JOURNAL of Applied Economic Sciences

JAES
Journal of Applied Economic Sciences

Volume VII
Issue 3(21)

Fall 2012

I.S.S.N. 1843-6110

JOURNAL of Applied Economic Sciences

Quarterly Journal

Editorial Board

Publisher:

Spiru Haret University
Faculty of Financial Management Accounting Craiova
Brazda lui Novac Street, no 4 Craiova, Dolj, Romania
Phone: +40 251 598265 Fax : + 40 251 598265

European Research Center of Managerial Studies in Business Administration
http://www.cesmaa.eu
Email: jaes_secretary@yahoo.com *Web:* http://cesmaa.eu/journals/jaes/index.php

*J*ournal of *A*pplied *E*conomic *S*ciences

Journal of Applied Economic Sciences is a young economics and interdisciplinary research journal, aimed to publish articles and papers that should contribute to the development of both the theory and practice in the field of Economic Sciences.

The journal seeks to promote the best papers and researches in management, finance, accounting, marketing, informatics, decision/making theory, mathematical modelling, expert systems, decision system support, and knowledge representation. This topic may include the fields indicated above but are not limited to these.

Journal of Applied Economic Sciences be appeals for experienced and junior researchers, who are interested in one or more of the diverse areas covered by the journal. It is currently published quarterly with three general issues in Winter, Spring, Summer and a special one, in Fall.

The special issue contains papers selected from the International Conference organized by the European Research Centre of Managerial Studies in Business Administration (www.cesmaa.eu) and Faculty of Financial Management Accounting Craiova in each October of every academic year. There will prevail the papers containing case studies as well as those papers which bring something new in the field. The selection will be made achieved by:

Journal of Applied Economic Sciences is indexed in SCOPUS www.scopus.com CEEOL www.ceeol.org, EBSCO www.ebsco.com, RePEc www.repec.org and in IndexCopernicus www.indexcopernicus.com databases.

The journal will be available on-line and will be also being distributed to several universities, research institutes and libraries in Romania and abroad. To subscribe to this journal and receive the on-line/printed version, please send a request directly to jaes_secretary@yahoo.com

Journal of Applied Economic Sciences

ISSN 1843-6110

Table of Contents

THE ACTIVE MANAGEMENT OF THE COMPANY'S TREASURY, A SOLUTION FOR AVOIDING THE CRISIS SITUATIONS

Floarea GEORGESCU
Spiru Haret University, **Romania**
georgescuflori@yahoo.com

Abstract:

One of the most important roles of a company's management is to forecast the future economic conditions in which the company will develop its activity. Based on these forecasts and taking into account the economic, technical and competitive environments, the management establishes the position of future activities. Therefore, the financial forecasted previsions stimulate the results expected by the management.

The working capital management involves on one hand the management of the current assets (stocks, debts, short term investments, liquidities) and on the other hand the management of the current passives (debts to suppliers, employees, banks, state budget), activities which take up the financial management's time.

Keywords: working capital management, current assets, current passives, required financing, operating cycle.

JEL Classification*:* M 21, M 41

1. Introduction

Let's image that in the last years a company has registered an increasing of the production, reflected on the turnover and profit, but does not have the necessary liquidities to pay its debts. Thus, the solution would be to undertake short term credits. Is this situation in which the profit is significant but there aren't enough resources to pay the debts even possible? Yes. Obtaining a positive result does not necessary implicates the existing of liquidities, a phenomenon explicable by the existence of the un-monetary revenues and expenses (which do not affect the treasury) and at the same time by the delaying between the recording of the revenues and expenses in the accounting and their collection/payment. Therefore, how can it be avoided the absence of cash? Through an active management of the company's treasury, a useful solution not only for avoiding the crisis situations generated by the lack of cash, namely by the unfavourable delaying between the payments and collections delaying, a fact which influences the company to appeal on short term credits and implicitly paying the afferent interests, but also the over-sizing of the cash from treasury or account, which generates opportunity costs.

In order for the company to obtain positive cash flow, a good correlation with the collection/payment deadlines should exists and eventual supplementary resources should be determined.

The short term administration is linked to the performance of the entire activity and takes into account two complementary activities: first of all, the determination of the current assets, so the determination of the temporary needs of capital and second, the determination of the financing sources of the current assets necessary, respectively the temporary sources for the operating cycle.

