efficiency of architectures.
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Source: authors

2.2. Knowledge categories and levels

In cooperation with CACIO and SPIS, we formulated the requirements on required skills of ICT professionals, which are required from all roles. These include mainly a high level of *creativity in problem-solving*, *good command of English* (written and spoken), *ability of teamwork* and *communication skills*.

On defining the skills, we defined the knowledge domains in the meaning of explicit knowledge. We defined knowledge domains required for the different roles with various level of urgency. In cooperation with CACIO and SPIS and according to the description of ICT study majors in (Al-Jabri, Fraihat 2005; Strawman 2004; Strawman 2012; Varga, Stiffler and Luzar-Stiffler 2004; Maryska 2012; Doucek *et al.* 2011; Maryska *et al.* 2013; Doucek, Maryska and Novotny 2013), we split them into the following sixteen ICT knowledge domains: “MS01 – Process modeling”, “MS02 – Functionality and customization”, “MS03 – Management IS/ICT”, “MS04 – Analysis and design” (of the corporate information system as a whole and its parts), “MS05 – Software engineering” (techniques and procedures of software products development), “MS06 – Data and information engineering”, “MS07 – IS/ICT knowledge”, “MS08 – Operational excellence”. Besides, we also monitored the required knowledge in non-ICT domains, which were as follows: “MS09 – Team leadership skills”, “MS10 – ICT market knowledge”, “MS11 – Organizational management methods”, “MS12 – Enterprise finance and economics”, “MS13 – Sales and marketing”, “MS14 – Mathematics and statistics”, “MS15 – Law”, “MS16 – Knowledge in business sectors” (Maryska, Novotny and Doucek 2010).

The level of required knowledge for the different knowledge domains is expressed as days of intensive training in the respective area. The levels of the companies' requirements are converted to a non-linear six-grade scale. The conversion method is defined as follows:

- 0 – No expertise;
- 1 – General awareness of the issues (corresponds to approximately 1–2 days of intensive training);
- 2 – Basic orientation in the issues and terminology (corresponds to approximately 3–5 days of intensive training);
- 3 – Solid overview of the issues and basic practical skills (corresponds to approximately 6–20 days of intensive training);

- 4 – Solid overview of the issues and solid practical skills (corresponds to approximately 21–40 days of intensive training);
- 5– Highest expertise – in-depth current knowledge and advanced practical skills (corresponds to approximately 41 or more days of intensive training).

2.3. Data collection – questionnaire survey

The survey was carried out via phone method CATI (Computer Assisted Telephone Interviewing) in combination with online survey.

The questionnaire for online and phone calls included the following groups of questions: *Characteristic of the company* – dependency on information and communication technologies with values LIT (low dependency on ICT), MIT (medium dependency on ICT) and HIT (high dependency on ICT), whether it is ICT supplier or user, if the owners of the company are domestic or international, what is the number of employees and identification of the sector according to OKEČ (Sector Classification of Economic Activities), *requirements for knowledge* broken down according to knowledge domains listed above. The knowledge required by the company were assigned to each of the seven defined roles (see Table 1 in Section Definition of Roles and further for instance Doucek, Maryska and Novotny 2012a). The required experience for each professional role, supplementary information on the average monthly salary in each professional role and the number of ICT professionals in the respective role, who are employed by the company, including the forecast of the company as to their numbers in 2011–2015.

We based the survey among companies on the data in the Register of Economic Entities, maintained by the Czech Statistics Authority. As of 31st December 2005, the register contained a total of 2,388,490 entities, of which 1,266,336 entities were economically active. Economically active entities were the target group, which we further restricted by other selection criteria. Applying them, we selected a sample to be approached from the resulting set of economically active entities. The limiting and distinguishing criteria were as follows:

- Size of the economic entity, which is defined by the number of employees. For the purposes of the survey, we selected three categories of company size – 0–49²⁰, 50–249, 250 or more.
- The company dependency on ICT in the company. According to the share of investment in ICT in the company's turnover, we divided the industry into three categories: industries with the weakest (low) dependency (LIT), industries with medium dependency (MIT) and industries with the strongest (high) dependency on the ICT use (HIT).

According to these criteria, we identified the numbers of economically active entities broken down by size and ICT dependency.

In deciding on the size of the sample, we assumed that the simplest, i.e., proportionate distribution into areas where the selection shares are the same in all areas, would not be suitable in this case. The areas in the master set have significantly different sizes. We decided to reflect this fact as follows: in the group of the largest entities (over 250 employees), which is the smallest one, exhaustive survey would be taken. In the industries dependent on information technologies, exhaustive survey would be taken also for entities over 50 employees. In the other areas, we defined the selection scopes to be equal with respect to the company size and increasing as to the dependency of the industry, which can be regarded as more significant in that respect. This was based on standard approaches to definition of structure of the observed sample defined by the Czech Statistic Organization. Using the rules thus defined, based on theoretical principles for indirect sampling (Lavalloé 2007; Thompson 2012) and on consulting the company carrying out the actual survey among the companies, we proposed the selection set with the structure and numbers as shown in the following Table 3.

²⁰ In this category, we also included those entities who did not state the number of employees.

Table 3 - Structure of the observed sample 2010

	10-49	50-249	250 +	TOTAL
LIT	45	46	44	135
MIT	57	474	98	629
HIT	66	142	39	247
TOTAL	168	662	181	1,011

Source: authors

Surveyed data:

- Number of ICT professionals in the economic entity in 2010 broken down into seven roles;
- Expected number of ICT professionals employed in the economic entity in the next five years;
- Requirements on the level of knowledge in the different jobs broken down into 16 knowledge domains;
- Other variables influencing the entities and their requirements for ICT professionals: number of employees, economic sector in which the entity carries out its economic activities, requirements of the economic sector on the ICT, ICT suppliers for the entities, ICT customers of the entity, domestic or international owners of the entity;
- Requirements for knowledge of the different roles.

2.4. Evaluation methodology

We evaluated the obtained data using the platform Microsoft SQL Server 2008 R/2, which possesses functionality important for our purposes, namely the ETL (Extract – Transform – Load) tools, the tools for generating multidimensional solutions and tools for data mining. A separate group of tools was MS Excel. We used the ETL tools for processing the input data files, which we imported into the relational data model of our design, over which we built a multidimensional solution. The main dimensions of our solution, which we used for the analysis of the responses, were the main parameters of the approached companies. An example is the number of employees, dependency on ICT, industry, region of activity, etc.

We did not use the data mining tools during primary processing and evaluation of data obtained from the companies, but we used them in later evaluation steps, for which we created proprietary data mining models, which enabled us to discover mutual dependencies in the respondents' answers. However, the issues of creating business intelligence and data mining models goes beyond the scope and objective of this article, and therefore, for detailed information, we refer on a general level to (Kimball 2012) and in detailed focus of this article's issues in the journal paper (Doucek, Maryska and Novotny 2012a; Hanclova, Doucek 2011). The last tool – Microsoft Excel – was used for the presentation of the obtained survey results. For presenting them, we found as the most suitable the spider charts, which are included in this article.

3. Results

According to a survey carried out in 2010, we selected certain results among the economic entities for the Enterprise Architect role that focus mainly the differences in understanding of that role by companies, which differ in dependency of their core business on information technologies and in their sizes. Interesting statistics is provided by the view of the Enterprise Architect role in various dimensions of the analyzed companies. These figures can be translated as understanding of the importance put on this role in the companies. The total numbers of roles of all 1,011 analyzed companies are shown in Table 4.

Table 4 - Number of respondents for each role provided by companies

ICT Specialist Role	LIT	MIT	HIT
IS/ICT Development and Operation Manager	35	126	71
Business Analyst	14	62	43
ICT Dealer	11	37	23
ICT Developer	18	117	58

Administrator of Applications and ICT Infrastructure	82	386	189
Lecturer in ICT	14	22	33
Enterprise Architect	12	36	38

Source: authors

The Table 4 implies that the Enterprise Architect role is important for only 8.6% respondents. Practically for all companies included in the survey, the Administrator of Applications and ICT Infrastructure role is important. For companies with little dependence on ICT, it is virtually the only role these companies use to a larger extent. For companies with medium and high dependence on ICT, two roles are important, namely the IS/ICT Development and Operation Manager and the ICT developer. Small number of responses on the characteristics of the roles ICT Dealer, Business Analyst and Lecturer in ICT from companies with low dependence on ICT is due to the fact that these professions are mostly outsourced (Kunstova 2012).

The sum total in the different view is not 1,011, i.e., the total number of companies, as a large number of companies do not distinguish or require the Enterprise Architect role, and thus did not define any requirements for that role.

Table 5 - Numbers of companies responding the Enterprise Architect Role

Size	Respondents	Dependency on ICT	Respondents
<50	10	LIT	12
50-249	41	MIT	36
250 +	35	HIT	38
TOTAL	86	TOTAL	86

Source: authors

The response rate is 8.6 % for the Enterprise Architect role for the whole sample. Only these corporations have requirements on the

3.1. Requirements on the enterprise architect role by the dependency of companies on information and communication technologies

In this area, our survey obtained 86 responses, which were split up depending on the dependency of the industry on ICT (Table 5). The following Table 6 shows statistical characteristics derived from the data of our survey.

Table 6 - Companies Requirements on the Enterprise Architect Role According to the Dependency on ICT

	HIT n= 38						MIT n= 36						LIT n= 12					
	Med	Avg	Σ	σ^2	δ	T	Me _d	Avg	Σ	σ^2	δ	τ	Me _d	Avg	σ	σ^2	δ	τ
MS01	4.0	3.69	1.28	1.65	-1.10	1.00	3.5	3.42	1.05	1.11	-0.47	-0.02	4.0	3.75	1.22	1.48	-1.25	1.33
MS02	4.0	3.50	1.11	1.23	-0.87	1.38	3.0	3.31	0.89	0.79	-0.40	0.13	4.0	3.58	1.08	1.17	-1.54	2.28
MS03	4.0	3.58	1.16	1.34	-0.74	1.06	3.0	3.28	1.16	1.35	-0.58	0.55	4.0	3.58	1.00	0.99	-1.60	3.83
MS04	4.0	3.94	1.07	1.14	-1.53	3.97	4.0	3.67	1.01	1.03	-0.48	-0.80	4.0	3.83	1.03	1.06	-2.01	5.58
MS05	3.0	3.09	1.22	1.49	-0.69	0.16	4.0	3.44	1.00	1.00	-1.21	2.79	4.0	3.50	1.24	1.55	-0.85	-0.09
MS06	3.0	3.37	1.11	1.24	-0.54	1.07	3.0	3.44	1.05	1.11	-0.39	0.05	3.5	3.42	1.31	1.72	-0.36	-0.76
MS07	4.0	3.50	1.11	1.23	-0.87	1.38	4.0	3.53	1.18	1.40	-1.06	1.10	4.0	3.42	1.24	1.54	-0.63	-0.34
MS08	4.0	3.54	1.15	1.31	-0.86	1.16	4.0	3.36	1.27	1.61	-0.74	0.08	4.0	3.58	1.00	0.99	-1.60	3.83
MS09	4.0	3.39	1.13	1.27	-0.84	0.72	3.0	3.00	1.26	1.60	-0.72	0.33	3.5	3.42	1.00	0.99	-1.05	2.55
MS10	3.0	3.46	1.07	1.14	-0.73	1.92	3.0	2.97	1.25	1.57	-0.59	0.22	4.0	3.67	1.23	1.52	-0.99	0.65
MS11	3.0	3.22	1.17	1.38	-0.68	0.51	3.0	3.03	1.23	1.51	-0.74	0.60	4.0	3.50	1.17	1.36	-0.82	0.61
MS12	3.0	2.81	1.04	1.08	-0.56	0.66	3.0	2.67	1.12	1.26	-0.83	0.65	3.5	3.42	0.90	0.81	-0.15	-0.43
MS13	2.5	2.56	1.11	1.22	-0.02	-0.15	2.0	2.31	1.28	1.65	-0.18	-0.47	3.0	3.17	1.11	1.24	-0.39	-0.05
MS14	3.0	2.74	1.29	1.67	-0.10	-0.64	3.0	3.03	0.94	0.88	-0.28	-0.34	3.0	2.92	1.38	1.90	0.18	-1.00
MS15	2.5	2.61	1.15	1.33	-0.23	0.00	3.0	2.50	1.23	1.51	-0.19	-0.55	3.0	3.00	1.28	1.64	-0.31	-0.86
MS16	4.0	3.58	1.18	1.39	-0.98	1.31	3.0	3.00	1.31	1.71	-0.57	0.05	4.0	3.75	0.87	0.75	-0.44	0.23

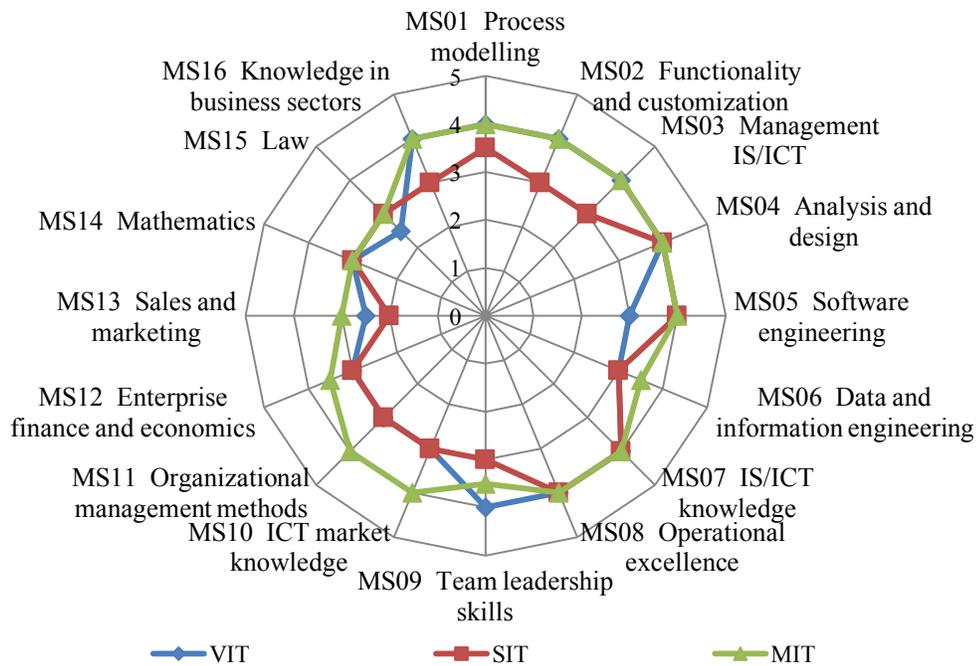
Source: authors

The data set for companies dependent on ICT (HIT) is relatively consistent. The largest deviation shows kurtosis (τ) for the domain “MS04 – Analysis and design”, which means that the obtained values were more dominantly (compared to normal distribution) distributed around the average. Negative values of skewness (δ) for all the monitored domains mean that the obtained average values are moved towards the maximum monitored value.

The companies with medium dependence on ICT (MIT) show very similar consistent characteristics. Negative values of skewness (δ) of all the monitored domains mean that the obtained averages are moved towards the maximum monitored value. The largest deviation of kurtosis (τ) has the domain “MS05 – Software engineering”, which means that the obtained values were distributed more around the average than in extreme values compared to the normal distribution.

The companies with *low dependency on ICT (LIT)* have significantly less consistent characteristics than the previous sets. For knowledge domains “MS01 – Process modeling”, “MS02 – Functionality and customization”, “MS03 – Management IS/ICT” and “MS04 – Analysis and design” where the value of kurtosis is higher than 1. For the domain “MS04 – Analysis and design”, the kurtosis (τ) is significantly positive at 5.58, which corresponds to the fact that a small fraction of respondents agreed on values very close to the average value. The negative value of skewness (δ) indicates deviation of the obtained values towards the maximum value. As to kurtosis, very similar situation is for the domains “MS08 – Operational excellence” and “MS09 – Team leadership skills”.

The results regarding the requirements for the different knowledge domains are shown in the Figure1.



Source: authors

Figure 1 - Companies Requirements on the Role Enterprise Architect According to the dependency on ICT

The Figure 2 implies that the requirements for the Enterprise Architect role depending on the importance of ICT for the industry:

- In practically all the knowledge domains the level of requirements lies between 3 and 4 – i.e., the requirements are uniform regardless on ICT or non-ICT knowledge;
- The requirements are the highest in companies with *low dependency on ICT* – here we have a working hypothesis that in such companies it is necessary for the Enterprise Architect to possess summary knowledge as the company cannot afford more specialists in ICT and this role is ideal

for a sum of strategic and tactical executive positions in the company's ICT. We will try to verify this conclusion from the collection of data in the following survey, which will be focused in a more detail on the Enterprise Architect role and will be carried out in the second half of 2012;

- For the companies that provided their responses in the survey, it further holds (small number of respondents who have such a role implemented in their managements) that the Enterprise Architect role is not, in their opinion, essential for the companies although the ICT plays any key role for the core business proper. Therefore, orchestration of applications in the company is not necessary, either;
- In companies *heavily dependent on ICT* for all the monitored ICT domains the median equals to 4, except “MS05 Software engineering” and “MS06 Data and information engineering”, for which indicate the median value is equal to 3.

These results express two important findings for academics. If the persons responsible for definition of university curricula prepare study programs that should prepare graduates for the role Enterprise Architect they don't need to have to take into account the company dependency on ICT. The second finding is that it is not possible to prepare study programs based only on the knowledge of ICT. This role strongly needs the non-ICT knowledge too, because the specialists in this role have to be permanently in touch with representatives of non-ICT departments.

3.2 Requirements for the enterprise architect role by company size

Further dependency monitored in our survey was the requirements on the Enterprise Architect role the companies. Therefore, we split the companies in the Czech Republic into three groups – small companies and micro companies up to fifty employees (< 50 employees), medium-sized companies between 50 and 249 employees (50–249 employees) and large companies over 250 employees (250+ employees). Statistical characteristics of the obtained data for each monitored group are shown in the Table 7.

Table 7 - Companies Requirements on the enterprise architect role according to the number of employees

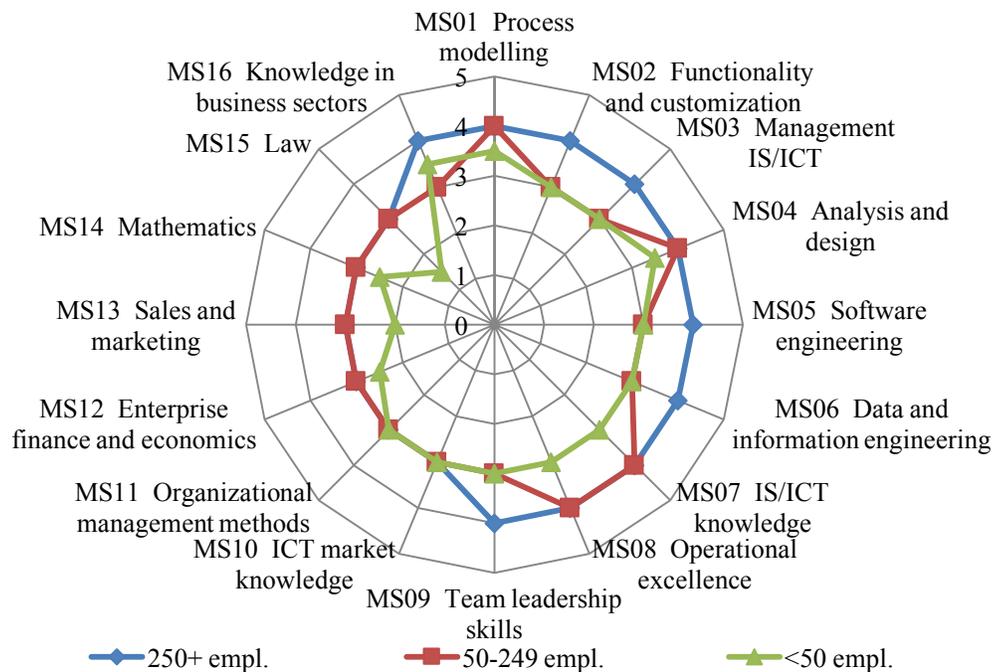
	250+ employees n= 35						50-249employees n= 36						<50 employees n= 12					
	Med	Avg	Σ	σ ²	δ	τ	Med	Avg	Σ	σ ²	Δ	τ	Med	Avg	σ	σ ²	δ	τ
MS01	4.0	3.86	0.88	0.77	0.26	0.67	4.0	3.44	1.29	1.65	0.60	-0.59	3.5	3.13	1.55	2.41	-1.19	1.65
MS02	4.0	3.77	0.81	0.65	0.61	0.30	3.0	3.20	0.95	0.91	0.41	-0.15	3.0	3.13	1.64	2.70	-0.78	0.87
MS03	4.0	3.69	0.83	0.69	0.02	0.57	3.0	3.34	1.26	1.58	0.53	-0.09	3.0	3.00	1.51	2.29	-0.99	1.66
MS04	4.0	4.00	0.80	0.65	0.72	0.57	4.0	3.76	1.09	1.19	0.70	-0.30	3.5	3.25	1.49	2.21	-1.60	3.62
MS05	4.0	3.43	1.07	1.13	0.65	0.10	3.0	3.30	1.07	1.14	1.05	1.65	3.0	2.75	1.67	2.79	-0.46	-0.60
MS06	4.0	3.69	0.90	0.81	0.08	0.72	3.0	3.33	1.14	1.30	0.25	-0.41	3.0	2.63	1.41	1.98	-0.34	2.05
MS07	4.0	3.86	0.88	0.77	0.81	0.34	4.0	3.32	1.21	1.47	0.65	0.13	3.0	2.88	1.46	2.13	-0.82	2.00
MS08	4.0	3.77	0.81	0.65	0.26	0.23	4.0	3.33	1.31	1.71	0.64	-0.29	3.0	2.88	1.55	2.41	-0.64	0.59
MS09	4.0	3.51	0.95	0.90	0.59	0.24	3.0	3.05	1.26	1.60	0.72	0.06	3.0	2.88	1.46	2.13	-0.82	2.00
MS10	3.0	3.51	1.04	1.08	0.87	2.54	3.0	3.15	1.23	1.52	0.47	-0.12	3.0	2.88	1.55	2.41	-0.64	0.59
MS11	3.0	3.23	1.24	1.53	0.56	0.07	3.0	3.17	1.12	1.25	0.81	0.80	3.0	3.00	1.51	2.29	-0.99	1.66
MS12	3.0	3.11	0.99	0.99	0.05	0.83	3.0	2.71	1.05	1.11	1.12	1.33	2.5	2.25	1.28	1.64	-0.61	-0.02
MS13	3.0	2.74	1.19	1.41	0.03	0.38	3.0	2.43	1.24	1.53	0.29	-0.50	2.0	2.25	1.16	1.36	-0.63	1.74
MS14	3.0	3.11	1.02	1.05	0.07	0.26	3.0	2.78	1.17	1.36	0.05	-0.91	2.5	2.50	1.60	2.57	0.00	-0.31
MS15	3.0	2.97	0.98	0.97	0.26	0.68	3.0	2.46	1.25	1.55	0.24	-0.53	1.5	1.88	1.46	2.13	0.65	-0.73
MS16	4.0	3.49	1.15	1.32	0.95	1.45	3.0	3.24	1.24	1.54	0.57	-0.02	3.5	3.38	1.60	2.55	-1.38	2.67

Source: authors

The data of *companies larger than 250 employees* are relatively very homogeneous. An exception is the distribution of data in the domains “MS10 – ICT market knowledge” and “MS16 – Knowledge in business sectors”, where the kurtosis parameter (τ) indicates high concentration of response values close to the average. Slightly negative skewness (δ) of the data indicates very slight tendency of the identified values towards the maximum.