The financing necessary of the operating cycle expresses the total need for capital which determines an efficient development of the operating cycle. Establishing the base of the financing necessary of the operating cycles represents an important stage in the short term financial equilibrium planning, because it provides the information on the size of the capital investments in the current assets. The next step would be the establishment of the current assets resources needed to cover the financing necessary of the operating cycle.

2. Case study

In the following part, we will present a case study on which we will observe how the short term equilibrium is realized, by drawing up a treasury plan. Therefore, we will determine the financing necessary of the operating cycle and its financing sources, using analytical and syntactical methods

based on the operating costs and the turnover, starting from the following information[1] presented in the table below:

Table 1

THE ELEMENT	PRODUCT A	PRODUCT B
Forecasted annual quantities (piece)	281.250	243.750
Norm of consumption (kg/piece)	0,5	0,8
The unitary production cost previously calculated (lei)	50	165
Period of fabrication (days)	8	13
Correction coefficient (K)	0,7	0,93
Unitary cost previously calculated (lei)	60	170
Period of staying in the shop (days)	7	9

Other useful information:

- the unitary price of raw material provisioning is 160 lei/kg;
- the medium interval for conditioning is 4 days;
- the medium internal for internal transportation 3 days;
- the medium duration for invoices discount is 10 days;
- the production complete fabricated an year before 26.573.200 lei;
- the absorption coefficient of current assets rotation through the costal total of the production for the forecasted period, K = 0,22;
- turnover of the last year CA_{N-1} = 43.125.000 lei;
- turnover from the forecasted year CA_N = 100.608.400 lei;
- the absorption coefficient of current assets rotation through the turnover, K_{CA} = 0.20;
- the allocation on trimesters of the annual production which is going to be produced, represented in the complete cost of the planned turnover and the forecasted annual expenses for raw materials, on-going production, end products and delivered products is the following one:

  Q I = 24% Q II = 26% Q III = 25% Q IV = 25%
- the provisioning situation with raw materials is presented in the Table 2;
- the value of inventory items in the previous year was of 93.750 lei, with 37.500 lei inactive inventory;
- the annual acquisitions are 187.500 lei, allocation on trimester according to the percentages presented above;
- the depreciation of the inventory items is 164.400 lei, allocated as following:

  Q I = 39.456 lei; Q II = 42.744 lei;
  Q III = 41.100 lei; Q IV = 41.100 lei.
- the materials stocks is 6.090.000 lei and includes raw and other materials and inventory items;
- the amount of planned expenses for other materials is 652.500 lei, allocated on trimesters as following:

  Q I = 156.600 lei; Q II = 169.650 lei;
  Q III = 163.125 lei; Q IV = 163.125 lei.

[1] Vintilă, G. 2010. The financial administration of the enterprise, Didactica and Pedagogica Publishing House, Bucharest, pp. 329-348.

Table 2.The provisioning situation with raw materials

DATE OF PROVISIONING	INTERVAL BETWEEN TWO CONSECUTIVE PROVISIONING	PROVISIONING QUANTITIES
31.Oct	30 days from the last provisioning	37.500
15.Mar	44 days from the last provisioning	75.000
19.Jun	96 days from the last provisioning	37.500
25.Sep	98 days from the last provisioning	75.000
31.Oct	37 days from the last provisioning	75.000
18.Dec	48 days from the last provisioning	50.000

Table 3. Balance sheet at 31.12. N-1-lei

THE ELEMENT	AMOUNT
Fixed assets	11.250.000
Current assets:	8.529.200
d.c: Materials	6.090.000
On-going products	840.000
End products	730.700
Clients	868.500
Short term debts	7.000.000
d.c: Suppliers	4.375.000
Diverse creditors	375.000
Treasury credits	2.250.000
Financial debts	8.529.200
Own equity	4.250.000

Solving plan

A. The determination of the financing necessary of operating cycle

1. Analytical methods to determine the financing necessary:
   1.1. Analytical methods based on costs;
   1.2. Analytical methods based on turnover;
2. Syntactical methods to determine the financing necessary
   2.1. Syntactical method based on the cost turnover;
   2.2. Syntactical method based on current asset to 1.000 de lei manufactured production (AC/1000);
   2.3. Syntactical method based in the kinetic rate of current assets

B. The determination of the financing sources of operating cycle

1. The determination of the established sources of financing;
2. The determination of the treasury credits;

Solution:

A. The determination of the financing necessary of operating cycles:

1. Analytical methods to determine the financing necessary:

1.1 Analytical method based on costs:

- *The determination of the annual medium financing necessary and the trimestral one for the raw materials stock:*

The necessary of raw materials will be:

$$\mathbf{FN} = \sum_{n=1}^{2} (Q \times Nc \times Up)$$

Where:
FN = financing necessary;
Q = quantity of products to be fabricated;
Cn = consumption norm;

Up = unitary price of the supply;
FN = [(281.250 x 0.5) + (243.750 x 0.8)] x 160 = 53.700.000 lei

- *The annual medium financing necessary for the raw materials stock will be*:

$$\textbf{FN Raw materials} = \frac{FN}{360}\left(\frac{I}{2} + S + C + T\right)$$

Where:
I = the medium interval of time between two consecutive provisioning
S = the medium interval of time for the safety stock
C = the intervals for conditioning
T = the medium interval for interior transport

$$\textbf{FN}_{\textbf{Raw materials}} = \frac{FN}{360} \times T_{IT}$$

Where:
$\boldsymbol{T_{IT}}$ = the total time of immobilization

a) The determination of the medium interval for two consecutive provisioning (I), as a weighted arithmetical mean of the provisioned quantities and the interval of time between two consecutive provisioning:

$$\textbf{I} = \frac{\sum C_I \times T_I}{\sum C_I}$$

Where:
$\boldsymbol{C_I}$ = the provisioned quantities
$\boldsymbol{T_I}$ = the intervals between two consecutive provisioning

$$\textbf{I} = \frac{(37.500 \times 30) + (75.000 \times 44) + (37.500 \times 96) + (75.000 \times 98) + (75.000 \times 37) + (50.000 \times 48)}{37.500 + 75.000 + 37.500 + 75.000 + 75.000 + 50.000}$$

$$\textbf{I} = \frac{20.550.000}{350.000} \approx 59 \text{ days}$$

b) The determination of the medium interval for the safety stock (S), as weighted arithmetical mean of the provisioning quantities with delaying and the delaying time:

Table 4.

The interval between two provisioning (T_I)	Medium interval (I)	The deviation from the mediu interval (T_A)	Q_I	$Q_I \times T_A$
30		- 29		
44		- 15		
96	59	+ 37	37.500	1.387.500
98		+ 39	75.000	2.925.000
37		- 22		
48		- 11		
TOTAL			112.500	4.312.500

$$\textbf{S} = \frac{\sum Q_I \times T_A}{\sum Q_I} = \frac{4.312.500}{112.500} = 38.3 \text{ days}$$

$$\mathbf{FN}_{\mathbf{Raw\ materials}} = \frac{FN}{360}\left(\frac{I}{2}+S+C+T\right) = \frac{53.700.000}{360}\times\left(\frac{59}{2}+38{,}3+4+3\right)$$

$\mathbf{FN}_{\mathbf{Raw\ materials}} = 11.157.667$ lei

- *The determination of the financing necessary for any type of raw materials stock:*
  - $S_{CRT} = \frac{N}{360}\times\frac{I}{2} = \frac{53.700.000}{360}\times\frac{59}{2} = 4.400.417$ lei
  - $S_{SIG} = \frac{N}{360}\times S = \frac{53.700.000}{360}\times 38{,}3 = 5.713.083$ lei
  - $S_{COND} = \frac{N}{360}\times C = \frac{53.700.000}{360}\times 4 = 596.667$ lei
  - $S_{TRANSP} = \frac{N}{360}\times T = \frac{53.700.000}{360}\times 3 = 447.500$ lei

- *The annual medium duration of rotation of raw materials stocks*:

$$\overline{D}_{\text{raw materials}} = \frac{FN_{\ rawmaterials}\times 360}{FN} = \frac{11.157.667\times 360}{53.700.000} = 74{,}8\ \text{Days}$$

$$\overline{D}_{\ rawmaterials} = 74.8\ \text{Days}$$

- *The quarterly financing necessary for raw materials stocks, by allocating the total annual necessary (NF), according to the following percentages:*
  - $FN_{\ QuartI}$ 24% $\rightarrow$ 12.888.000 lei;
  - $NF_{\ QuartII}$ 26% $\rightarrow$ 13.962.000 lei;
  - $NF_{\ Quarter} \rightarrow$ 13.425.000 lei;
  - $NF_{\ Trim\ IV}$ 25% $\rightarrow$ 13.425.000 lei;

$$FN_{\ \text{raw materials quarterly}} = \frac{FN_{\ \text{quarter}}\times \overline{D}_{raw\text{materials}}}{90}$$