For the *companies with 50–249 employees*, the data is also relatively homogeneous. Slightly negative skewness (δ) was identified for all domains – that means that the identified values have a tendency of slight inclination towards the maximum value. The value of kurtosis was, except two domains, indicated in the range between +1 and -1. Two domains with higher kurtosis values are “MS05 Software engineering” and “MS12 Enterprise finance and economics”. For these it holds that most respondents responded the questions with values of the surveyed parameters very close to the average.

The data set for *small companies and micro companies* (up to 50 employees) is relatively small and their statistical characteristics are not very homogeneous. For all domains, the calculated values of both the standard deviation (σ) and dispersion (σ^2) are significantly higher than in previous cases. Another moment characteristic – skewness (δ) is negative for all the knowledge domains: for two domains the value of skewness is significantly higher than for the other. These are the domains “MS04 Analysis and design” and “MS16 Knowledge in business sectors”. The values of kurtosis are significantly positive in nine knowledge domains, which mean that the identified values occurred largely close to the average. The requirements for the knowledge domains for the Enterprise Architect role by company size are shown in the following Figure 3.



Source: authors

Figure 2. Companies requirements on the enterprise architect role according to the number of employees

The Figure 2 implies that the requirements for the Enterprise Architect role depending on company size:

- Are the highest in *companies with more than 250 employees*, where more demands are put on that role, in particular in the area of ICT knowledge, and high requirements are also connected with the domain “MS16 Knowledge in business sectors”. It indicates that for large companies it is important that the incumbent in the Enterprise Architect role should possess good knowledge

of the company's core business. Besides, the requirements on that role are also higher in the area of leadership skills – the knowledge domain “MS09 Team leadership skills”.

- Are the lowest in all knowledge domains (except the domain “MS16 Knowledge in business sectors”) in *companies up to 50 employees*? The working hypothesis is that in small companies the Enterprise Architect role also executes activities related to the company's core business. What is surprising is very low requirements in small companies for the domain “MS15 Law”. From that we deduce that legal services in those companies are mostly outsourced in those companies and therefore it is not necessary to have this type of knowledge in the company directly.
- Companies with *sizes between 49 and 250 employees* put maximum requirements on the domains “MS01 Process modelling”, “MS04 Analysis and design”, “MS07IS/ICT knowledge” and “MS08 Operational excellence”. It implies that main requirements of medium-sized companies are primarily on process modelling, analysis and design of the corporate information system as well as the concept of the information system as a whole. Besides, he/she is also subject to requirements in the area of the company's information system operation connected with the knowledge of ICT.

In general, it can be said that the companies require a relatively complex level of knowledge for the Enterprise Architect role. These requirements are dominated by ICT knowledge, though also the level of requirements for non-ICT knowledge is high.

These results express for academics two important findings. The first one is that business requirements for small corporations on the role Enterprise Architect are lower than in larger companies, but the difference is not dramatic – only one level. It can be concluded that the Enterprise Architect oriented curricula could be the same for companies of all sizes. By this point of view, is visible necessity of ICT based corresponding curricula should have larger share of non-ICT courses oriented on business, finance and on economics.

Conclusions

The article, based on the conditions of a small European economy, identifies the practical requirement on the Enterprise Architect role. Less than 10 percent of respondents consider this role vital for the operation of the company. The Enterprise Architect role is relatively new on the labor market in the Czech Republic and universities don't provide education for this role because they don't know what knowledge should be provided.

Current study programs of universities do not include enough curricula that would prepare professionals for the Enterprise Architect role. In our opinion, this is caused by the fact that the Enterprise Architect role unifies in it the requirements on theoretical knowledge and on experience obtained by a prolonged practice in real situations of managing corporate ICT as well. The main results from the research in this article are as follows:

For business:

- The research summarizes requirements of companies on the role Enterprise Architects according to the number of employees and on the level of corporate dependency on ICT.
- The companies who put relatively high requirements on the knowledge connected to the Enterprise Architect role must at the same time realize that it is no easy task to find and hire such a professional. This is also confirmed by the results of (The Open Group, 2009).

For academics:

- The research provides to the universities information what knowledge the companies expect from the employees in the role Enterprise Architect.
- The size of company or dependence on ICT does not have to be taken into account – the impact of size or dependence on ICT is not significant.
- Study programs that prepare students for the role Enterprise Architect have to provide not only ICT knowledge but they have to provide also non-ICT knowledge that enables to Enterprise Architect communicate with representatives of non-ICT departments.

- The universities *can* prepare “universal” well-educated type of Enterprise Architects for all sectors in the economics because the requirements of companies are not too different in analyzed sectors.

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SUCCESS FACTORS OF GROWTH AND DEVELOPMENT FOR SMALL AND MEDIUM ENTERPRISES IN TOURISM SECTOR

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Abstract

Polish SMEs are the key aspect for the development of Polish economy. They can be a solution to reducing the unemployment, improving the economic situation, soothing social tensions and increasing the quality of life in Poland. SMEs provide employment opportunities for Polish citizens, and engage in local issues and contribute to sustainable economic development. Therefore, they are crucial for helping Polish economy by cushioning the impact of institutional changes caused by Poland's transition to a capitalist economy.

The aim of this research is to identify factors influencing the success of Polish SMEs in tourism sector (measured by the gross profit per employee). Our results show that being a middle-aged owner/manager who established an enterprise because he or she wanted to achieve self-realization or experience risk and run a one-person, or sole-trader enterprise that had certificates for its products, used Broadband Internet connection and was located in the province in the proximity of large cities increased the probability of achieving enterprise success.

Keywords: SMEs, economies in transition, entrepreneurship, tourism, Poland, enterprise success.

JEL: C23, D22, L26, P20

1. Introduction

Small and medium enterprises (SMEs) are of crucial importance for the development of the entire Polish economy. Poland is a post-communist country that has undergone various transformational changes, including the breaking up and consequent rebuilding of economic and social institutions, particularly that of entrepreneurship (Abraham, 2011). Although private business in some limited form have always existed in Poland, even in the times of the Communist regime, the structural changes of the 1990s caused unemployment, a decrease in production and economic stagnation in the country. Even though the Polish economy has achieved stable economic growth (on average 3-4% annually), the impact of the system's changes is still apparent (Zientara, 2009).

The high level of unemployment and the GDP per capita below the EU average are still their main distinguishing features. This is mainly a result of the poverty and other problems in Polish regions. Thus, Polish small and micro enterprises represent one of the best means how to improve the situation in Poland. Small firms' engagement in local issues, creation of new jobs and opportunities for people makes them one of the key factors in the economic development of Poland. Therefore, the success of Polish SMEs that constitute most of Polish SMEs is closely connected to the improvement of the quality of life in Poland. This is, therefore, the main reason why the researchers should be interested in defining this success and identifying its factors (Mullins, 1996).

And this does not only go to the researchers. Policy-makers and relevant stakeholders responsible for SMEs development and promotion should also be interested in what predetermines the success of SMEs in Poland. This knowledge might be crucial in devising targeted policies aimed at supporting

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successful SMEs development and growth (Variyam and Kraybill, 1992; or Chancharat and Chancharat, 2013).

This paper is structured as follows: Section 2 provides the comprehensive overview of the research literature that is dealing with the concept of SMEs success. Section 3 outlines the main hypothesis and describes the data that was used in this study. Section 4 presents the empirical model of the success of SMEs in tourism sector and discusses in detail its main outcomes. Section 5 concludes with some closing remarks and policy implications for the future.

2. Literature review

In neoclassical economics a successful enterprise is defined as one with largest profits. However, many enterprises may have other objectives than profit maximization and employment (Strielkowski, 2012). Therefore, it was accepted that the success of the small enterprise is the attainment of its goals according to its desire or termination (Perry, 1999). The success of the enterprise is a category it is trying to achieve using all available means and tools. Among most widely-used measures of SME's success are annual profits (Bogdănoiu, 2008; Walker and Brown, 2004), average operating profits or profits before interest as a per cent of total investment returned (Guarini, 2013). However, for the purposes of this study objective (financial) measures of success were chosen over the subjective (qualitative) ones. It was accepted that enterprise profit maximization is the criterion that distinguishes successful Polish enterprises from unsuccessful ones. Since profit per se is likely to be highly correlated with the enterprise size and large enterprises would report higher profits than smaller ones it seemed more appropriate to use profit per employee. This measure, however, can be only used in case some specific sector of economy is concerned. This sector would be the one with the number of enterprise employees being a reasonable proxy for its amount of capital (e.g. small crafts, micro food-processing, etc.).

Other economic studies identified a number of characteristics that are likely to influence enterprise success. These characteristics are usually divided into internal to the firm (owner/manager and enterprise) and external to the firm (see Storey, 1994). Small business literature states that the greatest determinant of a small business's success is the entrepreneur him/herself (Keats and Bracker, 1988; Gaskill et al, 1993; or Driessen and Zwart, 2006). According to it the most relevant owner/manager characteristics include: motivation, education, experience, training, functional skills, age, prior sector experience, regional ties (Storey, 1994). The most important enterprise characteristics include: enterprise age, enterprises market position, enterprise legal form, enterprise location, enterprise size, enterprise ownership, new technologies in enterprise, enterprise trademark. External characteristics of the firm include: competition, areas of advantage, innovation, "hard" and "soft" supports, relationships with local governments, obtaining the credit for business, structure of sales and integration processes (i.e. EU Enlargement). However, most of the recent studies include a combination of both internal and external characteristics (Honig, 1998; or Besser, 1999). Hence, it was decided to apply the same approach for this research.

The model developed in this study was drawn primarily from previous empirical work and therefore had elements of both neoclassical approach and institutional theoretical strands. This is mainly because these theories bring explanations of enterprise growth and success that can be used in real-life context. While the first theory allows to make assumptions about profit maximization and measure the determinants of enterprise's profits, the other one pays more attention to the role of individual economic agents, assumes the existence of formal and informal institutions, bears the assumption of non-zero transaction costs and allows for the inclusion and investigation of the influence of a number of factors external to the firm (Strielkowski, 2012).

3. Main hypothesis and data description

The main hypotheses for this work were derived from the literature on enterprise theory. Generally, a hypothesis states what the researcher thinks the outcome of the study will be; on the basis of verification the researcher either accepts the hypothesis or rejects it. Therefore, research hypotheses that concern the success factors of Polish SMEs in food-processing sector were built following the review of related research literature and prior to the execution of the study.

In terms of methodology for this study, the positivist epistemological approach was adapted. Based on this approach a structured interview-based survey methodology was implemented.

The examination of the available data from the Polish Central Statistical Office identified two provinces, Mazowieckie and Warmia-Mazury, as random and varied representatives of all Polish regions. These provinces were selected as the survey site. Due to the scope of the intended research (300 SMEs in total) to explore all the sites seemed impossible. Therefore a quota sampling of parishes and then communities was adapted using the “contacting the gatekeeper” method proposed in the research literature (Grumbach *et al.*, 1999).

The face-to-face questionnaire was implemented between in 2 Polish provinces and consisted of six main sections. The main information section was used to get to know each enterprise better. The characteristics and motivation of the owner section was designed to obtain all relevant information about enterprise owner/manager. Section three provides the in-depth view into the history and profile of the enterprise. Assets and sources of capital sections provide an overlook of enterprise most “sensitive” financial information. Section five was designed to obtain information on enterprise market position and competition. Section six provides an overview of subjective factors of enterprise development. The data obtained using the questionnaire was used in order to construct a profile of typical owner/manager of Polish SME and typical SME in the tourism sector and to carry out an econometric analysis.

According to this statistical analysis the general profile of owner/manager was as follows: he was 40 years old, male, with a college or University diploma who established an enterprise himself using his own savings and has owned and managed it for 10 years. He never followed any economic indicators. He came from the same province where he was currently working and was previously employed in the same or similar enterprise. The main motive for enterprise creation was seeking independence or risk-taking, although the enterprise registration was not smooth and easy.

The typical enterprise was established by its owner in 2000 or 2001 and it was a sole-trader company. It employed 6 people and was engaged in bakery, confectionery or meat-processing. It never applied for any patents and certificates for its products but had an Internet connection (usually Broadband). This factor serves as a threshold of technological innovation and can also be applied in other studies of SMEs around the world (*see e.g.* Fratostiteanu, 2010; Chancharat and Chancharat, 2013).

The typical enterprise was doing quite well: its turnover increased throughout the previous three years, and it gained new clients and its average annual gross profit per employee was around 8 000 Zloty (2 000 EUR). It had its own branded products and was selling them mostly on local market. The typical enterprise had main 15 competitors in the same parish and it was trying to compete with them increasing the quality of its products and decreasing the price. It chose the region where it operated due to the easy access to natural resources. The typical enterprise never received any financial help from local or central government and never applied for EU funding. In fact, Polish EU Accession was of no importance for the typical SME in the tourism sector. The main problems faced by the enterprise were locally and centrally-imposed taxes, fear of domestic competition and unfair governmental policies towards SMEs. Generally the typical enterprise would welcome the improvement of favourable climate for conducting business activity in Poland.

4. Empirical model of enterprise success

The purpose of the econometric analysis is to identify the factors that influence the success of Polish SMEs in tourism sector. Based on economic theory and previous empirical work, the generalized model of enterprise success used here anticipates that the success of small enterprise is influenced by combination of factors internal to the firm and external to the firm. Success of the enterprise is measured as the profit per employee. Due to the fact that the explanatory variables used in this model might have many levels (usually expressed by dummies), the number of variables that goes into estimating the model is equal to 7.

The specification of the model and its variables in chapter 4 provides guidelines for testing it and interpreting its results. It has to be noted that the values of the expected signs of the explanatory variables

have not been selected on random but are based on careful study of economic theory, previous findings and data analysis.

The model of enterprise success uses only truly exogenous variables. The logic behind this model is to test the causalities using the variables that are independent of the enterprise choice of activity and are shaped in the broader context and independently of the decisions taken inside the enterprise (i.e. by the market).

The rationale for the estimation of a model of enterprise success with purely exogenous variables is the following:

- The model is very transparent and clearly shows the fundamental relationships between the explanatory variables and dependent variable;
- The model utilizes only the exogenous variables, which makes the interpretation of its results easy and concise.

All the variables that are used in the econometric model are described in a greater detail further in this sub-section (Table 1). What follows is just a listing of explanatory variables without going deep into specific details and rationale for choosing each of the variables. Although some variables are self-explanatory, others require special explanation. Where necessary, explanation is provided. In total the list of truly exogenous variables used for estimation includes the following 7 variables.

Table 1: Variables used in the small model of enterprise success

No.	Variable Definition	Variable type	Expected sign
Enterprise success (dependent variables and their levels)			
Y	Enterprise gross profit per employee	Polish Zloty (PLN)	
1.	Owner/manager education	1 = primary 2 = secondary 3 = college 4 = university second level 5 = university third level	+ relationship between education and enterprise success
2.	Owner/management business experience	Years	+
3a.	Owner/manager age	Years	+
3b.	Owner/manager age squared	Years	-
4a.	Age of the enterprise	Years	-
4b.	Age of the enterprise squared	Years	-
5.	Location of the enterprise by the province	Dummy (1 = Mazowieckie province, 0 = Warmia-Mazury province)	Expect some regional differences
6a.	Location of the enterprise by parish	Parish dummy	Expect some regional differences
6b.	Location of the enterprise by community	Community dummy	Expect some regional differences
6c.	Distance from the parish to the regional center	Kilometers	Expect some differences
7.	Number of enterprise's main competitors	Number of firms	-

Source: Own results

Note: (i) Unless it is stated otherwise, all dummy variables are of the type 1= presence of factor and 0 = non-presence. (ii) “+” = enhancing the success; “-“= weakening the success.

The general econometric model used for our estimation has the following form:

$$Y_i = \sum_{k=1}^k \beta_k X_{ki} + \sum_{m=1}^m \beta_m Z_{mi} + \sum_{l=1}^l \beta_l W_{li} + u_c + e_i \quad (1)$$

where X are the exogenous variables of the small model, Z the extra objective variables of the intermediate model, W the extra subjective variables added to make the large model and u_c is a community identifier.

A number of econometric techniques are employed in the econometric analysis presented in this chapter in order to estimate this model. The standard econometric technique employed is to use ordinary least squares (OLS). To allow for heteroscedasticity problems robust standard errors are employed hereinafter in all OLS estimations. Heteroscedasticity is a violation of the assumption used in the Ordinary Least Squares (OLS) technique, which assumes that the error term has a constant variance (this will be true if the observations of the error term are assumed to be drawn from identical distributions) (Greene, 1993). However, due to the nature of the data and the problems that might occur due to unknown location-specifics sometimes the use of generalized least squares is justified. Thus, the full list of econometric techniques used includes Breusch and Pagan test for the presence of individual community effects, Hausman test (Hausman, 1978) for individual location effects, general least squares (GLS) for the estimation of fixed effects and random effects models as well as ordinary least square (OLS) estimations with robust standard errors.

The small model was computed for all 300 valid enterprise cases. This model uses only those explanatory variables that are assumed to be truly exogenous. The model is computed with and without provincial interactions in order to test for the location-specific differences. Overall, the results are presented in the following way: first, the results of the interaction model are shown, this is followed by the results of the estimation of the whole sample model and finally the results of province models are shown (Table 2).

Table 2: Results of the stepwise small models (OLS estimation); Dependent variable is success of the enterprise (measured as the profit per employee in 2011)

	Interact Model (Equation 1)		Whole sample model (equation 2)	Rich province only	Poor province only
	Poor	Rich*Dummy	Full Small	Rich Small	Poor Small
Age	1038.598**		1043.679**	1342.164**	
	[429.853]		[419.697]	[634.800]	
Age squared	-10.354**		-10.473**	-12.978**	
	[4.388]		[4.250]	[5.759]	
No. of Main Competitors	-232.841**	287.278**			-170.081*
	[113.579]	[116.325]			[92.211]
Distance from City					-29.214*
					[15.190]
Secondary		-3823.073			6643.932***
		[2350.301]			[1649.520]
College					10398.178**
					[4401.674]
University Second Level					4700.030***
					[1272.355]
University Third Level					4857.889***
					[1335.555]
Rich Province dummy			4207.899**		
			[1965.765]		
Constant	-15240.54		-19049.278*	-22988.3	3364.899***
	[9239.507]		[10152.628]	[15251.701]	[1051.720]
Observations	300		300	142	158
R-squared	0.03		0.02	0.01	0.09

Note: Robust standard errors in brackets; * significant at 10%; ** significant at 5%; *** significant at 1%

Source: Own results

In order to test for the community-specific effects Breusch and Pagan Lagrangian multiplier test for random effects has been run for the full interactions model. The result of the test are: $\chi^2(1) = 1.20$, $\text{Prob} > \chi^2 = 0.2738$. These results clearly show that there are no individual community effects present. Therefore it seems reasonable to use OLS estimation in this case and neglect the presence of community-specific effects. In addition, a Chow test with province dummy is run. This is done in order to test the interaction model against the whole sample model. The results of the test are the following: $F(12, 276) = 1.15$, $\text{Prob} > F = 0.3195$. This clearly shows that in this case the whole sample model without interactions is better for explaining the small enterprise success.

The Ordinary Least Squares technique has been used for all estimations. A stepwise regression model has been applied in order to identify the factors that are most significant for enterprise success. The model has been run using the stepwise procedure in Stata®. The removal threshold for entering the model has been set at 15% significance level (in order to see the variables which will over-bounce the 10% significance level).

Overall, it seems that coefficient of determination (R-squared) are quite small in all three cases indicating the weak explanatory power of the model. Small coefficients of determination are reported quite often in similar studies (see for example study on barriers to entry by Hashi (2001)). Small coefficients of determination mean that a good deal of variance in the model still remains unexplained. However, the results of the model can still be used to study factors that are significant for enterprise success. There are three variables that have come through as significant in the whole sample model: owner/manager age, owner/manager age squared and a provincial dummy.

In addition, if a comparison of results of two model exploring the rich province (Mazowieckie) only and a poor province (Warmia-Mazury) only is done, one can see that the following variables come through as significant: owner/manager age (Mazowieckie province only), owner/manager education (Warmia-Mazury province only), enterprise location to the closest regional center (Warmia-Mazury province only) and number of main competitors (Warmia-Mazury province only).

Owner/manager's age appears to be significant for enterprise success (positively significant impact for owner/manager age and negatively significant impact for owner/manager age squared at 10% significance level) in Mazowieckie province only. In case of Warmia-Mazury province the signs of the coefficients are the same but the factors appears to be insignificant. It is possible to compute an optimal age for the owner/manager from the model results. This optimal age is equal to 40 years. Therefore, it seems that the most successful enterprises are run by the middle-aged owners/managers. Young entrepreneurs have the age but lack knowledge and experience while older entrepreneurs lack the energy and will for undertaking the risky activities. A compromise stating that middle-aged entrepreneurs would combine the qualities of the previous two groups (Storey, 1994; or Kotey and Meredith, 1997) might be the solution to this puzzle.

The importance of owner/manager's age might be explained by the fact that in developed market such as Mazowieckie province it is not unreasonable to expect that people learn more in natural learning process (while working, doing business etc.). Therefore they tend to gain knowledge and experience that might help them to be better entrepreneurs. This process works to some point, of course (around 40-49 years). The situation is however different in the under-developed market such as Warmia-Mazury province. This learning process for enterprise owners/managers does not seem to work that well.

The highest education level obtained by owner/manager comes through quite strongly in the model (1% significance level for secondary, 5% level for college and 5% level for both university degrees) for Warmia-Mazury province. All levels of education have been compared to the primary education. Education seems to have a statistically significant impact on enterprise success in just one province. The results show that although education might be important for one of the provinces it is not important enough to appear in the full model of enterprise success. The fact that education comes through as important factor for enterprise success just in Warmia-Mazury province can be explained by the fact that labor market allocation might not work well in that province, so all kinds of people establish an SME: both people who would make good entrepreneurs and people who would not. Thus, people with good education in Warmia-Mazury province are more successful in establishing and running an SME on the

background of people with worse education. The same would not be true in Mazowieckie province where the labor market allocation is working well. People in this province become entrepreneurs because they have good entrepreneurial skills, so education factor does not matter there (if the self-selection of people to business is working well, mainly those well-educated entrepreneurs would tend to establish successful SMEs).

Enterprise distance from the regional center (measured in kilometers from the parish where enterprise is located to this center) comes through as a quite significant one (10% level) and it has negative effect on enterprise success. This effect has been observed only in results from Warmia-Mazury province indicating that in this province where no large urban centers (except for its capital Olsztyn and several other cities) similar to Warsaw are present the distance to the regional market center might impact on enterprise success. The results that do not show any significance of enterprise distance from regional market center in the case of the other province seem to verify this conclusion.

Enterprises having few competitors are more successful than those having more competitors (10% significance level). This effect has emerged in the results for Warmia-Mazury province only indicating that competition might be a serious matter in this province. The explanation of why this is not so in Mazowieckie province includes the highly competitive environment (due to the presence of Warsaw – the hub of country's commerce and trade), so that enterprises that are established in that province automatically take into consideration that they would have to compete with a large number of counterparts. In a way, these enterprises do not perceive competition as a serious threat, as far as they anticipate it. This might be different for Warmia-Mazury province: enterprises there are likely to sell on local markets and appearance of new competitors might mean the necessity to share the market which is already very small and segmented with them. That is why competition is viewed as a serious problem in that province.

Conclusions

The results of the small model of enterprise success can be summarized in the following way: being a middle-aged owner/manager and running the tourism-oriented SME that is located in Mazowieckie province all increase the probability of making more profit per employee. While being a younger or older owner/manager and running an enterprise that is located in Warmia-Mazury province all reduce the probability of increasing enterprise profit per employee (thus, its success).

In general, it seems appropriate to assume that the purpose of SMEs policies is to promote growth and success of enterprises, enhancing employment creation and increasing welfare in Polish regions and through this improve the quality of life in Polish regions. Usually, there are central and local governments who create these policies. There are many aspects and levels of governmental assistance. However, the most important steps central and local governments can do with regard to SMEs are the following:

- Improvement of the regulation environment;
- Using public assistance for strengthening the sector of SMEs;
- Deepening the knowledge on the impact of public assistance on the conditions of the sector of SMEs.

Moreover, the question arises: *What is the most appropriate enterprise policies would be in the context of Polish economy?* This question gains special importance with regard to Polish experience with economic transition, when old formal and informal socialist institutions were destroyed and new formal and informal institutions of business and entrepreneurship are still under construction. With regard to this, policies targeted at Polish SMEs should take into account Poland's local specifics and problems. There are no blueprints (i.e. copying enterprise support policies from developed countries) that can be easily used. This is due to the fact that the situation that persists in transition economies is very specific, and their impacts cannot be adequately envisaged.

Regulation environment is still seen by the majority of Polish SMEs as the main barrier for their operation and existence. That is why creation of more favourable conditions for the functioning of SMEs requires an in-depth improvement. This is of specific relevance for Polish SMEs that are bounded by the regulation environment and have difficulties in accessing public assistance. These firms are interested in

practical results, whilst the dissemination which is done on the public and local governments' level often focuses on "unpractical measures" (such as preparing reports and organizing conferences).

Perhaps the most crucial aspect in the creation of good regulatory environment is the creation of regulatory institutions that would have some expertise about the situation in Polish regions. In developed democracies there is a strong level of social control over these institutions (e.g. social pressure, lobbying, tradition and the political culture). Therefore, in order to secure their functioning in a post-socialist economy, such as Poland, there is a strong urge for creation of some verification mechanisms.

Public assistance, especially the EU structural funds, can be of a great assistance for Polish SMEs. The only problem is claiming these funds by small firms. In general, taking into consideration the existing practices for providing funding from the EU structural funds, it immediately becomes apparent that the procedures of applying for the public assistance might be simplified. This is especially important for opening public funding for Polish SMEs which have no time, human and intellectual resources for dealing with the paperwork and long application process. A number of things can be done in order to simplify the procedure of getting structural funds for Polish SMEs, namely: (i) limiting the bureaucracy and the paperwork necessary for applying for the EU funding and (ii) eliminating formal barriers (firms' eligibility). It often happens that SMEs have to put together multiple applications and overcome a number of other difficulties just to find out that they are not eligible for funding due to some conceptual reasons (size, credit history).

In order to create policies that would help SMEs, Polish government should have a good overview of small firms' problems and achievements. In today's Poland there is big disproportion in the information that enterprises have to provide when they apply for public assistance and the information researchers can obtain about enterprises. Therefore, it appears that Polish officials know more about enterprises than researchers. With regard to this, it is believed that some specific steps should be made by the Polish government. These steps might include the following: hiring specialists for preparing in-depth analyses of economic situation in Polish enterprises, viewing small but relatively homogenous samples of enterprises, constructing specific tools for assessment of the small enterprises sector situation as well as coordination of empirical research. Perhaps, the experience of some EU Member States that are particularly successful in getting the EU structural funding can be implemented in Poland.

Therefore, it seems that Polish stakeholders need to think about undertaking some practical steps with regard to small enterprises. Generally, there is a clear demand for specialists with a good knowledge of EU Institutions as well as researchers capable of creating a holistic and comprehensive picture of Polish SMEs. If such people cannot be found in Poland, perhaps, foreign specialists can be hired to prepare the entrepreneurial strategy for Poland. A very clear and transparent strategy that would envisage some practical steps can considerably increase the utility from assistance to the Polish small enterprises: less money would be spent in vain and more help will be directed to the areas where it is needed.

These and other actions should be undertaken as soon as possible. Relevant Polish stakeholders should understand that Polish economy needs success. Successful economy will never be able to exist without successful institution of entrepreneurship. Polish SMEs that play a crucial role in the creation of this institution and contributing to the positive overall economic development in Poland clearly constitute the key aspect of this success.

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MULTI-CRITERIA DECISION-MAKING TOOL DESIGN FOR THE INVESTMENT DECISION-MAKING OF TERRITORIAL SELF-GOVERNMENT REGIONS

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Abstract:

The aim of the paper is to propose a model of multi-criteria investment decision-making tool supporting the decision-making of territorial self-government regions at the level of NUTS 3, based on theoretical knowledge and data obtained from the empirical survey conducted in three analyzed countries (the Slovak Republic, the Czech Republic and Hungary). The proposed model of multi-criteria investment decision-making tool is based on the method of Data Envelopment Analysis (DEA) adapted to the needs of the investment decision-making of self-government regions. Based on the results it can be said that the proposed tool is a suitable complement of the investment decision-making of territorial self-government regions.

Keywords: region, self-government, investment decision-making, investment activities, data envelopment analysis.

JEL Classification: H43, H76, R15, R53

1. Introduction

Local self-government is a form of public government and public administration that allows an independent governance of “res publicae” in the territory smaller than the State. Individual management of local self-governments brings also in their investment activities. These are connected to local self-government functions and are used in order to improve the quality of life and the environment, to enhance the business environment, to increase the competitiveness of the region and to ensure its development. Implementation of investment implies sacrificing certain current values in order to achieve the future which usually is of uncertain values. Such a "risky" treatment of public finance and the responsibility to the public assume an adequate approach to the decision-making. Qualified decisions increase the likelihood of higher future values, and especially in the public sector these future values are often of non-financial nature.

2. Material and methods

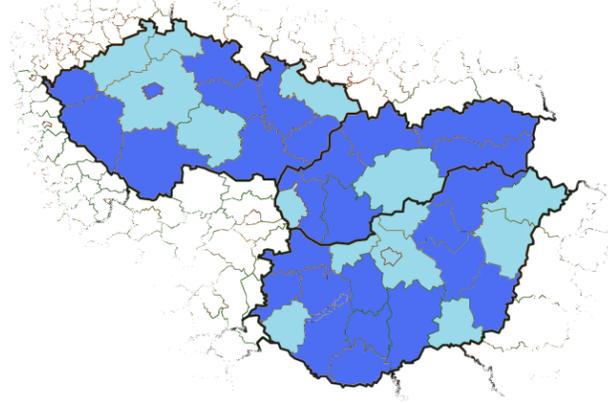
The aim of the paper is to propose a model of multi-criteria investment decision-making tool supporting the decision-making of territorial self-government regions at the level of NUTS 3 (*NUTS – Nomenclature of Units for Territorial Statistics*), based on theoretical knowledge and data obtained from the empirical survey. This paper was prepared within the project VEGA 1/0760/13 and it is one of its outputs.

The research sample consists of the subjects of public administration on the NUTS 3 level in selected countries, which are the Slovak Republic (SR), the Czech Republic (CR) and Hungary (HU). Within the analysis 42 regions at NUTS 3 level were approached. With regard to the success of information and data obtained, 27 regions were taken into account (on the Figure 1 marked by dark blue colour).

The selected countries are neighbouring countries of the Slovak Republic; they are forming an integrated larger area on which were requested subjects on the same level of NUTS. All the countries are

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characterized by similar characteristics. In the past they had common history. They are forming a part of the former Eastern Bloc. They are facing similar problems and defects and they joined the European Union at the same time.



Source: self elaboration

Figure 1 - Map of the NUTS 3 regions participating in the research

In regard to the geographical distribution of the research sample we decided to carry out the research through *categorized (structured) telephone interview*. Juszczak (2003, p.57) states that the researcher uses a special questionnaire in the categorized interview. During the interview realization with the representatives of the self-governments we used a special questionnaire created within the on-line platform that is offered by the Google Company.

The basic spatial analysis of the researched regions concerned in terms of belonging to a country is presented in Table 1.

Table 1 - Share of research sample on research population

	Number of regions	Number of participated regions	% share of the number of participated regions		% share of inhabitants in participated regions		% share of the area of participated regions	
			from all	within the country	from all	within the country	from all	within the country
SR	8	6	14.3%	75.0%	16.0%	76.5%	17.0%	76.5%
CR	14	9	21.4%	64.3%	24.0%	59.2%	21.3%	59.8%
HU	20	12	28.6%	60.0%	18.3%	47.5%	27.7%	65.7%
TOTAL	42	27	64.3%		58.3%		66.0%	

Source: self elaboration

From the point of view of share of the participated regions number, of share of inhabitants in participated regions on all the research population, as well as from the point of view of share of the area of participated regions, regions of Hungary have the highest weight in the survey. On the other hand, in terms of checking the explanatory ability of the research within individual countries, the relatively highest value is reached in the Slovak Republic.

The results obtained within the empirical survey have been further utilized in filling-in the model of a multi-criteria decision-making tool for the support of investment decision-making of regional self-governments.

3. The model of multi-criteria decision-making tool

Multi-criteria analysis establishes preferences between possible variants with regard to a clearly defined set of goals with measurable criteria identified for evaluation. These criteria quantify the extent of goals fulfilment. In the case of simple decision problems, the process of setting objectives and criteria can provide enough information for decision makers. However, when the decisions are more complicated, the MCA (Multi-Criteria Analysis) offers a number of ways of data evaluation in relation to different criteria, and through this sets the indicators of total performance of variants.

A key feature of the MCA is its emphasis on the judgments of the decision-making team in:

- setting out goals and criteria;
- estimating the weights of relative importance of the criteria;
- and to some extent in assessing the contribution of each variant in relation to the criteria set.

A reason for doubting about the correctness of the solution may be the subjectivity that enters into this process. The basis of the MCA is essentially a subjective choice of goals, criteria, weighting and estimation of the goals fulfilment (but not all data must be subjective in nature, some of them may be objective). On the other hand, the MCA can put into the decision-making process a certain structure, analysis and openness to alternatives, such as that based on the method of CBA (Cost-Benefit Analysis) was out of consideration.

There are many methods of MCA, several of which have useful features that could justify their use. However, the task of this paper is to establish an approach that is widely applicable in a wide range of investment decisions in public administration. The risk and the uncertainty are important aspects in any decision-making. There are many ways in which risks can be handled within the MCA. We decided to consider the risk as one of the criteria that is taken into account when deciding. We assume that the risks, associated with the implementation of the project, is a part of a qualitative assessment of each individual variant, then it is transformed into a quantitative form by scoring described in section 3.4.

3.1 Establishing the context of decision

At this phase it is necessary to define the decision-makers, the key players and the decision analysis system.

Decision-makers and key players – the paper deals with the strategic investment decision-making at the regional level. As a region we set the self-governments on the NUTS 3 level in the Slovak Republic, the Czech Republic and Hungary. At the mentioned regional level the Regional Parliaments of territorial self-governments have the decision-making competences, in the area of accepting/rejecting strategic investments.

Based on the analysis of the data from the empirical survey, we set the key players that are the initiators of primary impulse of the strategic investments such as: the competent department of the self-government, members of the regional parliament, a president of the self-government region, vice-presidents of the self-government region, a director of the office, representatives of the self-governments at higher NUTS level, the private sector, representatives of the self-governments at lower NUTS level, citizens and associations.

By the same principle, based on the analysis of empirical data, we can set also the key players in terms of participation in the creation of investment projects, as follows: the Committees and the Council, the aggrieved person/institution, the institutions that are required by law to give a feedback, the general public, the self-governments at higher NUTS level, the self-governments at lower NUTS level.

The system of multi-criteria decision-making analysis – in this paper we propose a multi-criteria decision-making model in which the decision applies multi-criteria analysis of DEA (Data Envelopment Analysis). To determine the decision criteria and their weights will use the results of the analysis of empirical data obtained through primary research. The DEA model applied to multi-criteria decision-making is also described in the section 3.6.

3.2 Identifying variants to be considered

Variants, which will be considered within the strategic investment decision-making of self-governments, are individually set in each case. Variants to address the strategic investments are set based on tenders of the public procurement. In this paper we test the proposed model for a fictitious set of 10 variants of the investment.

3.3 Identifying objectives and criteria

We identify the decision-making criteria based on the results of research conducted on a sample of 27 municipalities from the three countries analyzed. Experts (as we consider the representatives of self-governments) set the criteria to take into account when deciding on strategic investments. Criteria were identified as follows: the costs of implementation, the duration of implementation, the project's revenues, the public benefits of the project, environmental impact, risks associated with the project.

Based on the objectives that are trying to achieve each of these criteria in different variants, and based on requirements of the DEA model, we will divide the identified criteria to minimization and maximization criteria (Table 2).

Table 2 - Minimization and maximization criteria for the Data Envelopment Analysis model

Character of the criteria	Criterion	Objective
MINIMIZATION	- costs of implementation	- to reduce costs
	- duration of implementation	- to shorten the duration
	- project's revenues	- to increase revenues
MAXIMIZATION	- public benefits of the project	- to increase the public benefits
	- environmental impact	- to increase the positive impact, respectively reduce the negative impact on the environment
	- risks associated with the project	- to achieve the greatest reduction in risk

Source: self elaboration

3.4. Scoring – assessment of the expected performance of each variant according to established criteria

Given the nature of the proposed model it is not necessary to perform the evaluation of each criterion in the same unit. Established criteria will be divided into two basic groups:

a) quantitative criteria

The group of quantitative criteria will include criteria, the performance of which is expressed in numerical values (ordinal), regardless of the units in which they are expressed. In our case, these are: *the costs of implementation, the duration of implementation and the project's revenues.*

b) qualitative criteria

The group of qualitative criteria will include criteria, the performance of which is not expressed in numerical values (cardinal). These criteria need to be quantified. Quantification of qualitative criteria will be carried out using the method of scoring. For scoring within the multi-criteria decision-making using the DEA model it does not matter the form of scaling. Even in determining the scores of different criteria may choose different forms of scaling.

Condition to be kept when determining the range of scoring:

- in the case of qualitative *minimization criteria* it is necessary to set the score according to the principle: "*the better rating, the lower the score*";
- in the case of qualitative *maximization criteria* it is necessary to set the score according to the principle: "*the better the rating, the higher the score*".

In our case we have the qualitative criteria only as maximization criteria, and these are: the public benefits of the project, environmental impact and risks associated with the project.

Scaling is a method which can give a subjective qualitative assessment, opinion, attitudes and other factors and these can be transferred into objectified statistical data. To evaluate the individual variants in terms of fulfilling the above criteria, we have selected a decimal scale (1 to 10), which is one of the most common used; where $10 = \textit{closest to the desired state of performance}$.

Scores set in terms of performance of criteria for each of the variants is presented in the Table 4.

3.5. Weighting

Weighting or determination of the weights of the criteria is used to reflect their relative importance for decision-making. That determination of criteria weights, according to Keeney, Raiffa (1993) is the most important problem multi-criteria decision-making.

To determine the weights of the identified criteria we have chosen the *Points method*. The criteria were judged by 27 experts from three countries analyzed. As experts we consider in this case the representatives of self-governments participating in the survey. Evaluation of each of the experts we have transformed into a numerical (pointing) scale, where $5 = \textit{most important}$ and $1 = \textit{least important}$. This way we created a matrix of criteria evaluation by individual experts. It serves as an input for the DEA model adapted to the multi-criteria decision-making. The proposed DEA model also works with interval scales.

3.6. Combining weights and score – the use of the Data Envelopment Analysis method in multi-criteria decision-making

The basic principle of the DEA methods is the calculation of the ratio between the weighted value of outputs (virtual output) and the weighted value of inputs (virtual input) for the Decision-Making Unit (DMU) and its relative expression in regard to the best ratio value of all Decision-Making Units (Fandel, 2006). Relative value is often referred to as the *relative efficiency*. Darnton (1997, p.201) defined the relatively efficient process as a process that requires less inputs or produces more output when achieving the objectives compared to other processes. Relative efficiency is also often referred to as *technical efficiency*. Virtual input and output can be expressed as follows:

$$\text{Virtual input} = v_1x_{1o} + \dots + v_mx_{mo}$$

$$\text{Virtual output} = u_1y_{1o} + \dots + u_sy_{so}$$

where: v_i – input weights ($i = 1, \dots, m$); u_r – output weights ($r = 1, \dots, s$); x_{io} – inputs ($i = 1, \dots, m$) of the decision-making unit DMU_o ; y_{ro} – outputs ($r = 1, \dots, s$) of the decision-making unit DMU_o .

The transformed linear model of calculating the relative efficiency ratio (θ) for the DMU_o will be expressed as follows (Charnes *et al.*, 1978):

$$\begin{aligned} \text{Max.} & \quad \theta = u_1y_{1o} + \dots + u_sy_{so} \\ \text{condition:} & \quad v_1x_{1o} + \dots + v_mx_{mo} = 1 \\ & \quad u_1y_{1j} + \dots + u_sy_{sj} \leq v_1x_{1j} + \dots + v_mx_{mj} \quad (j = 1, \dots, n) \\ & \quad v_1, v_2, \dots, v_m \geq 0 \\ & \quad u_1, u_2, \dots, u_s \geq 0 \end{aligned}$$

The solution of the transformed linear model will be the relative efficiency of the j -th Decision-Making Unit, and this will take its values from the interval $\langle 0;1 \rangle$. Decision-Making Units with a value of relative efficiency equal to 1 are effective, the others are ineffective. Values of the weights v_i represent the importance of the i -th input, respectively u_r represent the importance of r -th output in respect to the maximization of the ratio of relative efficiency (θ). It is obvious that for each Decision-Making Unit have

the inputs x_i and the outputs y_r different weights and these are implicitly given by the importance of inputs, respectively outputs for each Decision-Making Unit.

3.7 Adaption of the Data Envelopment Analysis model to the multi-criteria decision-making

Analysis of the efficiency of Decision-Making Units have some common formal features with the decision problem of the multi-criteria decision-making, also known as multi-criteria evaluation of variants, and this is why under certain conditions it is possible to use the model as a method of multi-criteria evaluation of variants. These conditions are:

- Decision-Making Units DMU_j will be substituted by the evaluated variants V_j ;
- Inputs will represent the minimization criteria;
- Outputs will represent the maximization criteria.

For this purpose, the symbols can be redefined as follows:

v_i – weights of the minimization criteria ($i = 1, \dots, m$);

u_r – weights of the maximization criteria ($r = 1, \dots, s$);

x_{io} – positive value of the i -th minimization criteria ($i = 1, \dots, m$) of the evaluated variant V_o ;

y_{ro} – positive value of the r -th maximization criteria ($r = 1, \dots, s$) of the evaluated variant V_o ;

In the multi-criteria evaluation of the variants there is an assumption that the individual criteria have assigned to global weights. Several methods can be used in order to estimate the weights (Method of Order, Points method, Fuller's triangle, Saaty's method). The estimation of points of global criteria is a result of their use is. In this part of the paper, we propose a method which allows the use of interval weights given by the lowest and the highest value of local weights of individual experts. This method is based on applying the DEA model with pre-defined intervals of weights of inputs and outputs. Intervals can be defined absolutely or relatively. The first method published by Roll, Cook and Golan (1991) attached to the model the absolute limitations of the input weights and output weights:

$$d_i \leq v_i \leq h_i \qquad D_r \leq u_r \leq H_r$$

Then, in the multi-criterial evaluation of variants it would mean that we will set the lower and upper limits of the criteria weights, based on the individual experts' estimation of local weights of criteria, as follows:

d_i – the minimum weight given to the i -th minimization criterion by the expert;

h_i – the maximum weight given to the i -th minimization criterion by the expert;

D_r – the minimum weight given to the r -th maximization criterion by the expert;

H_r – the maximum weight given to the r -th maximization criterion by the expert.

The method with the relatively set intervals of weights is known in the DEA literature as "Assurance Region Method" (Thompson *et al.*, 1986). This method assumes that for any pair of inputs, respectively outputs, will be set the lower and the upper limit of the weights ratio. For example, for the input 1 and the input 2, this ratio will be: $d_{1,2} \leq v_2/v_1 \leq h_{1,2}$.

Within the multi-criteria evaluation of variants allows this method to set the interval of weights ratio between any pair of minimization criteria, or any pair of maximization criteria. A disadvantage is that it is not possible to use the intervals of weights ratio between inputs and outputs, respectively between minimization and maximization criteria.