- $FN_{Raw.materials}\ QuarterI = \frac{12.888.000\times 74{,}8}{90} = 10.711.360$ lei
- $FN_{Raw.materials}\ QuarterII = \frac{13.962.000\times 74.8}{90} = 11.603.973$ lei
- $FN_{Raw.materials}\ QuarterIII = \frac{13.425.000.\times 74{,}8}{90} = 11.157.667$ lei
- $FN_{Raw.materials}\ QuarterIV = \frac{13.425.000.\times 74{,}8}{90} = 11.157.667$ lei

- *The determination of the annual and quarterly medium financing necessary for diverse materials*

The amount of the planned expenses for diverse materials is 652.500 lei, allocated on trimesters as follows:

- $FN_{\ QuarterI}$ 24% $\rightarrow$ 12.888.000 lei;
- $FN_{\ Quarter\ II}$ 26% $\rightarrow$ 13.962.000 lei;
- $FN_{\ Quarter\ III}$ 25% $\rightarrow$ 13.425.000 lei;
- $FN_{\ Quarter\ IV}$ 25% $\rightarrow$ 13.425.000 lei;

$$FN_{\text{Diverse materials quarterly}} = \frac{Diverse\ exepenses_{quarterly}}{FN_{quarterly}} \times FN_{raw materials\ quarterly}$$

- $FN_{Diverse.materials}\ Quarter I = \frac{156.600}{12.888.000} \times 10.711.360 = 130.152$ lei;
- $FN_{Diverse.materials}\ Quarter II = \frac{169.650}{13.962.000} \times 11.603.973 = 140.998$ lei;
- $FN_{Diverse.materials}\ Quarter III = \frac{163.125}{13.425.000} \times 11.157.667 = 135.575$ lei;
- $FN_{Diverse.materials}\ Quarter IV = \frac{163.125}{13.425.000} \times 11.157.667 = 135.575$ lei;

- *The determination of annual and quarterly financing necessary for the unfinished production (on-going production)*

We have the following information in Table 5:

Table 5.

Q_A= 281.250 pieces	Cp_A= 50 lei	K_A= 0,7	D_A= 8 days
Q_B= 243.750 pieces	Cp_B= 165 lei	K_B= 0,93	D_B= 13 days

Where:
Q_A and Q_B = the forecasted annual quantities for products A and B*;*
Cp = the annual post calculated cost of production*;*
K = the correction coefficient
D = the time of production in days

1) The annual value of the production at cost of production:

$$V_{Cp} = Q \times Cp$$

$V_{Cp}A = 281.250 \times 50 = 14.062.500$ lei
$V_{Cp}B = 243.750 \times 165 = 40.218.750$ lei

2) The annual medium financing necessary for unfinished production (FNup)

$$FN_{UP} = \frac{V_{Cp} \times K_i}{360} \times D_i$$

$$FN_{Up}A = \frac{14.062.500 \times 0,7}{360} \times 8 = 218.750 \text{ lei}$$

$$FN_{Up}B = \frac{40.218.750 \times 0,93}{360} \times 13 = 1.350.680 \text{ lei}$$

3) The annual medium time of fabrication ($\overline{Da}$)

$$\overline{Da} = \frac{FN_{UP} \times 360}{V_{Cp}}$$

$$FN_{UP}(A+B) = 218.750 + 1.350.680 = 1.569.430 \text{ lei}$$
$$V_{Cp}(A+B) = 14.062.500 + 40.218.750 = 54.281.250 \text{ lei}$$

$$\overline{Da} = \frac{1.569.430 \times 360}{54.281.250} = 10,4 \text{ Days}$$

4) The quarterly financing necessary for on-going production:

The following percentages are applied for the allocation on quarters of the annual production value at production cost (54.281.250 lei):

- V_{Cp}Q I 24% $\rightarrow$ 13.027.500 lei
- V_{Cp}Q II 26% $\rightarrow$ 14.113.124 lei
- V_{Cp}Q III 25% $\rightarrow$ 13.570.313 lei
- V_{Cp}Q IV 25% $\rightarrow$ 13.570.313 lei

$$FN_{UP}Quarterly = \frac{V_{Cp}Quarter \times \overline{Da}}{90}$$

- $FN_{UP}QuarterI = \frac{13.027.500 \times 10,4}{90} = 1.505.400$ lei
- $FN_{UP}QuarterII = \frac{14.113.124 \times 10,4}{90} = 1.630.850$ lei
- $FN_{UP}QuarterIII = \frac{13.570.313 \times 10,4}{90} = 1.568.125$ lei
- $NF_{UP}QuarterIV = \frac{13.570.313 \times 10,4}{90} = 1.568.125$ lei

- *The determination of the annual and quarterly medium financing necessary for end products:*

We have the following information in Table 6:

Table 6.