After modifying the DEA model as a vector-matrix entry, it will get the following form:

$$\begin{array}{ll} \text{Max.} & \theta = uy_o \\ \text{condition:} & vx_o = 1 \\ & -vX + uY \leq 0 \\ & vP \leq 0 \\ & uQ \leq 0 \\ & v \geq 0, \qquad u \geq 0 \end{array}$$

where:

$$P = \begin{pmatrix} d_{12} & -h_{12} & d_{13} & -h_{13} & \dots & \dots \\ -1 & 1 & 0 & 0 & \dots & \dots \\ 0 & 0 & -1 & 1 & \dots & \dots \\ \dots & \dots & \dots & \dots & \dots & \dots \\ \dots & \dots & \dots & \dots & \dots & \dots \end{pmatrix} \quad Q = \begin{pmatrix} D_{12} & -H_{12} & D_{13} & -H_{13} & \dots & \dots \\ -1 & 1 & 0 & 0 & \dots & \dots \\ 0 & 0 & -1 & 1 & \dots & \dots \\ \dots & \dots & \dots & \dots & \dots & \dots \\ \dots & \dots & \dots & \dots & \dots & \dots \end{pmatrix}$$

To calculate this model it is recommended to implement the associated dual task, because its solution and interpretation are easier.

Dual task:

Min. θ

condition: $\theta x_o - X\lambda + P\pi \geq 0$

$X\lambda + Q\tau \geq y_o \quad \lambda \geq 0, \quad \pi \geq 0, \quad \tau \geq 0$

The rate of *relative efficiency* for each of the evaluated variant will be reached thank to resolving the given task. The variants with the rate of relative efficiency $\theta = 1$ are the best (efficient) alternatives. Other variants with $\theta < 1$ are inefficient variants (Fandel, 2006). To distinguish between efficient alternatives the DEA model calculating the super-efficiency can be used (Anderson, P., Petersen, N.C., 1993). Calculation of the super-efficiency is also known as Anderson-Peterson model and its specific feature is that within the calculation of the rate of relative (technical) efficiency will be excluded from the convex combination of minimization and maximization criteria the evaluated variant (its maximizing and minimizing criteria). Through this will be in the input-oriented models achieved the rate of relative efficiency with a value higher than 1.

4. Modelling of setting the efficient variants of the strategic investment of the region

The method will be tested on the decision-making problem, where ten possible variants of the strategic investment of the self-government will be assumed. Ten variants are hypothetical and they serve as a sample for the calculation of the proposed model.

The criteria are set based on the analysis of primary data, and they are described in the Paragraph 3.3. The importance of each of the criteria was evaluated by 27 experts from 3 countries. The evaluation of each of the experts was transformed into a Point Scale (see Paragraph 3.5).

For the correct calculation of the model it is necessary to set the local weights of the evaluation of criteria by experts. Such a conversion will better reflect the variability of views on the importance of the criteria used. It will remove the disadvantages of using the average weight associated with high variability of opinions.

The conversion of local weights of criteria evaluation by experts is given in table (Table 3). The table also displays the minimum and the maximum local weights for each of the criteria.

Table 3 - Local weights of criteria evaluation by experts

No.	costs of implementation (v1)	anticipated project's revenues (u1)	public benefits of the project (not expressed in monetary units) (u2)	environmental impact (u3)	duration of implementation (v2)	risks associated with the project (u4)	Σ
1	0,200	0,200	0,160	0,160	0,160	0,120	1,000
2	0,192	0,154	0,154	0,192	0,154	0,154	1,000
3	0,182	0,182	0,182	0,182	0,136	0,136	1,000
4	0,250	0,200	0,200	0,150	0,050	0,150	1,000
5	0,250	0,167	0,167	0,167	0,083	0,167	1,000
6	0,174	0,174	0,217	0,130	0,130	0,174	1,000
7	0,105	0,158	0,105	0,211	0,211	0,211	1,000
8	0,238	0,190	0,143	0,143	0,190	0,095	1,000
9	0,200	0,200	0,250	0,150	0,100	0,100	1,000
10	0,217	0,087	0,217	0,174	0,130	0,174	1,000
11	0,250	0,200	0,150	0,150	0,100	0,150	1,000
12	0,208	0,167	0,167	0,125	0,167	0,167	1,000
13	0,167	0,208	0,167	0,167	0,125	0,167	1,000
14	0,200	0,160	0,160	0,160	0,160	0,160	1,000
15	0,105	0,158	0,105	0,211	0,211	0,211	1,000
16	0,200	0,200	0,250	0,150	0,100	0,100	1,000
17	0,250	0,200	0,150	0,150	0,100	0,150	1,000
18	0,167	0,208	0,167	0,167	0,125	0,167	1,000
19	0,150	0,200	0,250	0,150	0,100	0,150	1,000
20	0,200	0,150	0,150	0,200	0,150	0,150	1,000
21	0,167	0,167	0,167	0,167	0,167	0,167	1,000
22	0,143	0,095	0,190	0,143	0,238	0,190	1,000
23	0,227	0,182	0,182	0,136	0,136	0,136	1,000
24	0,190	0,143	0,238	0,095	0,190	0,143	1,000
25	0,217	0,174	0,217	0,130	0,043	0,217	1,000
26	0,174	0,217	0,174	0,217	0,130	0,087	1,000
27	0,182	0,182	0,136	0,182	0,182	0,136	1,000
Min.	0,105	0,087	0,105	0,095	0,043	0,087	
Max.	0,250	0,217	0,250	0,217	0,238	0,217	

Source: self elaboration

Based on the materials prepared especially for each of the individual variants will be available the quantitative and the qualitative evaluation of criteria performance. The performance of criteria that are evaluated in the materials qualitatively will be adjusted (quantified) based on the scoring described in the Paragraph 3.4. In the model example we consider ten hypothetical variants with randomly set values of individual criteria performance (Table 4). These hypothetical variants were randomly evaluated by ten independent persons. In our example, the Criterion Matrix will have the following form:

Table 4 - The criterion matrix of the hypothetical variants

Investment variants	Criteria					
	Costs of Implementation	Duration of Implementation (in years)	Yearly Revenues	Public Benefits of the Project	Environmental Impact	Risks Associated with Project
V1	38.4	2.25	1.2	8	8	8
V2	36.0	2.75	0.9	6	8	2
V3	35.0	3.50	3.1	6	4	6
V4	40.0	2.50	1.1	8	10	4
V5	34.5	2.25	1.7	4	6	4
V6	31.2	20.00	2.4	4	8	6
V7	32.6	3.00	2.5	6	6	2
V8	40.8	2.75	1.7	8	4	4

V9	44.4	5.00	0.4	8	6	6
V10	30.0	4.00	0.2	4	2	6
Character of the criterion	Minimiz.	Minimiz.	Maximiz.	Maximiz.	Maximiz.	Maximiz.

Source: self elaboration

Based on the local weights set and the Criterion Matrix we are able to build a *model with the intervals of absolute weights of the criteria*. A disadvantage of the DEA models is that it is necessary to formulate an independent model for the evaluation of each of the variants. Therefore, we will see how it looks the DEA model with intervals of absolute weights formulated to evaluate the V1 variant (the same procedure for formulation of models will be used for the other variants):

$$\begin{aligned}
 \text{Max.} & \quad \theta = 1,2u_1 + 8u_2 + 8u_3 + 8u_4 \\
 \text{condition:} & \quad 38,4v_1 + 2,25v_2 = 1 \\
 & \quad 1,2u_1 + 8u_2 + 8u_3 + 8u_4 \leq 38,4v_1 + 2,25v_2 \\
 & \quad 0,9u_1 + 6u_2 + 8u_3 + 2u_4 \leq 36v_1 + 2,75v_2 \\
 & \quad 3,1u_1 + 6u_2 + 4u_3 + 6u_4 \leq 35v_1 + 3,5v_2 \\
 & \quad 1,1u_1 + 8u_2 + 10u_3 + 4u_4 \leq 40v_1 + 2,5v_2 \\
 & \quad 1,7u_1 + 4u_2 + 6u_3 + 4u_4 \leq 34,5v_1 + 2,25v_2 \\
 & \quad 2,4u_1 + 4u_2 + 8u_3 + 6u_4 \leq 31,2v_1 + 2v_2 \\
 & \quad 2,5u_1 + 6u_2 + 6u_3 + 2u_4 \leq 32,6v_1 + 3v_2 \\
 & \quad 1,7u_1 + 8u_2 + 4u_3 + 4u_4 \leq 40,8v_1 + 2,75v_2 \\
 & \quad 0,4u_1 + 8u_2 + 6u_3 + 6u_4 \leq 44,4v_1 + 5v_2 \\
 & \quad 0,2u_1 + 4u_2 + 2u_3 + 6u_4 \leq 30v_1 + 4v_2 \\
 v_1 \geq 0,105 & \quad v_1 \leq 0,250 \\
 v_2 \geq 0,043 & \quad v_2 \leq 0,238 \\
 u_1 \geq 0,087 & \quad u_1 \leq 0,217 \\
 u_2 \geq 0,105 & \quad u_2 \leq 0,250 \\
 u_3 \geq 0,095 & \quad u_3 \leq 0,217 \\
 u_4 \geq 0,087 & \quad u_4 \leq 0,217 \\
 v_1, v_2 \geq 0 & \quad u_1, u_2, u_3, u_4 \geq 0
 \end{aligned}$$

To build the *DEA model with relatively given intervals of weights* it is necessary to make a few additional calculations. Firstly you need to find lower and upper limits of the weights for all combinations of minimization criteria weights among themselves and for all combinations of maximization criteria weights among themselves. Based on the comparison of the local weights of criteria for each of the experts we will get the results shown in the table (Table 5).

Table 5 - The ratio of minimization criteria among themselves and of maximization criteria among themselves

No. of expert	v2/v1	u2/u1	u3/u1	u4/u1	u3/u2	u4/u2	u4/u3
1	0,800	0,800	0,800	0,600	1,000	0,750	0,750
2	0,800	1,000	1,250	1,000	1,250	1,000	0,800
3	0,750	1,000	1,000	0,750	1,000	0,750	0,750
4	0,200	1,000	0,750	0,750	0,750	0,750	1,000
5	0,333	1,000	1,000	1,000	1,000	1,000	1,000
6	0,750	1,250	0,750	1,000	0,600	0,800	1,333
7	2,000	0,667	1,333	1,333	2,000	2,000	1,000
8	0,800	0,750	0,750	0,500	1,000	0,667	0,667
9	0,500	1,250	0,750	0,500	0,600	0,400	0,667
10	0,600	2,500	2,000	2,000	0,800	0,800	1,000
11	0,400	0,750	0,750	0,750	1,000	1,000	1,000
12	0,800	1,000	0,750	1,000	0,750	1,000	1,333
13	0,750	0,800	0,800	0,800	1,000	1,000	1,000
14	0,800	1,000	1,000	1,000	1,000	1,000	1,000
15	2,000	0,667	1,333	1,333	2,000	2,000	1,000
16	0,500	1,250	0,750	0,500	0,600	0,400	0,667
17	0,400	0,750	0,750	0,750	1,000	1,000	1,000
18	0,750	0,800	0,800	0,800	1,000	1,000	1,000
19	0,667	1,250	0,750	0,750	0,600	0,600	1,000
20	0,750	1,000	1,333	1,000	1,333	1,000	0,750
21	1,000	1,000	1,000	1,000	1,000	1,000	1,000
22	1,667	2,000	1,500	2,000	0,750	1,000	1,333
23	0,600	1,000	0,750	0,750	0,750	0,750	1,000
24	1,000	1,667	0,667	1,000	0,400	0,600	1,500
25	0,200	1,250	0,750	1,250	0,600	1,000	1,667
26	0,750	0,800	1,000	0,400	1,250	0,500	0,400
27	1,000	0,750	1,000	0,750	1,333	1,000	0,750
The lower limit of the interval	0,200	0,667	0,667	0,400	0,400	0,400	0,400
The upper limit of the interval	2,000	2,500	2,000	2,000	2,000	2,000	1,667

Source: self elaboration

As it is evident from the calculation of the ratio of weights listed in the table (Table 5), the intervals of v_2/v_1 , u_2/u_1 , u_3/u_1 , u_4/u_1 , u_3/u_2 , u_4/u_2 and u_4/u_3 , are as follows:

$$\begin{aligned}
 &0,2 \leq v_2/v_1 \leq 2 \\
 &0,667 \leq u_2/u_1 \leq 2,5 \\
 &0,667 \leq u_3/u_1 \leq 2 \\
 &0,4 \leq u_4/u_1 \leq 2 \\
 &0,4 \leq u_3/u_2 \leq 2 \\
 &0,4 \leq u_4/u_2 \leq 2 \\
 &0,4 \leq u_4/u_3 \leq 1,667
 \end{aligned}$$

We will prepare the matrix P and the matrix Q:

$$P = \begin{pmatrix} d_{12} & h_{12} \\ -1 & 1 \end{pmatrix} = \begin{pmatrix} 0,2 & -2 \\ -1 & 1 \end{pmatrix}$$

$$Q = \begin{pmatrix} D_{12} & -H_{12} & D_{13} & -H_{13} & D_{14} & -H_{14} & 0 & 0 & 0 & 0 & 0 & 0 \\ -1 & 1 & 0 & 0 & 0 & 0 & D_{23} & -H_{23} & D_{24} & -H_{24} & 0 & 0 \\ 0 & 0 & -1 & 1 & 0 & 0 & -1 & 1 & 0 & 0 & D_{34} & -H_{34} \\ 0 & 0 & 0 & 0 & -1 & 1 & 0 & 0 & -1 & 1 & -1 & 1 \end{pmatrix}$$

$$= \begin{pmatrix} 0,667 & -2,5 & 0,667 & -2 & 0,4 & -2 & 0 & 0 & 0 & 0 & 0 & 0 \\ -1 & 1 & 0 & 0 & 0 & 0 & 0,4 & -2 & 0,4 & -2 & 0 & 0 \\ 0 & 0 & -1 & 1 & 0 & 0 & -1 & 1 & 0 & 0 & 0,4 & -1,667 \\ 0 & 0 & 0 & 0 & -1 & 1 & 0 & 0 & -1 & 1 & -1 & 1 \end{pmatrix}$$

Within the models with relative intervals of weights will be necessary again to formulate a specific model for each one of the variants V1 – V10. The formulated model for the variant V1 will have the following form:

$$\begin{aligned} \text{Max.} \quad & \theta = 1,2u_1 + 8u_2 + 8u_3 + 8u_4 \\ \text{condition:} \quad & 38,4v_1 + 2,25v_2 = 1 \\ & -38,4v_1 - 2,25v_2 + 1,2u_1 + 8u_2 + 8u_3 + 8u_4 \leq 0 \\ & -36v_1 - 2,75v_2 + 0,9u_1 + 6u_2 + 8u_3 + 2u_4 \leq 0 \\ & -35v_1 - 3,5v_2 + 3,1u_1 + 6u_2 + 4u_3 + 6u_4 \leq 0 \\ & -40v_1 - 2,5v_2 + 1,1u_1 + 8u_2 + 10u_3 + 4u_4 \leq 0 \\ & -34,5v_1 - 2,25v_2 + 1,7u_1 + 4u_2 + 6u_3 + 4u_4 \leq 0 \\ & -31,2v_1 - 2v_2 + 2,4u_1 + 4u_2 + 8u_3 + 6u_4 \leq 0 \\ & -32,6v_1 - 3v_2 + 2,5u_1 + 6u_2 + 6u_3 + 2u_4 \leq 0 \\ & -40,8v_1 - 2,75v_2 + 1,7u_1 + 8u_2 + 4u_3 + 4u_4 \leq 0 \\ & -44,4v_1 - 5v_2 + 0,4u_1 + 8u_2 + 6u_3 + 6u_4 \leq 0 \\ & -30v_1 - 4v_2 + 0,2u_1 + 4u_2 + 2u_3 + 6u_4 \leq 0 \\ & 0,2v_1 - v_2 \leq 0 \\ & -2v_1 + v_2 \leq 0 \\ & 0,667u_1 - u_2 \leq 0 \\ & -2,5u_1 + u_2 \leq 0 \\ & 0,667u_1 - u_3 \leq 0 \\ & -2u_1 + u_3 \leq 0 \\ & 0,4u_1 - u_4 \leq 0 \\ & -2u_1 + u_4 \leq 0 \\ & 0,4u_2 - u_3 \leq 0 \\ & -2u_2 + u_3 \leq 0 \\ & 0,4u_2 - u_4 \leq 0 \\ & -2u_2 + u_4 \leq 0 \\ & 0,4u_3 - u_4 \leq 0 \\ & -1,667u_3 + u_4 \leq 0 \end{aligned}$$

To calculate the input-oriented rate of efficiency through a model with relative interval weights, we have used specialized *software* called *EMS: Efficiency Measurement System*. The mentioned software was developed by Holger Scheele, a German professor, who works at the Technical University of Dortmund. This software is only for academic use and it can also work with more complicated DEA models such as the model "*Assurance Region Method*" used in this paper.

At first we must prepare the input data so that they can be used as input for the algorithm used within the software if we want to make an efficient use of the EMS software.

One of the inputs – the *Data Matrix* – of the model will be the matrix of input data of individual variants with defined minimization and maximization criteria; it is created based on the table (Table 4).

Another input of the model is the *Matrix of Weight Restriction (W)*. The matrix will be created based on the specified conditions of the model and it has the following form:

$$W = \begin{pmatrix} -0,2 & 1 & 0 & 0 & 0 & 0 \\ 2 & -1 & 0 & 0 & 0 & 0 \\ 0 & 0 & -0,667 & 1 & 0 & 0 \\ 0 & 0 & 2,5 & -1 & 0 & 0 \\ 0 & 0 & -0,667 & 0 & 1 & 0 \\ 0 & 0 & 2 & 0 & -1 & 0 \\ 0 & 0 & -0,4 & 0 & 0 & 1 \\ 0 & 0 & 2 & 0 & 0 & -1 \\ 0 & 0 & 0 & -0,4 & 1 & 0 \\ 0 & 0 & 0 & 2 & -1 & 0 \\ 0 & 0 & 0 & -0,4 & 0 & 1 \\ 0 & 0 & 0 & 2 & 0 & -1 \\ 0 & 0 & 0 & 0 & -0,4 & 1 \\ 0 & 0 & 0 & 0 & 1,667 & -1 \end{pmatrix}$$

Having solved the DEA model for all variants of the decision-making we obtained the rate of relative efficiency (θ) for each of the variants. Based on the rate of relative efficiency we will be able to sort the variants. The solution of the model with relative intervals of weights for evaluated variants is shown in the Figure 2.

	DMU	Score	Costs {0}\{w}	Duration {0}\{w}	Revenues {0}\{w}	Public Benefits {0}\{w}	Environm. Impact {0}\{w}	Risk {0}\{w}
1	V1	100,000%	0,023	0,047	0,025	0,062	0,025	0,034
2	V2	82,057%	0,027	0,005	0,036	0,057	0,071	0,028
3	V3	87,231%	0,028	0,006	0,074	0,066	0,049	0,030
4	V4	97,772%	0,025	0,005	0,027	0,043	0,054	0,022
5	V5	71,845%	0,029	0,006	0,080	0,080	0,069	0,032
6	V6	100,000%	0,032	0,006	0,053	0,035	0,070	0,028
7	V7	87,764%	0,030	0,006	0,077	0,072	0,052	0,031
8	V8	75,934%	0,024	0,005	0,049	0,082	0,033	0,033
9	V9	74,531%	0,022	0,004	0,031	0,077	0,031	0,031
10	V10	67,417%	0,032	0,006	0,054	0,054	0,065	0,108

Source: output of the EMS software based on self elaboration

Figure 2 - Output of the EMS software: The selection of efficient variants

According to the calculated rates of relative efficiency, we can see that in this case we consider as efficient the variants V1 and V6, because their rate of efficiency (expressed in percentage in the column "Score") is equal to 1. The rate of efficiency of the other variants doesn't reach the value of 1, so with respect to this finding the other models are inefficient. The order of variants can be determined as following:

$$1 > 0,978 > 0,878 > 0,872 > 0,821 > 0,759 > 0,745 > 0,718 > 0,674$$

$$V1 \sim V6 > V4 > V7 > V3 > V2 > V8 > V9 > V5 > V10$$

According to Andersen and Petersen (1993) if we want to distinguish the efficient variants the DEA model that calculates the superefficiency can be applied. The calculation of superefficiency (Andersen-Petersen model) for the analyzed variants is shown in Figure 3. While calculating its value the superefficiency remains the same in the inefficient variants as well as in the case of calculating the relative efficiency.

	DMU	Score	Costs {0}\{w}	Duration {0}\{w}	Revenues {0}\{w}	Public Benefits {0}\{w}	Environm. Impact {0}\{w}	Risk {0}\{w}
1	V1	115,138%	0,023	0,047	0,029	0,072	0,029	0,039
2	V2	82,057%	0,027	0,005	0,029	0,047	0,058	0,023
3	V3	87,231%	0,028	0,006	0,065	0,057	0,043	0,026
4	V4	97,772%	0,025	0,005	0,026	0,042	0,053	0,021
5	V5	71,845%	0,029	0,006	0,058	0,058	0,050	0,023
6	V6	108,435%	0,032	0,006	0,057	0,038	0,076	0,031
7	V7	87,764%	0,030	0,006	0,067	0,064	0,046	0,027
8	V8	75,934%	0,024	0,005	0,037	0,062	0,025	0,025
9	V9	74,531%	0,022	0,004	0,023	0,058	0,023	0,023
10	V10	67,417%	0,032	0,006	0,036	0,036	0,043	0,072

Source: output of the EMS software based on self elaboration

Figure 3 - Output of the EMS software: Calculation of super-efficiency

Based on the calculation of superefficiency the variant with the highest score (in the Figure 3 referred to as the "Score") is the most interesting variant for the self-government. In our case, the highest score is achieved by the variant number 1 (V1), and thus this variant should be submitted to the regional parliament for approval.

Conclusions

The paper deals with the design of the model of multi-criteria investment decision-making tool that integrates theoretical knowledge with the results of analysis performed on the basis of primary and secondary data. The proposed model is widely applicable as a decision-making support tool in deciding which investment variant of the strategic investment to choose by the regional self-governments in the countries surveyed (the Slovak Republic, the Czech Republic, Hungary). It is based on the method of Data Envelopment Analysis (DEA) adapted to multi-criteria decision-making in the investment decisions of regional self-governments. In the model there are identified the selection criteria, and the importance of each criterion as well and all is tested on a model example at the same time.

The *EMS software* was used for the calculations within the model in this paper. Although the aforementioned software is freely available on the personal website of the German professor Holger Scheel, this software is not for commercial use. As mentioned earlier, according to the statement of the author it serves only for academic purposes.

In the case the self-government's decision to use the proposed model as a support tool for their strategic investment decision-making, we would recommend to buy one of the specialized commercially available software that is able to calculate the DEA model "Assurance Region Method". We propose the following suitable software: DEAFrontier, DEA-Solver-Pro, Frontier Analyst.

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BUSINESS SUCCESS VERSUS FAILURE NEURAL NETWORK MODEL FOR SMALL AND MEDIUM ENTERPRISES

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Abstract

The role of small and medium enterprises in any economy needs no exaggeration. They provide employment to the local community and contribute significantly to the nation's income and growth. Yet many of these enterprises routinely fail. This study attempts to predict a non-financial qualitative factors model on the lines of Lussier (1995), with modifications in the independent variables and using 'profit for at least three years out of the last 5 years' as a measure of success or failure of an enterprise. The study will contribute to the limited literature on business success versus failure prediction studies using neural networks.

Keywords: business, success, failure, non-financial factors, neural network model.

JEL Classification: M210

1. Introduction

Small and medium enterprises play an important role in the economic functioning of any country. These entrepreneurs provide more jobs than large firms. UNIDO (1969) has reported in a study involving many developing countries that small enterprises achieved higher productivity than large capital intensive enterprises as the formers' investment per worker was lesser. Yeung and Chew (2001) stated that the small firms spent about two times higher amount than the large firms in fundamental research. Small and Medium enterprises were seen as creators of new jobs (Swierczek & Ha, 2003). Small entrepreneurs were the reasons for dynamism in the economy (Fritsch, 2008). They contributed for the local and regional development (Reynolds *et al.*, 1994; Westhead and Wright, 1998). Employment generation, productivity enhancement and commercialization of innovation were all engendered by the entrepreneurs (Van Praag & Versloot, 2007). This paper has attempted to design a neural network model to predict the business success versus failure with the help of data collected from small and medium enterprises located in an industrial estate in Trichirappalli and its surrounding areas in India.

The paper is based on the non-financial qualitative managerial factors suggested by Lussier (1995), with modifications in the explanatory variables and the meaning for business success or failure, but unique in using neural network for the purpose of the study.

2. Review of literature

Business success versus failure studies help many stakeholders like providers of capital, suppliers and public policy makers besides the entrepreneurs and the government agencies who train and advise the new entrepreneurs (Altman 1983; Lussier 1995). Ahn, Cho & Kim (2000) stated that researchers and practitioners have been exploring the validity of the business success versus failure models for a long time. Johnsen & Melicher (1994) revealed that the studies to predict business failures were always of interest. Many business success versus failure studies were conducted and referred to in the past (Carter & Van Auken, 2006; Cooper, Dunkelberg, Woo, & Dennis, 1990; Dennis & Fernald, 2001; Pompe & Bilderbeek, 2005; Reynolds, 1987; van Gelder, de Vries, Frese, & Goutbeek, 2007; Westhead *et al.*, 2001). Lussier (1995) made the most extensive study of the prediction model. Lussier (1996) made a study of the business success versus failure prediction model for startups in the retail industry. Many studies have been reported on success versus failure prediction models based on financial data (Gritta, Wang, Davalos, & Chow, 2000). However many studies had questioned the usefulness of the success versus failure models using only financial ratios (Lussier and Corman 1995, Gilbert, Menon, and Schwartz 1990; Sommers and Koc 1987). Measuring success or failure using financial and economic measure needed reconsideration (Brush *et al.* 2008). Storey *et al.* (1987) reported that qualitative data could equally

predict the success or failure as traditional financial ratios. There were not many studies using non-financial data for the purpose of prediction (Cooper *et al.* 1991 and Reynolds and Miller 1989). Lussier (1995) had formulated a success versus failure model as a function of the non-financial managerial factors, namely, advisors, planning, education, minority business ownership, staffing, parents owned a business, record keeping and financial control, capital, industry experience, economic timing. Claudia E. Halabí and Lussier (2008) advocated a model using internet, starting with adequate working capital, good financial and accounting records, planning, formal education, professional advice, partners, parents owning a business, and marketing efforts. Caludia E. Halabi and Lussier (2008) used the 15 variables in their study of the entrepreneurs in Chile. Ghosh *et al.* (2001), Yeung and Chew (2001), Ghosh and Kwan (1996) suggested many non-financial variables for the prediction model. The studies reported no unanimity regarding the significance of the managerial and non-financial factors in the prediction model for success or failure (Lussier, 1995). He concluded that capital was the only variable supported in all the five models compared in his study, and that the variables, industry experience, education, staffing, product/service, economic timing, age of owner, and partners were both supported and rejected in the prediction models analyzed by him. Neshamba (2000) came to the conclusion that the owner-manager's previous experience, understanding the needs of customers, access to capital, and hard work were important success variables for Kenyan entrepreneurs. Pratt's (2001) found that support of family members was equally important in addition to the availability of capital, possession of business skills and previous experience. Hyewon Youn (2007) found that "partners" and "parents who owned a business" were important variables affecting the results of the firm. Regarding the method of measurement of the dependent variable, business success or failure, again there is no unanimous agreement. Storey, Keasey, Watson, & Wynarczyk (1990) stated that the defining business failure was both emotive and thorny. According to Ulmer & Neilsen (1947) and Cahill (1980) business failure includes bankruptcies. Kwansa & Parsa (1991) was of the same opinion. Beaver (1966) stated that a business failure happened when it failed to make interest payments, had overdrawn from its bank or declared bankruptcy. Altman (1968) stated that a business failed when it had filed bankruptcy petition under the National Bankruptcy Act or it had made returns on the capital significantly and consistently lower than comparable investments. Blum (1969) also expressed similar opinion on the definition of business failure. Taffler & Tisshaw (1977), Hamer (1983) and Taffler (1982) revealed that creditors' voluntary liquidation, compulsory winding up under a court's order or government's action amounted to business failure. Olsen, Bellas & Kish (1983) opined that cumulative negative cash flow for consecutive six months indicated business failure. When a business had been closed and there was no likelihood that the business would be restarted, that showed business failure. Many of the business success versus failure models followed Dun and Bradstreet (1994) definition of business failure. They stated that business failure occurred when the firm filed for bankruptcy protection or liquidation or when the operations were stopped involving loss the creditors. Lau and Lim (1996) defined business failure as the closure of business with losses accruing to the creditors and shareholders. Similar meaning of business failure was echoed by Dimitras, Zanakis & Zopounidis (1996). So, success of business, according to him, was the continuation of the business with no losses. According to Lussier and Pfeifer (2001), successful business was the one which has made industry-average profits at the minimum during the previous three years and loss was made when the business has not made profit in the previous three years. Cho (1994) had also expressed similar opinion and stated that business failure happened when there was consecutive negative income for three or more years. The common statistical analysis used in business success versus failure model had been regression analysis (Brush, *et al.*, 2008). Many of the previous studies used Bivariate Logistic regression (Lussier 1995, 2001; Cooper *et al.*, 1990; Carter and Van Auken 2006; and Reynolds and Miller 1989). Logistic regression has been used by Harold Siow Song Teng *et al.* (2011) in their success versus failure prediction model for firms in Singapore. They identified employment, training and the retaining of high-quality staff members, good products, services, and the appropriate timing of their introduction into the market, excellent relationships with customers and availability of top managers with good leadership qualities as the most important factors for the success of a firm. Also Zavgren, (1985), Platt and Platt(1991), and Flagg, Giroux, and Wiggins (1991) used logit analysis and found that the results were similar to

discriminant analysis. Lussier (1995) and Altman (1968) had used discriminant analysis in their prediction models. Similarly, Deakin (1972), Edmister (1972), Blum (1974), and others utilized multiple discriminant analysis for their models. Altman & Saunders (1998) reported that multiple discriminant analysis and logit analysis were the top two techniques used in the prediction models. The earlier studies also used univariate statistical methods, probit analysis for business success versus failure studies (Ahn, Cho, & Kim, 2000). Hyewon Youn (2007) and Hanlon and Saunders (2007) used ordered probit model in their study on entrepreneur success versus failure model. Recent studies were found to use neural networks in the business prediction models (Shin & Lee, 2002). The research study by the author uses Lussier's (1995) model with some modifications. Lussier's model has been used because the variables included in the model were all at least identified as contributing significantly to success or failure in the previous studies.

Also it is a non-financial model which is more suitable for small business research where there are no reliable financial records. Chell & Baines (1998) and Castillo & Wakefield (2006) stated that success is measured according to the owners' own objective rather than on the basis of "one size fits all benchmark". Also, since the entrepreneurs were reluctant to part with their financial information, use of non-financial variables in small business research was suggested (Lussier, 1995). Likert scale has been used in the survey of the entrepreneurs in the study as was common (Wang, 2008; Wiklund & Shepherd, 2008). The model used in the study of the author is robust and unique because neural network is applied along with the modified non-financial variables of Lussier's model.

3. Methodology

A survey, using a structured questionnaire, was carried out among the entrepreneurs located in and around Trichirapalli, India and at an industrial area located there. The industrial area is an infrastructure promoted by the government to create infrastructure for small and medium enterprises and houses more than a hundred small scale operating units. One hundred and thirteen entrepreneurs responded to the questionnaire, but since twenty four of the entrepreneurs responded 'neutral', for the question regarding the profit for at least three years during the last five years of their business, data obtained from those twenty four questionnaires were not considered for the analysis. The non-financial independent variables used in the questionnaire were, advice before starting the business, planning, efficient employees, training in the business, bank finance whenever required, adequate capital, involvement (experience) in other businesses, participation of family members, prior experience in the line, maintenance of regular accounts and profit during the first three years. The variables not tested by Lussier (1995) in his study but used by the author are, prior training, bank finance and profit during the first three years of business. Involvement in other businesses gives better experience and may be taken to refer to the 'experience' used by Lussier (1995). Similarly, participation of other family members may refer to 'partners', one of the variables used by Lussier (1995). These variables were introduced in the survey questionnaire based the data collected during the pilot study carried out among twenty entrepreneurs. During the pilot study the entrepreneurs stated that 'timely and adequate bank finance' was important for the success of the firms and that it was also important for a business to make profit during the initial years to conserve its capital and succeed in the long run. A firm which incurs loss during the initial years would suffer from working capital problems unless additional capital is infused into the business or timely and adequate bank finance is made available to the firm. Altman (1968) also pointed out that failure occurred at a higher rate for firms in their infancy stages. Also, in this study of the author success is defined as profit made during any of the three years out of the previous five years as has been supported in Lussier and Pfeifer (2001) and, Cho (1994). This paper has made use of five point Likert scale to collect the data from the entrepreneurs with: 1 = strongly disagree, 2 = Disagree, 3 = Neutral, 4 = Agree and 5 = Strongly Agree. As earlier stated, the respondents with 3 = Neutral in their response to the dependent variable, '*My business has earned profits for at least 3 years out of the last 5 years*' were not included in the analysis. The dependent variable, '*My business has earned profits for at least 3 years out of the last 5 years*' was recoded with 1 = Strongly disagree and 2 = Disagree as 1 = Failure, and 4 = Agree and 5 = Strongly Agree as 2 = Success for the purpose of analysis using neural networks.

Recently, neural network analysis has begun to be used in classification studies (Shin & Lee, 2002) such as to ascertain a prediction model of success or failure of the entrepreneurs. Neural network has many advantages over the regression and discrimination methods used in studies related to success versus failure models until recently. This study adds to the limited literature of business success versus failure studies using neural network analysis. The unique feature of neural networks is that they have the ability to learn relationships from input data similar to the functioning of the human brain. Hawley *et al.*, (1990) and Udo (1993) state the merits of neural networks as they, “(a) tolerate noise and missing data, where all the data or rules are not known; (b) self-organize and learn by changing the network connections; (c) train by experience and dynamically adjust to changes in the environment; (d) generalize from specific instances; (e) tolerate noise or random inputs; and (f) find and establish complex relationships among input variables”. Neural networks do not make a priori assumptions as to the structure of the relationship among the variables as contrasted to the assumption of linearity among the variables as in multivariate discriminant analysis. Neural networks have the ability to predict with a high degree of accuracy (Wong and Selvi, 1998). Gritta *et al.* (2000) identified the use of neural networks in financial applications including the recognition of financial distress as in business success versus failure studies. According to Udo (1993) and Tsukada and Baba (1994) neural networks would be a better tool in bankruptcy prediction studies. Patrick A. Gambrel (2004) and Juan Jose Suarez (2004) had used neural networks in their dissertations of business success versus failure prediction model using financial information. Udo (1993) suggested that neural networks as a technique had attractive characteristics and capabilities to make business success versus failure predictions in a better way.

4. Findings

Eighty nine entrepreneurs responded to the questionnaire with valid data. 87% of the respondents were 26 years and above out of which 48% were above 35 years. The balance 13% of them was less than 25 years. 61% of the entrepreneurs were graduates and the others were under-graduates. 63% of the entrepreneurs ran the business as family and partnership business; company form of business constituted only for about 11% of the entrepreneurs. Regarding the age of business, 86% of the businesses were run for six years and more out of which 38% of the businesses were with an age of eleven years and more. 14% of the businesses were run for three to five years. Descriptive analysis revealed the following details regarding the independent variables:

Table 1 - Descriptive statistics

S. No.	VARIABLES	FAILURE		SUCCESS	
		Mean	S.D.	Mean	S.D.
1.	I received adequate advice to my full satisfaction before starting my business.	3.50	1.38	3.95	1.03
2.	I practice short term and long term planning in my business	3.67	1.23	3.88	0.76
3.	I am satisfied with the quality and competency of the employees in my business	3.00	0.95	3.95	0.79
4.	I have formal training in the line of my business	3.17	1.33	3.75	1.01
5.	Banker to my business supports the financial requirements of my business in time.	3.83	1.11	3.75	0.89
6.	I have invested sufficient capital in my business.	2.92	1.31	3.84	0.96
7.	I also own another one or two businesses.	3.33	1.23	3.47	1.14
8.	My family members participate in day-to-day running of the business.	2.50	1.31	3.45	1.13
9.	I have prior experience in the line of my business.	3.92	1.08	3.66	1.04
10.	I am satisfied that my business accounts are maintained on day-to- day basis properly.	3.58	1.31	3.73	0.89
11.	My business has earned reasonable profits during the first 3 years of the commencement of my business.	3.25	0.75	3.79	0.84

SPSS Neural Network was used to analyze the data collected from the survey. Multilayer Perceptron (MLP) method of neural networks with one hidden layer was chosen for the analysis of data. The data was partitioned as, the training sample 62.9%, the testing sample 22.5 % and the holdout sample 14.6 % for analysis using multilayer perceptron method. The Model Summary showed that the computation stopped as there was no more possibility for a decrease in error. The Cross Entropy Error of the training and holdout samples were the same at 15.4 % and the testing sample ended with a Cross Entropy Error at 8.40 %. Considering the sample size, these indicate that the result of the analysis is fairly acceptable. Neural Network analysis has classified the training, testing and holdout samples for success of the business close to 100%. The overall classification for the training and holdout samples were 89.3% and 84.6% respectively. The testing sample showed also similar classification for success and failure. These results show that the neural networks have predicted the model as accurately as possible. The Classification results regarding the success and failure of the entrepreneurs are tabulated as under for the training, testing and holdout samples:

Sample	Observed	Predicted		
		Failure	Success	% Correct
Training	Failure	0	6	.0%
	Success	0	50	100.0%
	Overall Percent	.0%	100.0%	89.3%
Testing	Failure	0	4	.0%
	Success	0	16	100.0%
	Overall Percent	.0%	100.0%	80.0%
Holdout	Failure	0	2	.0%
	Success	0	11	100.0%
	Overall Percent	.0%	100.0%	84.6%

Dependent Variable: Profit for at least 3 years out of 5 years

The factors causing success or failure have been ranked by the analysis as below:

	Importance	Normalized Importance
Adv_1	.019	8.4%
Plan_2	.038	16.6%
Empl_3	.231	100.0%
Trng_4	.011	4.8%
Bankr_5	.130	56.2%
Cap_6	.188	81.2%
Other_7	.114	49.4%
Parti_8	.046	19.8%
Exp_9	.123	53.1%
Accts_10	.075	32.4%
First_11	.025	10.7%

The first three significant factors have been found out to be Employees (100%), Capital (81.2%) and Bank Finance (56.2%). The next three important factors have been Experience, Involvement in other businesses and Regular maintenance of accounts. The other factors were relatively not important and the least important factor were identified as Advice and Training. The contribution of Profit during the first three years of the commencement of business contributed 10.7% to the model prediction. Harold Siow Song Teng *et al.* (2011) also have found in their Singapore model that the quality of employees was a critical factor for the success of the firm besides product timing and good relationship with customers. As previously stated, Lussier (1995) concluded that capital was the only variable supported in all the five models compared in his study. According to Neshamba (2000), owner-manager's previous experience, understanding the needs of customers, access to capital, and hard work were important success variables

for the Kenyan entrepreneurs. Pratt's (2001) and Hyewon Youn (2007) respectively found that "support of family members" and that "partners" and "parents who owned a business" were equally important for the success or failure of the business. Most commonly identified factors in prior research were capital and management experience. However, in the 20 such business success or failure studies only fourteen studies have concluded that these factors significantly contributed to the success or failure (Lussier, 1995). The list of factors compiled by Claudia E. Halabi and Lussier (2008) is given in Appendix. Lussier's (2001) model predicted 85.6% of the sample as successful whereas Harold Siow Song Teng *et al.* (2011) in their study predicted 86.3% of the sample as successful firms. Both Lussier (1995, 2001) and Harold Siow Song Teng *et al.* (2011) used logistic regression/discriminant analysis for their analysis. The explaining power of the model predicted by the author using neural networks is comparable to the models predicted by Lussier (2001) and Harold Siow Song Teng *et al.* (2011).

Conclusion

The model predicted in the study is useful to the entrepreneurs and the policy makers at the first instance. The entrepreneurs shall appreciate the criticality of the efficiency of their employees and follow scientific methods of recruitment, training and compensation. They may also watch the attrition rates and carry out suitable measures to retain the right employees in the business. As the small business generates employment and assists the wide spread development in the economy and sizeable investments have been made in these ventures, it is the policy makers' responsibility that those entrepreneurs are provided with adequate and timely funds through the bankers. Small firms can contribute to the distribution of economic resources equitably (Doern, 2009). The entrepreneurs shall also be prepared to bring in adequate capital and where necessary, additional capital so that their businesses can survive and become successful at times of distress. It is in the interest of the suppliers also that the entrepreneurs are successful so that they are able to have an enduring business relationship with the business. Again, the model reveals the importance of prior experience and exposure for the successful conduct of the business by the entrepreneurs.

The public agencies and bankers who provide funds shall do so only for the experienced entrepreneurs so the scarce resources of a developing country like India are used to the best advantage. Another fact the model brings out is that the regular maintenance of accounts and the taking stock of what happens in the business on a regular basis are important for the success or failure of the business. Obviously the model is useful to the investors whose return risk trade-off depend upon the success or failure of the business. The model is also useful to the public and the society at large as they can identify in advance the successful firms from the other firms.

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APPENDIX

A COMPARISON OF VARIABLES IDENTIFIED IN THE LITERATURE AS FACTORS CONTRIBUTING TO BUSINESS SUCCESS VERSUS FAILURE

Senior Author	Independent Variables														
	capt	rkfc	inex	maex	plan	prad	educ	staf	psti	ecti	age	part	pent	mior	mrkt
Barsley	F	-	F	F	F	F	-	-	-	-	-	-	-	-	-
Bruno	F	F	-	F	F	-	-	F	F	F	-	-	-	-	F
Cooper 90	F	-	N	N	F	F	N	-	F	F	F	F	-	F	-
Cooper 91	F	-	F	N	-	F	F	-	N	N	N	N	F	F	-
Crawford	-	-	F	-	-	F	F	-	-	N	N	-	-	-	-
D+B St.	F	F	F	F	-	-	-	-	-	F	-	-	-	-	-
Flahvin	F	F	F	F	-	F	-	F	-	-	-	-	-	-	-
Gaskill	N	F	F	F	F	F	N	-	-	N	-	-	-	-	F
Hoad	-	-	F	N	N	F	F	-	-	-	-	-	-	-	-
Kennedy	F	-	-	F	F	-	-	-	-	F	-	-	-	-	-
Lauzen	F	F	-	F	F	-	-	F	-	-	-	-	-	-	-
Lussier 95	N	N	N	N	F	F	F	F	N	N	N	N	F	N	N
Lussier 96a	N	F	N	F	F	F	N	F	N	F	N	F	F	N	F
Lussier 96b	N	F	N	N	F	F	N	N	F	F	F	N	N	N	N
Lussier & C 96	F	F	F	N	F	F	F	F	N	F	N	N	F	F	N
Lussier & Pf 01	N	N	N	N	F	F	F	F	N	N	N	N	N	N	N
McQueen	F	-	F	F	-	-	-	-	-	-	-	-	-	-	F
Reynolds 87	F	F	-	-	F	-	-	N	F	-	-	-	-	-	N
Reynolds 89	F	F	-	-	F	-	N	N	F	-	N	F	-	-	-
Sage	F	-	-	F	-	-	F	-	-	-	-	-	-	-	-
Sommers	-	-	-	F	F	-	-	F	-	-	-	-	-	-	-
Thompson	N	-	-	F	F	-	-	F	F	-	-	-	-	-	F
Vesper	F	F	F	F	N	F	F	-	F	F	-	F	-	-	F
Wood	-	F	F	F	F	-	F	-	-	-	-	-	-	-	-
Wight	F	F	-	F	-	F	-	-	-	-	-	-	-	-	-
Total F	15	13	11	15	16	14	9	9	7	8	2	4	4	3	6
Total N	6	2	5	6	2	0	5	3	5	5	7	5	2	4	5
Total -	4	10	9	3	7	11	11	13	13	12	16	16	19	18	14

- F - supports variable as a contributing factor;
- N - does not support variable as a contributing factor;
 - does not mention variable as a contributing factor

1. Capt: working capital
2. Rkfc: record keeping and financial control
3. Inex: industry experience
4. Maex: management experience
5. Plan: planning
6. Prad: professional advice
7. Educ: formal education
8. Staf: staffing
9. Psti: product service timing
10. Ecti: economic activity
11. Age: age
12. Part: partners
13. Pent: parents
14. Mior: minority
15. Mrkt: marketing efforts

Source: Claudia E. Halabí and Lussier (2008)

VALUE-CHAIN MODELING IN E-COMMERCE SYSTEMS

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Abstract:

Currently, e-business and e-commerce systems became standard tools in the business environment. As we can see in practice and literature, current trend in e-business and e-commerce, is to develop systems enabled to manage and coordinate (and help the managers to manage) the business and production operations. Companies' managers increasingly need new methods and tools that can help them in their decision-making. In general, managements can make right decisions only in case they have current and adequate information. In addition, managers have to get all information in time, and decision-making processes should be realized quickly and under the strong thumb of a competitive environment. It also applies in the context of management of e-business and e-commerce systems. One of basic features of efficient e-commerce is correct definitions and descriptions of all internal and external processes of the supplier. All of them are targeted to customers' needs and requirements. The optimal and most exact way how to obtain and find optimal solution of e-commerce system and its process structure is modeling and simulation. Contrarily to most approaches using process-oriented modeling, this paper presents the value-chain-oriented modeling approach. Value chain model and its transformation into control loop is shortly presented as a base for simulation. The closing discussion outlines next research directions.