Q_A= 281.250 pieces	C_CA= 60 lei	D_{st}A= 7 days
Q_B= 243.750 pieces	C_CB= 170 lei	D_{st}B= 9 days

Where:
***C*$_C$** = the unitary post calculated complete cost;
***D*$_{st}$** = the period of time in which the two products stay in shops.

1) The annual value of production at complete cost (V_{Cc}):

$$\mathbf{V_{Cc}} = \mathbf{Q} \times C_C$$

V_{Cc}A= 281.250× 60= 16.875.000 lei
V_{Cc}B= 243.750×170= 41.437.500 lei
V_{Cc} A+B= 58.312.500 lei

2) The annual medium financing necessary for finished products (FN_{FP}):

$$FN_{FP} = \frac{V_{Cc} + D_{st}}{360}$$

$$FN_{FP}A = \frac{16.875.000 \times 7}{360} = 328.125 \text{ lei}$$

$$FN_{FP}B = \frac{41.437.500 \times 9}{360} = 1.035.938 \text{ lei}$$

FN_{FP} A+B = 1.364.063 lei

3) The medium annual storage time of finished products ($\overline{D}_{st}$):

$$\overline{D}_{st} = \frac{FN_{FP} \times 360}{V_{Cc}}$$

$$\overline{D}_{st} = \frac{1.364.063 \times 360}{58.312.500} = 8.42 \text{ Days}$$

4) The quarterly financing necessary for end products:
The allocation on quarters of the annual production at complete cost (58.312.500 lei):

- V_{Cc} Quarter I 24% → 13.995.000 lei
- V_{Cc} Quarter II 26% → 15.161.250 lei
- V_{Cc} Quarter III 25% → 14.578.125 lei
- V_{Cc} Quarter IV 25% → 14.578.125 lei

$$FN_{FP}Quarterly = \frac{V_{Cc}Quarter \times \overline{D}_{st}}{90}$$

- $FN_{FP}QuarterI = \frac{13.995.000 \times 8,42}{90} = 1.309.310$ lei
- $FN_{FP}QuarterII = \frac{15.161.250 \times 8,42}{90} = 1.418.419$ lei
- $FN_{FP}QuarterIII = \frac{14.578.125 \times 8,42}{90} = 1.363.865$ lei
- $FN_{FP}QuarterIV = \frac{14.578.125 \times 8,42}{90} = 1.363.865$ lei

- *The determination of the medium quarterly financing necessary at charged but uncollected products (clients):*

$$FN_{Clients}Quarter = \frac{V_{Cc}Quarter \times \overline{D}_{i}}{90}$$

Where:
$\overline{D}_{i}$ = *The medium collection period of the charged product;*
$\overline{D}_{i}$ = *10 days*

- $FN_{Clients}QuarterI = \frac{13.995.000 \times 10}{90} = 1.555.000$ lei
- $FN_{Clients}QuarterII = \frac{15.161.250 \times 10}{90} = 1.684.583$ lei
- $FN_{Clients}QuarterIII = \frac{14.578.125 \times 10}{90} = 1.619.792$ lei

- $FN_{Clients} QuarterIV = \frac{14.578.125 \times 10}{90} = 1.619.792 \text{ lei}$

- *The determination of the annual and quarterly financing necessary for inventory times:*

$$FN_{Working.inventory} = S_I + A_T - S_{FM} - U_Z$$

Where:
S_I = initial stocks
A_T = quarterly acquisitions
S_{FM} = inactive inventory
U_Z = depreciation of the inventory items

We have the following information:
- S_I= 93.750 lei
- S_{FM}= 37.500 lei
- Quarterly acquisitions is 187.500 lei, allocated on trimesters as follows:
  - Quarter I 24% $\rightarrow$ 45.000 lei
  - Quarter II 26% $\rightarrow$ 48.750 lei
  - Quarter III 25% $\rightarrow$ 46.875 lei
  - Quarter IV 25% $\rightarrow$ 46.875 lei
- The depreciation of the inventory items is 164.400 lei, allocated as follows:
  - Quarter I $\rightarrow$ 39.456 lei
  - Quarter II $\rightarrow$ 48.519 lei
  - Quarter III $\rightarrow$ 29.550 lei
  - Quarter IV $\rightarrow$ 46.875 lei

$$FN_{working.invetory} = 93.750 + 187.500 - 37.500 - 164.400 = 79.350 \text{ lei}$$