The aim of this paper is to outline value chain approach to modeling in e-commerce systems. First, we present an e-commerce system as a subject of our research. Next the role of modeling at the design level and its' role in the decision support is discussed. After that, we shortly characterize the two main business modeling perspectives, namely the process-oriented and value-chain-oriented approach. Section 4 deals with an outline of generic e-commerce model based on value chain modeling. The last sections include simulation model, model results, and closing remarks.

Keywords: E-commerce system, business process modeling, value oriented model, basic transaction cycle.

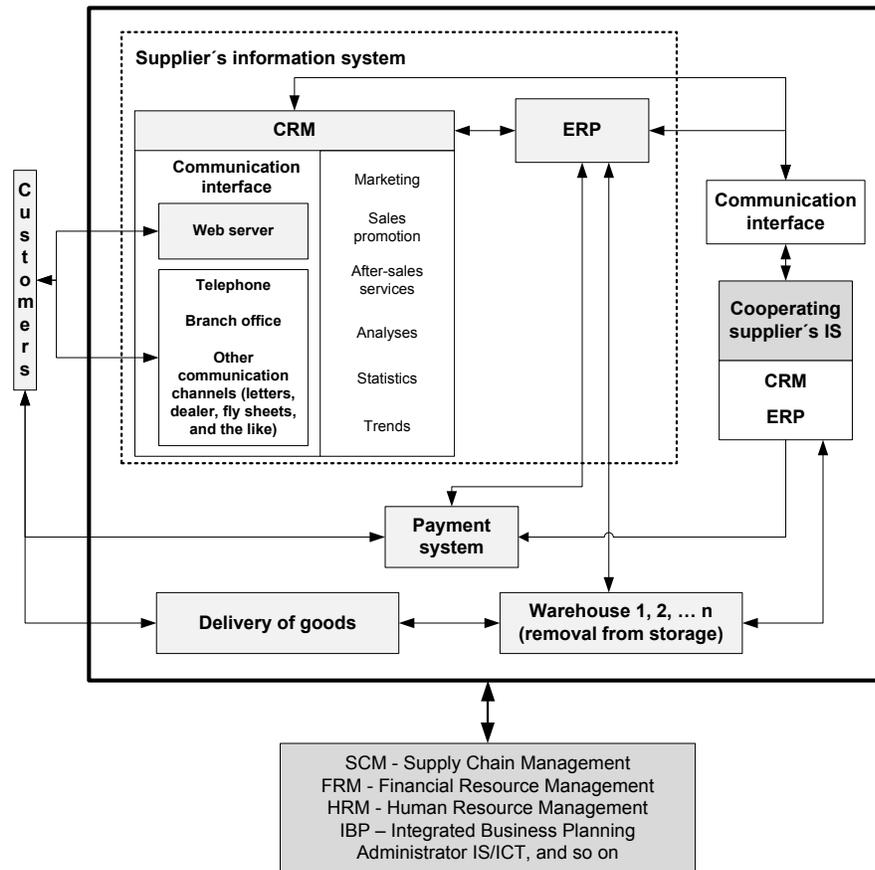
JEL Classification: C02, C19, C63, C69, M11, M29, M31.

1. Introduction

E-Commerce systems are standard prerequisite of most sales and manufacture oriented companies now. Enterprises using e-commerce are challenged by increasing competition what makes it necessary to improve their internal efficiency. Experience shows that the most effective way to achieve the efficiency goals is re-engineering process based on modeling and simulation. Re-engineering methods have been recognized as a useful general performance improvement tool (Davenport, 1992), (Hammer; Champy, 2000). In this paper we focus on the e-commerce modeling having the simulation support as ultimate aim in mind. In our opinion, using typical process oriented modeling needs some enhancement to achieve more flexibility of decision-making based on simulation. This is where the business pattern and semantic oriented value flow models may come into consideration. The aim of this paper is to outline value chain approach to modeling in e-commerce systems. First, we present an e-commerce system as a subject of our research. Next the role of modeling at the design level and its' role in the decision support is discussed. After that, we shortly characterize the two main business modeling perspectives, namely the process-oriented and value-chain-oriented approach. Section 4 deals with an outline of generic e-commerce model based on value chain modeling. The last sections include simulation model, model results, and closing remarks.

2. E-commerce system

E-commerce systems became a standard tool of companies' business activities. The history of e-commerce dates back to 1970, when for the first time, Electronic data interchange (EDI) and electronic fund transfer were introduced. Since 1990, a rapid growth of e-commerce has pervaded almost every other aspects of business such as supply chain management, transaction processing, internet marketing and inventory management (Suchánek; Slaninová; Bucki, 2010).



Source: adapted from (Suchánek, 2010)

Figure 1 - Basic structure of e-commerce system

More frequently than ever, companies use e-commerce systems for the support of their business activities. E-commerce systems support simple business units, but also large-scale systems. E-commerce systems can be modeled in a number of ways (Suchánek; Slaninová; Bucki, 2010). Structural model describes an e-commerce system as a set of functionally connected components (Figure 1). Main basic components of e-commerce systems are: customers, Internet, web server, LAN, CRM (Customer Relationship Management) (characterized for example in (Pradeep *et al.*, 2010), ERP (Enterprise Resource Planning), payment system, delivery of goods, post-delivery (post-sales) services and information systems of cooperating suppliers. As we can find, for example, in (Bucki and Suchánek, 2012), (Chaffey, 2011), (Chaffey; Hickie; Greasley; Bocij, 2006) and others, all shown parts of e-commerce systems are supported and controlled by the management at all control levels. Most important control and support functions are SCM - Supply Chain Management, FRM - Financial Resource Management, HRM - Human Resource Management, IBP - Integrated Business Planning, Information system / Information and communication technology administration, etc. Next important classes of models, namely the business process and value chain process models are discussed later in this paper. E-commerce systems are part of the so-called modern (or intelligence) organizations in which more and more emphasis is put on knowledge

management. If individuals and technologies can harmonize their intelligence under various forms, only the intelligent organizations will have the capacity to transform and coordinate these abilities for their own advantage by using informational technologies, by combining the most advanced software technologies with the newest management instruments in order to produce extremely efficient organizations (Bălan, 2009). Important and integral parts of the whole system are hardware, software, people, co-operative suppliers, legislation, Internet services. However, e-commerce system must be seen as a part of complete business environment. Here, the main and decisive part of the environment is the customer. Customer-oriented functionalities of e-commerce comprise business-to-customer applications such as remote shopping, banking, and infotainment-on-demand. To study the possibilities of e-commerce functionality improvement the structure model presented in Figure 1 is not sufficient. Any company strives to accomplish its' business strategy. Following the business strategy, long-term and short-term objectives and targets are set. After measuring the results achieved in a certain period of time the differences from the target values are evaluated and corrective actions for the next term are specified by the company management. Thus, in a very general way, any business system can be looked upon as a specific form of a control loop. In our opinion this holds true also for e-commerce systems. Control loop model of e-commerce will be presented in *Section 4*.

3. Business modeling

Modeling and system design techniques are currently widely required. This is caused by information technologies support needed to achieve and sustain necessary business flexibility imposed by market fluctuations. Authors of this paper deal with the issue of economic and especially business systems modeling for a long time, and this is the reason that there are numerous references to other authors' works in the text. Each authors' business and simulation model is unique (*Sections 4, 5, 6*) but model formation is based on the same or similar theoretical and practical foundations.

There are two substantial ways to use the model. During the system design, the model serves as a conceptual description of the future system. After the new system is put into operation, the management can use it also for decision support. Typical management control loop incorporates the measurement of the controlled system outputs ("what has happened" - facts) which are evaluated and compared with the company objectives (targets). The controller – manager then takes corrective action ("what should or must be done") in order to reach the specified targets. In case of decision support by simulation the outputs of the controlled subsystem and the data concerning company environment have to be included in the model structure. The results of simulation are presented to decision maker – manager for evaluating possible decision alternatives. While conceptual modeling forms the base of new system design, the simulation modeling can be seen as operations support. This is why both ways of modeling are important for achieving flexibility of data processing in particular, the company management effectiveness in general (Suchánek; Šperka; Dolák; Miškus, 2011). More additional information related in business modeling can be found, for example, in (Huňka, 2013), (Šperka, 2012), (Gao; Zhang; Tian; Guan; Li, 2013), (Baden-Fuller; Haefliger, 2013) and others.

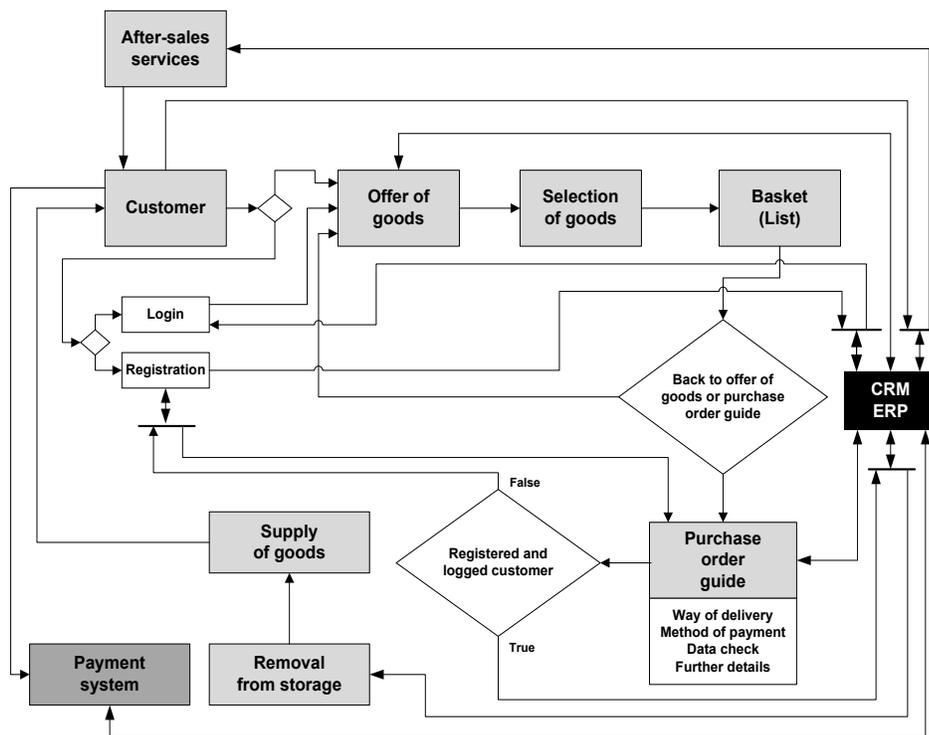
4. Business process model perspective

The mainstream of current techniques is a business process model perspective representing the operations inside the company from the control, data flow, resource handling and co-ordination of cross-operational processes points of view. Business process modeling is a concept useful in a wide variety of situations and for many purposes. Business process models are not only useful for producing software that is aligned with the requirements of the business, but they can also serve as a part of the knowledge management, cost analysis, business process analysis, etc. (Ripl, 2005) Process modeling methods and their management are dealt with by several authors e.g. (Aris, 2000), (Bpme, 2008), (Bpmi, 2003), (Krajčík, 2013) and others. As hereinafter more fully described in (Vymětal, 2009-a), Řepa (Řepa, 2006) in his publication analyzed several methodologies including MMABP (modeling management and business processes) having been developed at VSE Prague for a long time. Dealing with activities, decision processes and functions in a company is the main aim of methods set IDEF (Integrated

DEFinition Methods) developed for US Department of Defense (Nist, 1993). Main modeling elements of IDEF methods are activities connected with inputs, outputs, control signals and mechanisms what enables descriptions of various company activities. The basic elements of a process model include usually (Řepa, 2006), (Vymětal, 2009a):

- process;
- initiative or instigation;
- activity;
- relations among processes and activities.

The goal for process-oriented modeling is a specification of activities and their structure. Each activity can be looked upon as a process and decomposed into further ones until the set of single activities is reached (Vymětal, 2009a). The activities do not come into being or exist independently from the environment. They are instigated by defined external or internal impulses or reasons. Figure 2 shows an example of a business process model corresponding to the e-commerce system presented in Figure 1. Note that although Figure 2 and Figure 1 model the same system, both models have different focus. For example, business process model in Figure 2 does not show which components realize the activities, although some elements such as customer or payment system are present in both models. On the other hand, e-business process model includes activities such as login, registration, removal from storage and supply of goods, which cannot be shown in the structural model. E-commerce system is normally a part of more general firm structure. Some activities presented in Figure 2 are surely realized in other firm subsystem. So, e.g. the payment system comprises booking activities, general ledger posting supply of goods is carried out by logistic or transport system, etc. We can see that such activities follow some general business patterns. However, in the process model we do not usually see these repeated functionalities (Vymětal, 2008).



Source: own

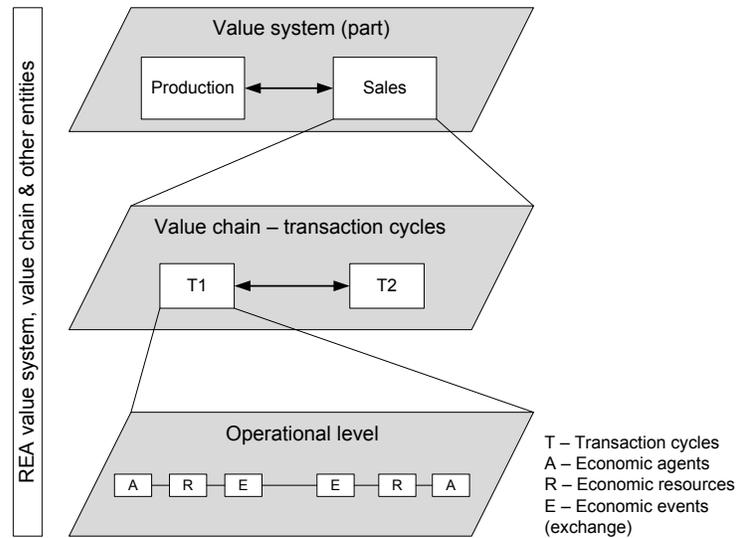
Figure 2 - Basic process model of e-commerce system

As we can find in more detail, for example, in (Vymětal, 2009-a), business process models have several important advantages. The main advantage of process modeling is the orientation on actual activities. They clearly define sequences of operations and process status representations, what makes them easy to understand. Other advantage of process modeling is the orientation on actual activities. This helps process re-engineering and software production. On the other side, by virtue of their basic principles, the process models do not typically explain economic reasons of the activities (why the process runs). They are usually not oriented on the repeating activities (patterns). This is the result of basic process modeling principle – orientation on process logic and workflow. This can make some features of models redundant or can result in stove-pipe solutions.

Value-chain model perspective

A Value Chain perspective, developed and introduced by Michael Porter (Porter, 1980) can be arranged as a series of input-output business processes with resource flows between them. (Dunn; Cherrington; Hollander, 2005), (Hruby, 2006) Value chain models deal with the participants of the value flow (customer, enterprise etc.); define the objects of value flow (like goods, services, cash) and types of economic events accomplishing the actual value flow itself. The basic difference to traditional business process models explaining how processes happen by means of general process description concepts such as activity, entity, process state, is that value chain models explain why processes happen in terms of the added value to the participants' entrepreneurial goals (Suchánek; Šperka; Dolák; Miškus, 2011). While the REA business processes are related by the duality relationships (exchange and conversion), the REA value chain model can be seen as a web of resource inflow and outflow relationships (Huňka; Hučka; Kašík; Vymětal, 2009). Our object of interest is the REA (Resources, Events, Agents) methodology, because it links together business process modeling with the underlying economic phenomena. The REA model represents a conceptual framework and ontology for Enterprise Information Architectures (Geerts; McCarthy, 2006), (McCarthy, 1982).

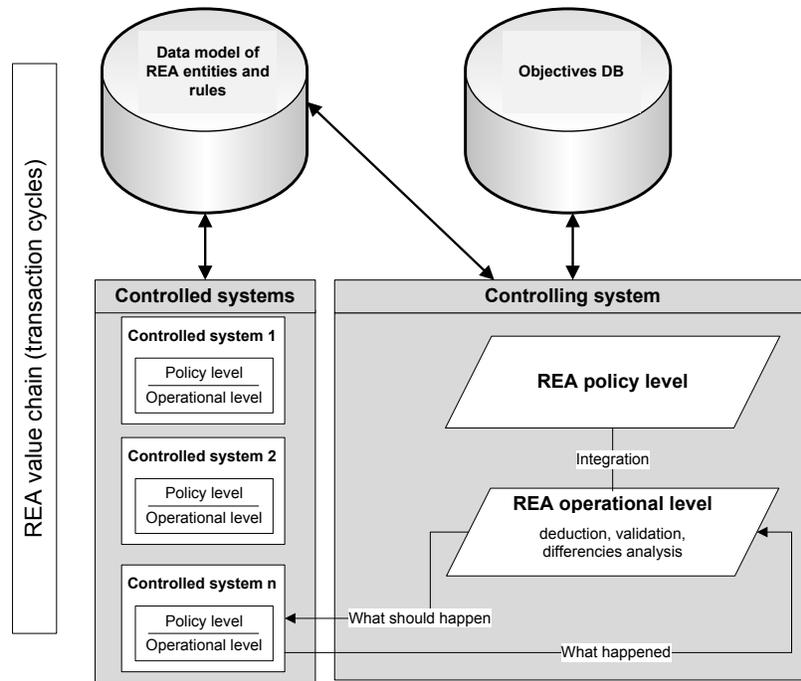
The REA ontology illustrates the value flows inside and among enterprises at several levels as shown in Figure 3. As we can find in more detail, for example, in (Vymětal, 2009a), a general enterprise value system can be presented as follows. The enterprise produces goods and services for customers and receives cash in the value of the goods and services delivered. Working capital (cash) comes from the investors, creditors, or from revenues originating in sales of goods and services. The general value system is expanded into more specific value chain represented by basic transaction cycles decomposing value system entities. Each transaction cycle represents a specific set (subsystem) consisting of economic events. The company produces goods during conversion (manufacturing) cycle. Resources like raw materials, tools, third party services etc. are needed to accomplish the conversion. They are obtained and paid for by means of the acquisition/payment cycle. In the manufacturing also human resources are needed to produce and to supervise the process. Labor is procured and paid for in the human resources and payroll cycles. The payments are effected by finance cycle. The money for the payments is collected from revenue (sales) cycle.



Source: own

Figure 3. The REA levels

E-commerce can be seen as a part of a general revenue (sales) transaction cycle. On the other side, the transaction cycles can be looked upon as generalized control loops as they have to follow company targets (references in terms of control theory) and are controlled by management personnel in order to achieve them. In this meaning the transaction cycles represent the subsystems of the firm that can be further decomposed. The next level of the REA model decomposition is operational level. The concept of operational level using basic notions of economic event, economic resource and economic agent constitutes the base of the REA methodology. REA operational level captures events and resource flows in “what has happened” perspective”. It measures the results of the controlled system part. To depict the controlling part, REA introduces policy level that is semantically superordinate to operational level. Policy level defines “what should or must happen”. The entities of policy level are related to those of operational level by means of typification and grouping abstractions, in some special cases by other relations like fulfilment, reservation and others. Detailed description of policy level entities and relationships was presented in (Geerts; McCarthy, 2009). The operational and policy levels of decomposed company transaction cycles form a complex structure of generic REA control loop presented in Figure 4. Each defined cycle can be decomposed into operational and policy levels.



Source: own

Figure 4 - Generic REA control loop

The facts describing what happens or happened (operational level) are validated, analyzed and further processed to be compared with the target values (policy level). The differences from target values serve as an input to events running in the controlling subsystem. As the controlling subsystem is also a part of enterprise, the same patterns should be found there. Indeed, the activities of controlling personnel can be also looked upon on the REA basis. The economic events at controlling subsystem operational level consume the management labor, use needed equipment and other resources. These events result in plans, schedules, production rules, etc., generally, in knowledge intensive controlling resources (only one relation of controlling to controlled subsystem is shown in Figure 4 to simplify the picture). The controlling subsystem sets the rules, indicators, targets etc. of individual controlled subsystems via corresponding policy levels. The events running at controlling operational level follow typical REA patterns of agent-resource-event chains. In this way also overhead costs can be captured and modeled.

Following the REA concept, each controlling subsystem needs also its' own policy level. Controlling subsystem of an enterprise has to follow common rules, laws and other conditions set by the enterprise environment and also to follow the general enterprise strategy expressed by means of strategy objectives. Generally speaking, value chain models are advantageous for static and conceptual software design but they are not easy to understand. Moreover, they need some type of packages and classes orchestration at actual programming time. For this the time stamps and ordering concerns are needed. The process modeling tools such as flow charts, sequence diagrams etc. are more comprehensible as they specify sequences and workflows. However, they are not always appropriate for software design as they do not support crosscut concerns analysis. Distinctly from business process models, REA based models do not depict sequences in which these exchanges take place. It is clear, that both modeling perspectives are complementary and useful, but they seemed difficult to interconnect until recently. The reason for this is the fact that REA models usually end at the operational level leaving the actual tasks out of scope of the model. In our approach, for example (Vymětal, 2009b), we presented the possibility of value chain model dynamization. The principle of dynamization lies in transformation of rather static REA models at operational level into UML activity, sequence and state models. During this transformation the consistency check of the REA model can be done. The principle of dynamization bridges the gap between

process model and value chain model perspectives. Thus, starting with value chain oriented approach, we can define process models based on value chains and transaction cycles defining corresponding control loops to be used for decision support simulations. It was asserted in many other papers (see e.g. (Hruby, 2006), (Vymětal; Hučka; Huňka; Kašík, 2008), (Dunn; Cherrington; Hollander, 2005), (Chang; Ingraham, 2007)) that more general perspective can be obtained by using the value chain approach, as the basic economic events and relations to other REA entities are principally the same for all transaction types and patterns. In case of e-commerce modeling this is a major advantage as it simplifies the modeling procedures. This brings us to the idea to use value oriented approach as the groundwork for simulation-oriented modeling.

Generic e-commerce model supporting simulations

Referring to Figure 1 and Figure 3, we can see that the basic components of the e-commerce process model pertain to revenue transaction cycle comprising sales. The payment is a part of the finance transaction cycle. The actual sales administration and measurement of revenue is carried out by the ERP, which can be seen as an underlying layer in the model. The achievement of sales targets is supported by marketing loop (cycle). Other cycles like e.g. procurement, production, finance can be presented in similar control-loop perspective. They are not presented here in order not to complicate the conceptual picture of the presented approach. The function of the controller part can be seen as a part of REA model with its own operational and policy level. It is also clear that some parts of the e-commerce process model (e.g. login, basket, purchase order guide) are not handled at all in this model perspective.

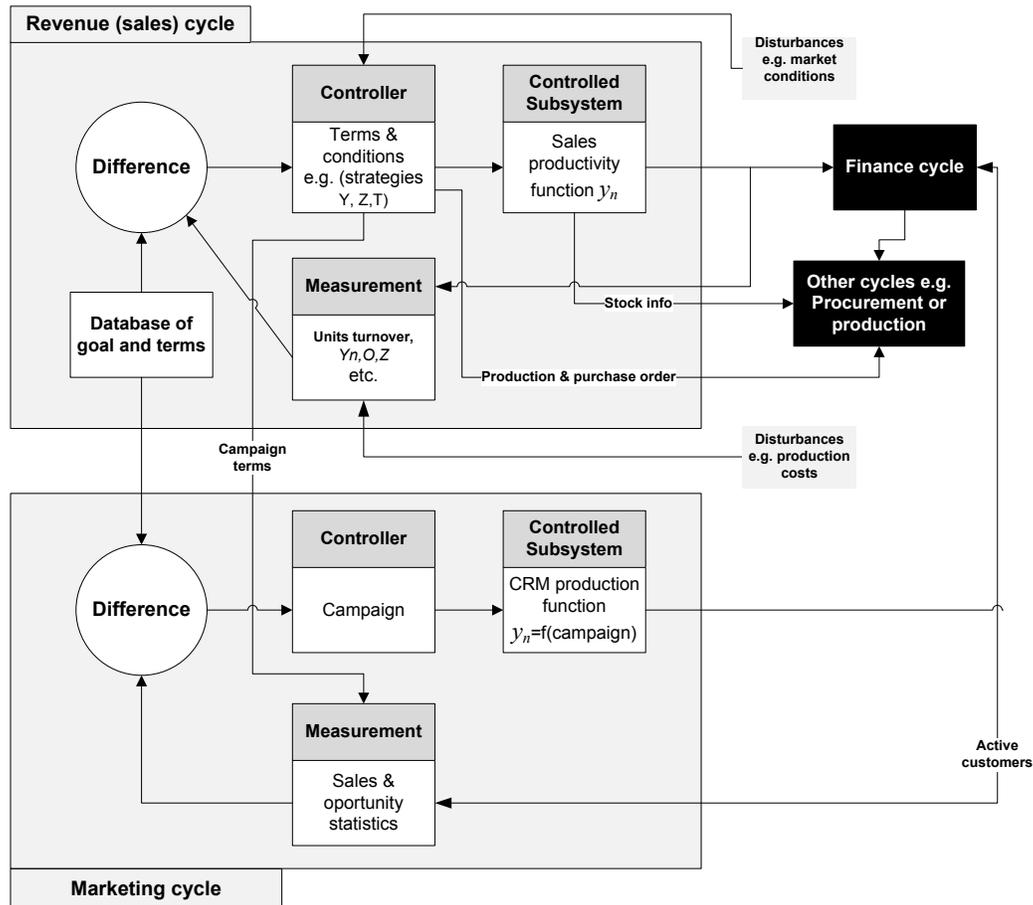
Using business patterns with the value chain paradigm gives the possibility to define a generic business model of company's e-commerce part. The steps involved can be listed as follows:

- definition of transaction cycles representing the main value exchange events;
- definition of REA policy level entities and their interconnections;
- interconnection of transaction cycles (subsystems) by means of messages using typical or defined message structure and contents (ontology);
- definition of relatively independent control loops based on transaction cycles defined;
- definition of disturbances affecting the loops, the disturbances represent the phenomena outside the company (external disturbances) or in other transaction cycles (internal disturbances).

Let us look into two basic transaction cycles of e-commerce: the revenue cycle (sales) and the marketing cycle. In real business life both cycles are mutually interconnected. Results of sales often result in marketing activities; marketing activities normally lead to changes in sales results. The structure of the model is presented in Figure 5. The descriptions of other important cycles namely the production (conversion) cycle, the purchase and finance cycle are left out here, however, it does not mean at all, that they can be neglected in the modeling and simulations.

The controlled subsystem (e-commerce sales cycle) is modeled by the REA operational level. Its structure is defined by static REA diagram while the running value flows and messages are presented by results of the dynamization. The controlled indicators - the outputs of the controlled subsystem e.g. Units sold and Turnover are measured and evaluated by the measuring part of the control loop. As a part of evaluation the profit margin is calculated in the measurement item and compared with the target (Units, Turnover and Margin). The controller changes the sales terms and conditions, e.g. the margin limits for the sales force. The indicator values can be calculated by a special function connecting the situation on the market with the outputs of the controlled subsystem. Let us call this function sales production function. The environment – the market itself produces the disturbances, e.g. the prices of the competition. The notion of disturbances represents an important component of the simulation. We presented our approach to this matter in (Vymětal; Šperka, 2011). As internal influence – disturbance the stock information message from the purchase/production cycle can be used as an example. Production costs influencing the profit margin can be simulated as other internal disturbance to the sales cycle. Results of sales can lead to several decision strategies influencing the behavior of the controlled subsystem such as the decision to start a marketing campaign. Marketing strategy decision is an external message to marketing controller

instigating the campaign. The sales strategy decisions such as planned turnover and profit margin are the input for the sales cycle control loop.



Source: own

Figure 5 - Generic e-commerce model supporting simulations

In the presented model the target values comprise profit, revenue, and units sold. The company objective is to sell the highest possible number pieces of products of specified types at optimal prices in the specified term (month). The sales process is modeled by means of control loop consisting of following parts (Figure 5):

- controlled subsystem – the actual REA operational level of the sales cycle; the quantification of results is represented by sales productivity function influenced by market conditions and other parameters;
- measuring part, which transforms the output values of the controlled subsystem into values that are comparable with the target values;
- controller part directly following the measuring part;
- relevant part of the targets database containing the target values.

The controlled subsystem has to sell altogether N types of products. Order realization (number of units sold) depends on market situation, represented by the dependency of sold units on the achieved price.

- company market strength represented by the company market share in the product and the total product sales volume possible in the market;
- competition, the influence of competition is specified as external disturbance influencing the

- control loop;
- product inventory at hand.

In connection with the use of control loop and e-commerce and generally e-business, control loop can be used as a starting model for a number of areas. Theory of control loop is the basis for management of almost all parameters by which the system (in our case e-commerce system) can be described. Control loop may be used in the field of economic indicators, the system features, security, etc. In this context, for example, the control loop can be used for modeling and then simulation of security of business processes presented for example in (Vymětal; Scheller, 2012).

Fundamental initial mathematical description of the simulation model

The simulation model can be described by a set of formulas depicting the market situation, the output indicators and the targets. Generally, basic simulation can be done in terms of customer, vendor or product. In our case we try to find the basic relation between the market environment and the units sold – the customer decision function as a prerequisite for further simulation. The derivation of customer decision function was presented e.g. (Vymětal; Šperka, 2011). As an example, let us define a function based on following factors. Sales controlled subsystem consists of M sellers, who sell N types of products. The sales orders achieved by m -th trader depend on:

- market situation – expressed as a dependence on number of units sold and prices (production function of the seller);
- the strength of company in the market – expressed as a market share of the products and the total market capacity expressed as financial capacity, which can be achieved by selling products;
- the competition on the market (expressed as a coefficient γ) - we understand the impact of competition here as an external disturbance acting on the controlled system;
- the ability of customers to buy - it can also be considered as a possible disturbance;
- the condition of the goods in stock;
- the trader's ability to sell.

For simplicity we will assume an unlimited number of products in the warehouse. Productivity of the m -th seller is determined by the number of units sold of the n -th product type (1):

$$y_n^{mi} = \frac{\tau_n \cdot T_n \cdot \gamma \cdot \rho_m}{Z \cdot M \cdot c_n^m} \quad (1)$$

where:

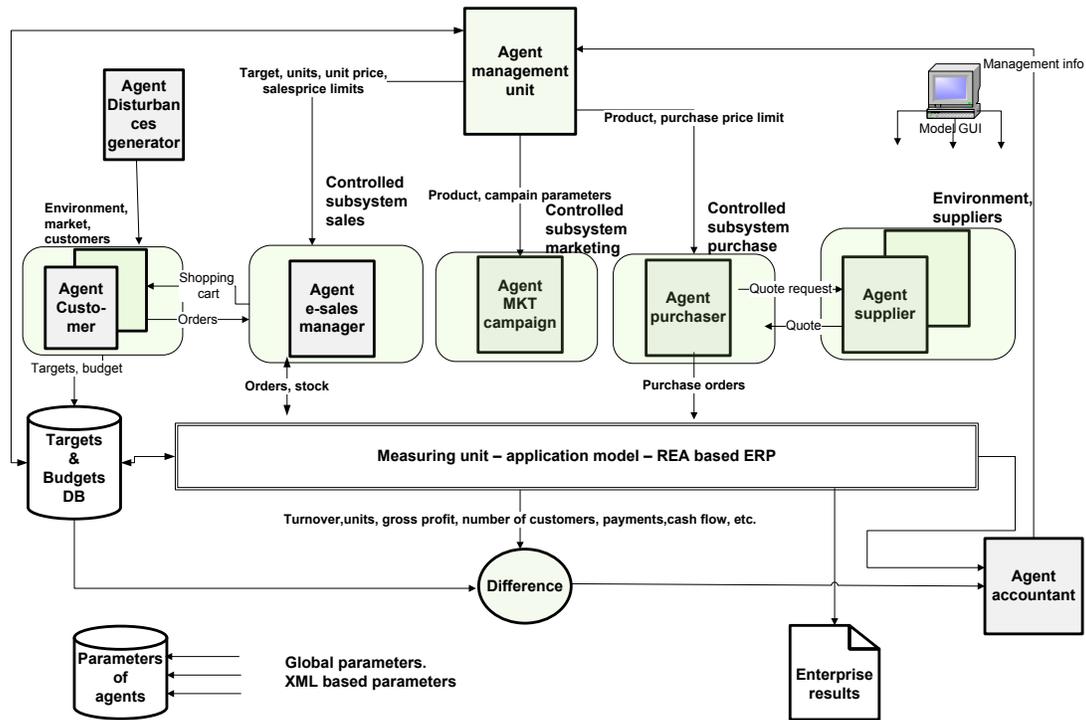
- τ_n – company's market share of n -th product type $0 < \tau < 1$;
- T_n – financial market value for n -th product type;
- γ – competition coefficient decreasing sales success, $0 < \gamma \leq 1$;
- ρ_m – ability coefficient of the m -th seller, $0,5 \leq \rho_m \leq 2$;
- M – total number of sellers;
- Z – total number of customers.

Following the previously mentioned, we assume that the customer's production will be calculated by an agent – called customer (its parameters are the price and pieces of products). In that way we can create production functions relating to sellers, purchase, etc., while each function can be calculated by a special agent. Thus created multiagent system then can be used to simulate the behavior of the whole e-commerce system and for decision support.

Simulation model

Proposed simulation model was realized for a high tech business company using REA ERP system as a measuring and planning element and software agent framework MAREA presented in our previous works (see e.g. (Vymětal; Šperka, 2011), (Vymětal; Scheller, 2012)). General model structure is presented in Figure 6. The model is based on the control loop paradigm. The outputs of controlled

subsystems are registered in the measuring unit – the REA based ERP system, which registers also all activities of the software agents and the development of the basic company KPIs. The differences from target values are sent via accountant agent to the controlling unit – the manager agent who decides about next company strategies, such as marketing campaign, limit purchase and sales price, education of the personnel and others. These decisions are the set as parameters of the internal agents, namely the e-sales manager, purchase representatives and marketing agents.



Source: adapted from (Vymětal; Šperka, 2011) and (Vymětal; Scheller, 2012)

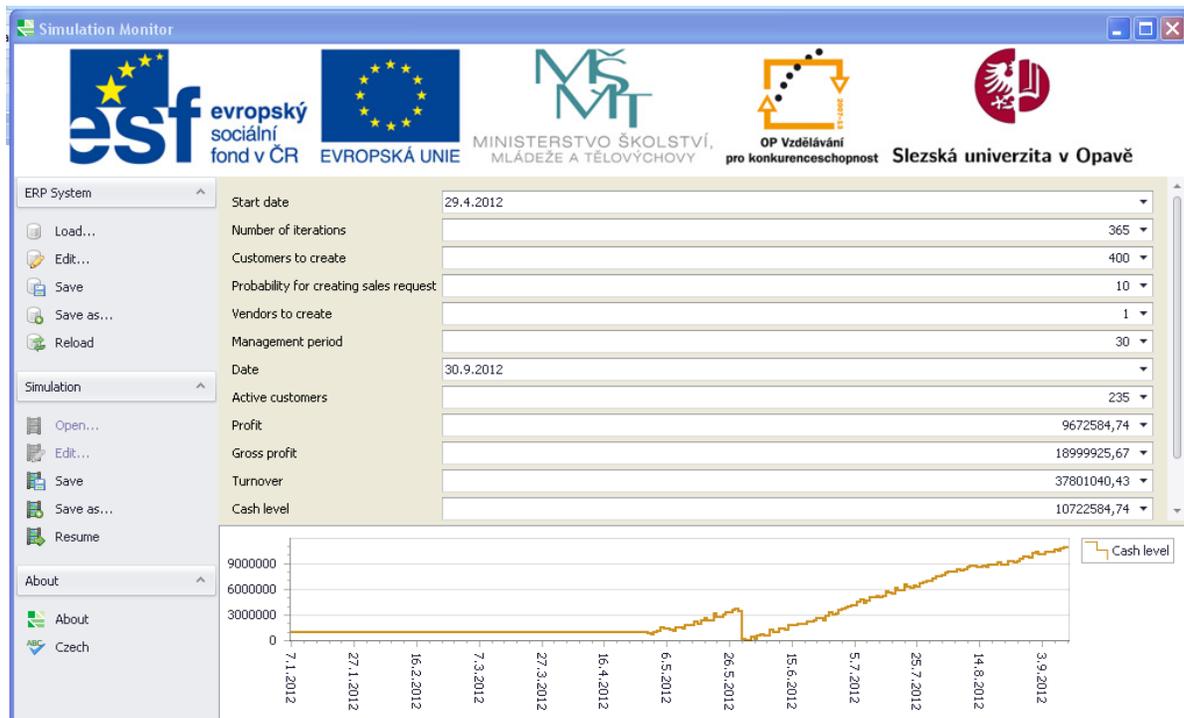
Figure 6 - General simulation model structure

The customer agents generate purchase requests. The purchase requests are generated randomly using random uniform distribution. The e-sales agent then “proposes” the price (this is analogical to the product presentation on the e-commerce web). The customer decides whether to buy or not based on the sales production function. On the purchase side, analogical purchase quote requests are generated by purchase representative agents. This activity uses product information such as minimum stock level, re-ordering point, re-ordering quantity etc.

E-commerce manager and purchase representatives possess an internal parameter called “quality of service” – ability coefficient of the production function improvable by education. The quality of service thus influences the success of sales and purchases. If an advertising campaign on some product is decided by the manager agent, the campaign is started by advertising agent and as a result, the company market share of the product advertised is slightly improved. No matter how simplified the model may be, the results show its real modeling power as presented in the next session. In this context, we have to take into account that communication interface between customers and sales company is a web portal having properties of sales agent. Whereas the permitted range and content focus, implementation and programming of web interface is not included in this article. It should be noted, however, that it is a very interesting issue and development of it takes place in parallel with development of presented simulation software MAREA (Vymětal; Scheller, 2012).

Model results

The simulation was repeatedly carried out for a company dealing with 4 high tech products and two low level furniture products with expected 400 customers. The number of customers was limited due to hardware used for simulation. A period of 365 days was always modeled with management decision period 30 days. The most important KPIs such as revenue (turnover), gross profit, profit, number of active customers and cash on hand were computed in each step by the REA ERP system and delivered to manager agent for decision on the next strategy. In Figure 7 we present the simulation monitor (GUI - Graphical User Interface) output for one simulation (365 days – steps modeled). In the graphical part of the monitor we can see a cash flow development in three months starting on April 30th. An outcome of management decision to start an advertising action is shown on May 30th, after the first management period was finished. The REA ERP system registered the history of the important KPIs. A part of the history is shown in Figure 8. Here we can see the KPI values development for first 12 days of simulation. Management decisions after first and second management periods are shown in Figure 9. After the first period (on May 30th) the marketing action was started and at the end of the second period the manager agent decided to re-negotiate the purchase prices in order to lower the costs.



Source: own

Figure 7 - Simulation monitor output – example

Date	Cash level	Turnover	Gross profit	Profit	Active customers
29.4.2012	1000000	0	0	0	0
30.4.2012	830152,15	249500	79000	-169847,85	4
1.5.2012	660364,16	258500	82000	-339635,84	5
2.5.2012	985695,62	635000	276883,14	-14304,38	8
3.5.2012	1152968,05	840500	360216,07	152968,05	11
4.5.2012	1486901,85	1234250	582343,27	486901,85	12
5.5.2012	1379368,12	1243250	586407,78	379368,12	13
6.5.2012	1379526,67	1269500	598516,17	379526,67	15
7.5.2012	1252222,04	1400750	672558,57	252222,04	16
8.5.2012	1136916,45	1400750	672558,57	136916,45	16
9.5.2012	1565970,76	1898750	929898,61	565970,76	20
10.5.2012	1534023,81	2140000	1065327,61	534023,81	22
11.5.2012	1417661,15	2140000	1065327,61	417661,15	22

Source: own

Figure 8 - History of the KPIs in the first simulated days

Date	Description
30.5.2012	Manager chose to create advertising request
30.5.2012	Manager chose to create advertising request
30.5.2012	Manager chose to create advertising request
30.5.2012	Manager chose to create advertising request
30.5.2012	Manager chose to create advertising request
30.5.2012	Manager chose to create advertising request
30.6.2012	Manager chose to decrease cost of HighTech Copier by 5%
30.6.2012	Manager chose to decrease cost of HighTech Printer by 5%
30.6.2012	Manager chose to decrease cost of Chair by 5%
30.6.2012	Manager chose to decrease cost of Bench by 5%
30.6.2012	Manager chose to decrease cost of PC Set1 by 5%
30.6.2012	Manager chose to decrease cost of PC Set2 by 5%

Source: own

Figure 9 - Management decisions in the first two management periods

By changing various parameters of the agents and other system elements a large number of business simulations can be prepared and realized. This enables to model business situations and probable disturbances affecting the company situation.

Conclusion

While typical process modeling methods concentrate on work- and control flow, value chain modeling perspective takes the added value created during the business process in consideration. This approach opens very interesting perspectives from the system analyst and programmer point of view as the main question asked during the model definition is not “How” the workflow runs, but “Why” it runs in the way as we see it. Of course, the fact that the value chain perspective omits some important features of the process such as starting point splits and joins of control flow and so on, it is important for the presented modeling research that both perspectives are combined together. Using this combination, a generic e-commerce simulation model was presented based on control loop paradigm. In this loop, the measuring part of the model uses REA value chain approach, while the dynamic part of the company and the environment entities such as customers and suppliers are realized as software agents.

The examples of simulation runs were presented paper showing that is possible to use such environment both for e-business modeling and as a decision support tool for company stakeholders. However, several challenges for further research are still open. First, the decision function concept used for customer decision is still too simple and does not take customer budget limitations into consideration. Second, the feedback function and management decision model is to be expanded with the aim to close the control loop more realistically. Third, the presented concept of disturbances from the environment is to be researched taking necessary statistic data as a source for further modeling.

Acknowledgment

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FINANCING CLUSTERS FROM PUBLIC FUNDS IN THE EUROPEAN COUNTRIES

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Abstract

Supporting and financing geographically concentrated industrial clusters became an object of public regional policies as the positive effects raising from spillover of knowledge among the clustered firms and institutions is believed to supporting growth of regional economies. An interesting dimension of the industrial cluster financing is a mode of private and public funds combination that might present a major factor in the success of a cluster. The approach in this paper states research hypotheses on the relation between the share of public funds and innovative performance level of a particular country as well as the length of its EU membership. The empirical investigation is based on an extensive primary research of 125 clusters in 25 European countries. Unexpectedly, the survey has proved significantly higher use of public funds for cluster activities in the countries of innovation leaders and innovation followers (as divided in The Innovation Union Scoreboard 2013), at all national, regional and local levels. Hence, strong financial support of clusters is not prevalently a subject of structural aid to less developed regional economies, but a regular measure in well developed countries with higher innovation performance. Statistically significant differences have been observed also in the structure of financing clusters when comparing old or EFTA countries with new member countries. The paper was elaborated within the project VEGA 1/0506/13.

Keywords: clusters, financing clusters, public funds, private funds.

JEL Classification: O31, R58.

1. Introduction

Financing clusters has been an issue of a number of studies in several European countries (Lämmer-Gamp *et al.*, 2011; Oxford Research AS, 2008; OECD, 2007). Some of the studies were aimed at the position of clusters in the countries of Central and Eastern Europe (Ketels and Sölvell, 2006; Pavelková and Jirčíková, 2008). Financing clusters is possible by employing resources either from the private sector or public sector, or their combinations. The present state of affairs is based on empirical studies partially focused on the sources of financing clusters. Sölvell *et al.* (2003) discovered the public sector as the main source of initial financing of cluster initiatives in 54% cases. Another extensive research (Ketels *et al.*, 2006) revealed that in developing countries the majority of resources come from international donor organizations, in the new EU member countries the greatest share comes from the private sector. The cycles of clusters are time after time marked as missed opportunities, what raises a question of effectively of partial public financing and a proper financial structure according to its public/private ratio and vertical proportioning (EU, national, regional, local). There exist a number of obstacles and gaps to cluster potential realization and the differences can be clearly identified at the country level associated with innovation performance, EU membership length, etc. what is researched extensively by The European Cluster Observatory launched in 2007. The distinction among countries in availability and use of various forms of capital is rather omitted in research so far and not included in the standard mapping of the European clusters.

The main goal of the article is to find out whether statistically significant differences in cluster public support based on the innovation performance of a country's membership in the EU exist. Different structure of financing cluster initiatives is supposed to coincide with the economic power, or innovative performance of the individual EU countries.

2. Theoretical background to financing clusters from public funds

The OECD study (2007) confirmed that the current trends of financing clusters from public funds of cluster programmes dominate in all developed EU countries. This is a true also for some new EU member countries, e.g. Poland, Czech Republic, Bulgaria and Hungary (Charles et al., 2009). In Czech Republic the support of making the cluster initiatives and clusters became one of the activities financed from the structural funds in shortened programming period in the 2004-2006 and later in the following programming period. Also in case of Poland the initiative factor of interest in clusters was the support from the structural funds. Similarly, in Romania, public funds have become more available for the business sector, including cluster members, through the structural funds (Chițu, 2012; Chițu and Tecău, 2012) while the EU funding is considered an important tool contributing to the recovery of the Romanian economy (Bogdan, 2011).

In 2002 Radosevic drew attention to the threats of approach based on the financing of regional clusters from the public resources connected with the questions of tenability of projects after ending of funding from the European resources, and the factitiousness of the whole process with the vague impacts on relationships in networks and on the innovativeness of the clusters supported in this way. This fact is confirmed by Bednářová (2008) who claims that the managers of many clusters in Czech Republic stated that without the donations from operational programme Entrepreneurship and Innovations they cannot guarantee the existence and further development of clusters. Also Žižka (2008) says that majority of clusters funded in the operational programme Industry and Entrepreneurship, sub programme Clusters does not have the presumptions for the increasing of competitiveness of its members and it is not possible to expect essential growth of profit and job creation. These facts were approved by Stejskal and Hájek (2012) who drew attention to many examples from Czech Republic where after restriction or ending of support of cluster from the public resources cluster terminated and so the public resources were spent ineffectively. That is why the representatives at national and regional levels should consider more carefully according to which criteria the clusters supported by public resources will be chosen, so that the highest possible effectivity of public financial resources would be achieved.

The volume and purpose of the funds vary to a great extent depending on the type of cluster and its dominant activities. The OECD study (2007) classifies cluster programmes according to the volume of funds into three groups:

1. building partnerships and networks: the annual finance is usually lower than 100,000 EUR, frequently lower than 50,000 EUR and; as a rule the funding does not last longer than 3 years (Local Production Systems in France or Visanu Programme in Sweden);
2. cluster programmes typical of "light" investments in science and R&D and the provision of common services. The annual budget ranges from 100,000 to 1,000,000 EUR. (The Basque Country's Competitiveness Programme in Spain, the German programme InnoRegio); and
3. programmes with massive investments in science and R&D, the amounts exceeding one million EUR. (The National Cluster Programme in Finland, BioRegio Programme in Germany, VINNVÄXT in Sweden, or Pôles de compétitivité in France).

Public funds are principally employed by cluster organizations – the majority of cluster organizations employ a minimum of 60% of public funds (Lämmer-Gamp et al., 2011). Actually, the budgets of one third of clusters are more than 80% dependent on public funds and only in 20% of the clusters the share of public funds is lower than 20%.

Table 1. Share of public funds in the overall funding of a cluster organization

Shares of public funds in the overall funding of a cluster organization	0-19%	20-39%	40-59%	60-79%	>80%
Number of clusters	29	11	26	34	43

Source: Lämmer-Gamp *et al.* (2011)

Naturally, it is interesting to discover to what degree the cluster policies of the individual member countries determine the share of funds in cluster organizations. The share of public funds in the overall funding of clusters is assumed to be largest in the north-west of Europe – in Finland, Norway, Sweden, Denmark, Iceland and Germany. The most modest share of public funds is in Poland, partly due to the strict cluster policy (for instance, requiring a special legal status for cluster organizations). The empirical research (Oxford Research AS, 2008) assessed the number and type of cluster programmes which differs markedly – 26 were identified in Poland, 23 in Great Britain, 14 in the Netherlands, 12 in Spain, 9 in Austria, and 8 in Germany, whereas only very few (1 or 2) cluster programmes have been implemented in most European countries. Although, the number of cluster programmes correlates only moderately with the total volume of allocated funds (Urbančíková and Burger, 2010). Financing clusters employing venture capital is rather unique (Babcock-Lumish, 2009). Venture capital should be both a source and a signal of added value or benefit by way of stimulating technological innovations in the activities of a cluster.

Nevertheless, the real extent of supporting clusters in different countries is not vivid from the existing grant schemes, there is a great variety of requirements and financial conditions given by the decision-making authorities for clusters as public support recipients in different countries and/or regions. To collect the information on real degree and intensity and forms of financing clusters from public sources must be collected directly at the eventual public sources recipients - clusters.

3. Methodology and hypotheses

The empirical investigation of clusters is based on a vast primary research. The extensive analysis of assorted sources on cluster organisations resulted in a long list of 834 entries from 32 European countries. The prospective clusters were addressed by the authors during the years 2011 and 2012. In total, 125 properly completed questionnaires from 25 European countries have been collected. The response rate, when calculated from the population of potential clusters, was 14.99%. Primarily the facilitators of the clusters were addressed. The majority of responses were received from the cluster representatives in the Czech Republic (17), Germany and Slovakia (14), Hungary (12), Sweden (8), Denmark (7) and Spain (6). Four responses came from the cluster representatives in Austria, Italy, Norway, Poland, Romania, Switzerland and the UK respectively. Three proper responses were sent from each of the countries of the Netherlands and Lithuania. Other European countries delivered only two, one or no response. The sample is not representative at the country level, but the statistical testing is possible at the level of groups of countries of the article interest.

There is a remarkable research question on differences in innovation and cluster policies of the EU countries, particularly the intensity of cluster financing. Finland is the country in Europe with the largest number of national cluster agencies. At the same time, Finland is often referred to as one of the global innovation leaders in terms of international recognized innovation output indicators (Oxford Research AS, 2008). At the same time, the old member countries have a longer history of innovation policy and industrial clusters than the new member countries, especially former post-communist countries which are late in market mechanism building and their cluster policy is not yet well developed. This indicates the existence of the two division lines in the intensity of financial support for clusters - EU membership length and the country innovation performance.

All presented studies support the main thesis of stronger support for clusters from public funds in the countries with higher innovative performance. The aim of the article is to determine whether statistically significant differences in cluster public support based on the innovation performance of a country's membership in the EU exist. Therefore, the research hypotheses of this article pertain to the

investigation of the factual connection between the share of public funds and the level of innovative performance of a particular country and the length of its membership in the European Union.

HYPOTHESIS 1: Clusters in the countries with a higher level of innovative performance generally have a larger share of public funds than those in the countries with a lower level of innovative performance.

HYPOTHESIS 2: Clusters in the old EU member countries have a larger share of public funds than those in the new EU member countries.

The former hypothesis requires innovation performance country classification. The source for its evaluation is Innovation Union Scoreboard 2013 and the main classification tool known as Summary Innovation Index. With respect to this index, the European countries are divided into four groups - innovation leaders, innovation followers, moderate innovators and modest innovators. In this research, the first two groups are considered as the countries with a higher level of innovative performance, the third and the fourth groups are defined as the countries with a lower level of innovative performance. In both selected samples there are a sufficient number of statistical units - 51 clusters (40.80%) with the higher level and 74 clusters (59.20%) with the lower level of innovative performance.

Table 2. Classification of clusters according to the findings of Innovation Union Scoreboard for 2013

	Number	in %
Clusters in the countries of innovation leaders	34	27,20
Clusters in the countries of innovation followers	17	13,60
Clusters in the countries of moderate innovators	63	50,40
Clusters in the countries of modest innovators	11	8,80
TOTAL	125	100,00

Source: Authors' own materials

The latter hypothesis is using a standard classification according to the EU membership length, i.e. the old EU member countries (EU-15), the new EU member countries (EU-13); the third group is formed by the countries of European Free Trade Association (EFTA). The belonging to old or new member countries is divided by the membership before and after the year 2000.

Table 3. Division of clusters based on whether they come from the old or new EU member countries or the EFTA member countries

	Number	in %
Clusters in the EU-15 member countries	55	44
Clusters in the EU-13 member countries	62	49,60
Clusters in the EFTA member countries	8	6,40
TOTAL	125	100,00

Source: Authors' own materials

Public finance for clusters may be allocated from different government levels. The recent research studies (Lindqvist and Sölvell, 2011; Barsoumian *et al.*, 2011; Meier zu Köcker, 2009; Charles, 2009; Sölvell, 2009; Paveleková *et al.*, 2009) have served as the basis for the creation of a suitable method of classifying cluster financing within the system of public funds as follows:

- national budgets (national /governmental funds to finance cluster activities);
- regional budgets (regional funds to finance cluster activities);
- local budgets (municipal funds to support cluster activities);
- and*
- European Union budgets (funding cluster activities from the EU funds).

Private funds studied in the research are categorised into four forms as Internal and external business resources; Bank resources; Venture capital; Business Angels networks (Švejda, 2007; Spišáková, 2010).

The findings of empirical research are clusters with different innovative performance tested with the help of Kruskal-Wallis test and pair comparisons using Mann-Whitney tests with Bonferroni correction in order to determine whether or not it is possible to generalize the equality in the share of public funds in various groups of countries depending on their innovative performance.

Kruskal-Wallis test presents a non-parametric alternative to the single-factor analysis of variance (Sheskin, 2007; Hudec *et al.*, 2007). It is used to compare medians of more than two independent populations providing that the conditions for the use of classical parametric analysis of variance are not met. Kruskal-Wallis test requires neither the fulfilment of the condition for statistical homogeneity of variance nor the normality of distribution. If the null hypothesis is rejected, there is a difference between a minimum of one pair of medians. After the rejection of the null hypothesis in the Kruskal-Wallis test, a post-hoc test is performed with some suitable properties according to the type of data - the Mann-Whitney test with Bonferroni inequality correction. The Mann-Whitney U-test belongs to more powerful non-parametric tests. In order to minimise errors of the second kind, the level of significance is corrected with Bonferroni correction (Field, 2005; Monroe, 2006).

4. The budget structure of clusters in countries with different levels of innovative performance

All public and private funds in cluster budgets are divided into three essential groups:

1. membership fees: these form the basis of revenues in cluster budgets. Most clusters (84.0%) make some use of the membership fees, 16.0 % do without;
2. structural funds and Community Programmes of the European Union, central government and local and regional subsidies and revenues from cluster's own activities: to some minimum extent each of these resources is used by more than the half of clusters; and
3. funds from venture capital funds and the networks of Business Angels are used only by one of the 125 clusters involved in the survey.

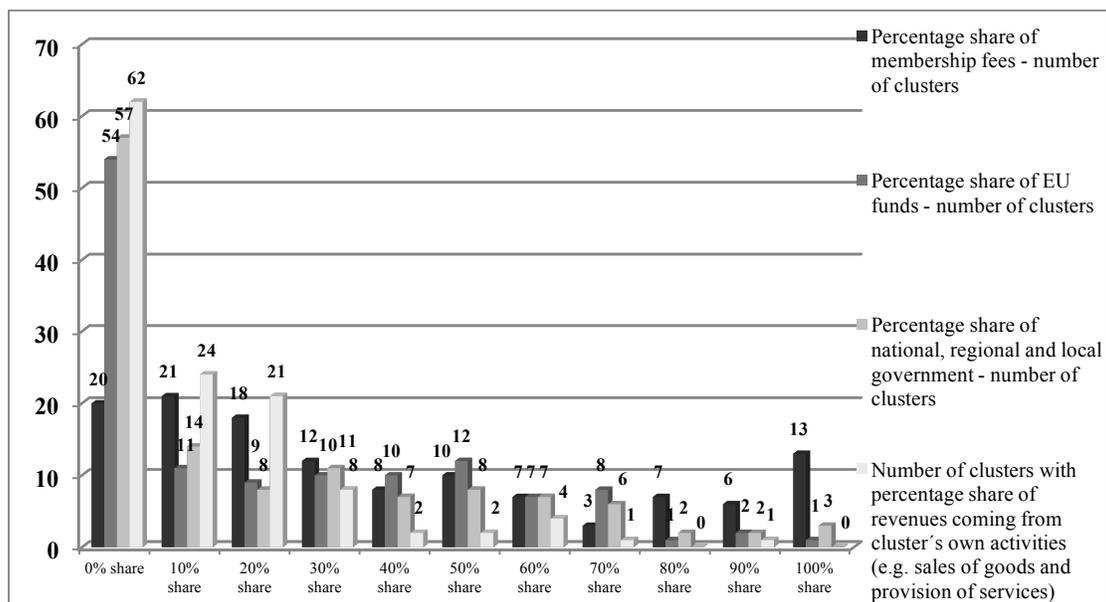


Figure 1. Shares of the individual resources in annual cluster budgets

None of the clusters mentioned any funds coming from the JEREMIE Initiative (Joint European Resources for Micro to Medium Enterprises) as part of its budget and only 7 clusters admitted that their revenues partly come from credit instruments (mostly 10%). It is quite surprising that clusters very rarely

utilize the resources from venture capital funds, Business Angels networks, and the JEREMIE initiative and credit instruments. The other public and private funds, whose share in the budgets of the clusters is much higher, are shown in Figure 1.

Shares of private and public funds in the revenue part of the cluster budgets do not really differ much. Financing from a single type of resource (34 clusters) is typical; in 22 clusters it happens exclusively from private resources and 12 clusters are financed solely publicly. The distribution of the financial structure is peculiar; 25.6% of clusters possess in their budget at least 90% of private sources, while 14.4% of the clusters at the other side rely on minimum of 90% of public funds in their budgets. The share of public funds is rather substantial even in a mixed financing of clusters (private and public funds combined) as is evident from Figure 2.

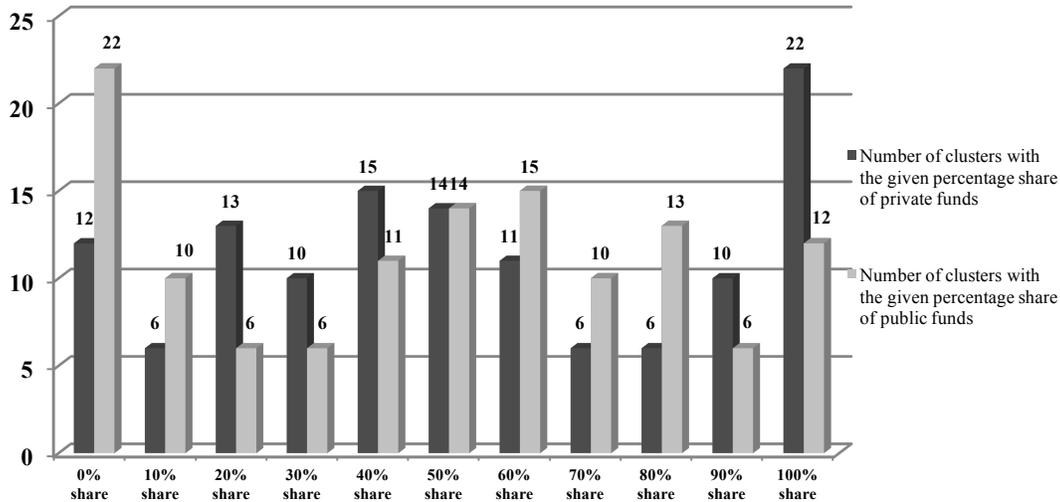


Figure 2. Private and public funds in cluster budgets

Based on the percentage shares of employment of public resources we shall now test the null hypothesis of the equality of shares in the clusters located in the four groups of countries according to their level of innovative performance:

Kruskal-Wallis test

$H_0: \mu_1 = \mu_2 = \mu_3 = \mu_4$

$H_1: \text{non } H_0$

Table 4. Comparison of private and public funds shares in annual cluster budgets according to innovation performance

	Group of countries according to innovative performance	Number of clusters	Average rank	0.05 level of significance	
Share of public funds in annual cluster budgets	Countries of innovation leaders	34	66.54	p-value	0.445
	Countries of innovation followers	17	67.56		
	Countries of moderate innovators	63	58.79		
	Countries of modest innovators	11	48.56		
	TOTAL	125			
0.445 > 0.05 H_0 is not rejected (the differences in the employment of public funds in various groups of countries according to their level of innovative performance are not statistically significant.)					
Share of private funds in annual cluster budgets	Countries of innovation leaders	34	50.66	p-value	0.107
	Countries of innovation followers	17	58.85		
	Countries of moderate innovators	63	65.98		
	Countries of modest innovators	11	77.94		

	TOTAL	125			
0.107 > 0.05 H₀ is not rejected (the differences in the employment of private funds in various groups of countries according to their level of innovative performance are not statistically significant).					

Source: Authors based on the IBM SPSS Statistics outputs

The differences in the employment of public and private funds in the revenue part of the cluster budgets in various groups of clusters according to the level of the innovative performance of a particular country are not statistically significant. Yet the average ranks in the Kruskal-Wallis test suggest decreasing share of public involvement with the lower level of innovation performance. The result can be explained by the overall implementation of the European innovation and cluster policies in all the countries. Modest or moderate innovators have usually at disposal additional source from the European Regional Development Fund substituting the lack of national and regional public money.

Another factor of differences in the employment of a share of public funds in the cluster budgets might be the membership in EU, or its length, respectively. Indeed, several statistically significant differences can be identified among the old and new EU member countries, as well as the EFTA countries.

Kruskal-Wallis test

H₀: $\mu_1 = \mu_2 = \mu_3$

H₁: non H

Table 5. Comparison of shares of private and public funds in annual cluster budgets according to EU membership

	Group of countries according to membership	Number of clusters	Average rank	0.05 level of significance	
Share of public funds	EU-15 countries	55	72.27	p-value	0.006
	EU-13 countries	62	53.97		
	EFTA countries	8	42.94		
	TOTAL	125			
0.006 < 0.05 H₀ is rejected (the difference in the employment of public funds in clusters according to the division into the old and new EU member countries and the EFTA member countries are statistically significant; therefore, pair comparisons using Mann-Whitney tests with Bonferroni correction is performed).					
Share of private funds in annual cluster budgets	EU-15 countries	55	48.45	p-value	0.001
	EU-13 countries	62	70.60		
	EFTA member countries	8	84.06		
	TOTAL	125			
0.001 < 0.05 H₀ is rejected (the difference in the employment of private funds in clusters according to the division into the old and new EU member countries and the EFTA member countries are statistically significant; therefore, pair comparisons using Mann-Whitney tests with Bonferroni correction is performed).					

Source: Authors based on the IBM SPSS Statistics outputs

The Kruskal-Wallis test has shown that the division of the clusters into categories of the EFTA, old and new EU member countries is statistically significant. By making pair comparisons (comparing the shares of public and private funds in annual cluster budgets) using Mann-Whitney test with Bonferroni inequality correction statistically significant differences among the groups of countries are tested.

Mann-Whitney tests with Bonferroni correction

H₀: $\mu_1 = \mu_2$ H₀: $\mu_1 = \mu_3$ H₀: $\mu_2 = \mu_3$

H₁: $\mu_1 \neq \mu_2$ H₁: $\mu_1 \neq \mu_3$ H₁: $\mu_2 \neq \mu_3$

Pair comparisons indicate that differences in financing exist; however, they do not depend much on the cluster's innovative performance factor but on the geographic location of the cluster in the old or new EU member country or in the EFTA member country. The large share of private funds in cluster budgets

is particularly typical of all EFTA member countries, partly due to the fact that as the non-EU members they have no full access to EU funds. In the shares of public and private funds there are no statistically significant differences between the clusters of the EU-13 member countries and the EFTA member countries. Significant differences may be found between the group of EU-15 members (the old member countries) and both the group of EU-13 members and the EFTA member countries in the public and private funds shares.

Table 6. Pair comparisons of shares of public and private funds in annual cluster budgets according to EU membership

	Group of countries according to membership	Number of clusters	Average rank	0.05 level of significance		
Share of public funds	EU-15 countries	55	66.20	p-value	0.006	
	EU-13 countries	62	49.39			
	TOTAL	117				
	0.006 < 0.016667 H₀ is rejected: significant difference					
	EU-15 countries	55	34.07	p-value	0.015	
	EFTA countries	8	17.75			
	TOTAL	63				
	0.015 < 0.016667 H₀ is rejected: significant difference					
	EU-13 countries	62	34.58	p-value	0.500	
	EFTA countries	8	29.69			
	TOTAL	70				
	0.500 > 0.016667 H₀ is not rejected					
Share of private funds	EU-15 countries	55	46.96	p-value	0.001	
	EU-13 countries	62	67.32			
	TOTAL	117				
	0.001 < 0.016667 H₀ is rejected: significant difference					
	EU-15 countries	55	29.49	p-value	0.004	
	EFTA countries	8	49.25			
	TOTAL	63				
	0.004 < 0.016667 H₀ is rejected: significant difference					
	EU-13 countries	62	33.28	p-value	0.407	
	EFTA countries	8	39.31			
	TOTAL	70				
	0.407 > 0.016667 H₀ is not rejected					

Source: Authors based on the IBM SPSS Statistics outputs

Conclusions

The intensity of financial support for clusters employing public funds varies greatly across the European countries. Some recent research studies of other authors have implied a larger share of public finance in the countries with higher innovative performance.

The Hypothesis 1 related to question of higher proportion of public funds in countries with higher levels of innovation performance is not statistically significant. However, Table 4 shows that the average rank in the Kruskal-Wallis test is decreasing with the lower level of innovation performance. Also, the supply of public funds for cluster activities in the countries of innovation leaders and innovation followers is generally more generous at all national, regional and local levels. Similarly, there is a range of private resources on offer in those countries. Clusters in the countries with a lower level of innovative performance have to rely more frequently on the membership fees of cluster members. As a result, lacking resources prevent such clusters from their further development and impede their progress. Representatives

of some clusters operating in the countries with moderate or modest innovation performance expressed an opinion that they commonly have problems to participate in some programmes or respond to public calls as they lack funds to co-finance the projects. This makes the receiving public funds even more complicated for the clusters in their early stage. At the same time the competitiveness of clusters is considerably higher when they are at least partly financed from public funds. Hence, this gives a powerful argument for continuing active public cluster policies.

Hypothesis 2 examines the impact of the length of EU membership on the share of public funds in clusters. This relationship has been statistically displayed - clusters in the old EU countries have in their income structure significantly higher proportion of public resources in comparison to clusters in the new EU member states. Statistically significant differences have been observed in the structure of financing clusters in the old member countries in comparison with the new member countries and the EFTA member countries. Besides, as the cluster support from the national, regional and/or local level in Germany, Sweden, Denmark and Finland has provided enough evidence to prove that these are efficient methods of improving competitiveness of clusters and the regions, similar results could be gradually achieved by the clusters in the new member countries.

The variability of the public sources supporting the cluster activities in the old and new member states depends on the overall country development as well as enhanced networking and trust. Moreover, clustering is a result of historical economic development and a natural model in western countries. The new member states use often the top-down approach in cluster initiatives supporting, what is somewhat extraneous element in the economy of a country or region. Also, the understanding the concept of clusters and their potential contribution to regional competitiveness is generally not well understood by the policy makers.

Another reason of a lower cluster support in the new EU countries is a less developed pro-innovation culture in comparison to the old EU countries. Regional or local level is not involved neither in the research or cluster financing, as it is common in the old EU countries. Following the empirical research results, the differences in supporting clusters from public resources can be confirmed mainly between the group of new EU member countries on one side and the old EU member and EFTA countries on the other side.

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