$FN_{working.invetory} = 79.350$ lei (the stock at the end of the forecasted year)

The quarterly allocation of the financing necessary for inventory items is:

$$FN_{Working.inventory} QuarterI = 93.750 - 37.500 + 45.000 - 39.456 = 61.794 lei$$

$$FN_{Working.inventory.} QuarterII = 61.794 + 48.750 - 48.519 = 62.025 lei$$

$$FN_{Working.inventory.} QuarterIII = 62.025 + 46.875 - 29.550 = 79.350 lei$$

$$FN_{Working.invetory.} QuarterIV = 79.350 + 46.875 - 46.875 = 79.350 lei$$

Table 7.The summary of the financing necessary for current assets determined through analytical methods based on costs *-lei-*

Current asset	*Quarter I*	*Quarter II*	*Quarter III*	*Quarter IV*
1. The financing necessary for materials stocks	10.903.306	11.806.996	11.372.592	11.372.592
-raw materials and materials	10.711.360	11.603.973	11.157.667	11.157.667
-diverse materials	130.152	140.998	135.575	135.575
-inventory items	61.794	62.025	79.350	79.350
2. Unfinished production	1.505.400	1.630.850	1.568.125	1.568.125
3. Finished products	1.309.310	1.418.419	1.363.865	1.363.865
TOTAL	**15.273.016**	**16.540.848**	**15.924.374**	**15.924.374**

2.1 Analytical methods based on turnover

- *The determination of the quarterly financing necessary on four categories of assets:*

$$FNQuarter = \frac{CA_{Trim}pl}{90} \times R_C \times (1 - K_{AC})$$

Where:
$\boldsymbol{CA_{Trim}pl}$ = forecasted quarterly turnover;
$\boldsymbol{R_C}$ = kinetic rate specific to each category of stocks;
$\boldsymbol{K_{AC}}$ = the acceleration coefficient of the current asset rotation as against the turnover.

The turnover allocated on trimesters from the forecasted year, 100.608.400 lei, will be:

- $CA_0 QuarterI 24\% \rightarrow 24.146.000 lei$;
- $CA_0 QuarterII 26\% \rightarrow 26.158.200 lei$;
- $CA_0 QuarterIII 25\% \rightarrow 25.152.100 lei$;
- $CA_0 QuarterIV 25\% \rightarrow 25.152.100 lei$.

$$R_C = \frac{Materials.balance}{CA_0} \times 360$$

- $R_C Mat. = \frac{6.090.000}{43.125.000} \times 360 = 50{,}8 \text{ days};$
- $R_C UP = \frac{840.000}{43.125.000} \times 360 = 7{,}01 \text{ days};$
- $R_C FP = \frac{730.700}{43.125.000} \times 360 = 6{,}1 \text{ days};$
- $R_C Clients = \frac{868.500}{43.125.000} \times 360 = 7{,}25 \text{ days}.$

- The financing necessary for Quarter I:

$$FN_{Mat} = \frac{24.146.000}{90} \times 50{,}8 \times (1 - 0{,}2) = 10.903.260 lei ;$$

$$FN_{UP} = \frac{24.146.000}{90} \times 7{,}01 \times (1 - 0{,}2) = 1.504.564 lei ;$$

$$FN_{FP} = \frac{24.146.000}{90} \times 6{,}1 \times (1 - 0{,}2) = 1.309.250 lei ;$$

$$FN_{Clients} = \frac{24.146.000}{90} \times 7{,}25 \times (1 - 0{,}2) = 1.553.929 lei .$$

- The financing necessary for quarter II:

$$FN_{Mat} = \frac{26.158.200}{90} \times 50.8 \times (1 - 0{,}2) = 11.811.880 lei ;$$

$$FN_{UP} = \frac{26.158.200}{90} \times 7{,}01 \times (1 - 0{,}2) = 1.629.947 lei ;$$

$$FN_{FP} = \frac{26.158.200}{90} \times 6{,}1 \times (1 - 0{,}2) = 1.418.356 lei ;$$

$$FN_{Clients} = \frac{26.158.200}{90} \times 7{,}25 \times (1 - 0{,}2) = 1.685.750 lei ;$$

- The financing necessary for quarter III:

$$FN_{Mat.} = \frac{25.152.100}{90} \times 50,8 \times (1-0,2) = 11.357.570 lei\ ;$$

$$FN_{UP} = \frac{25.152.100}{90} \times 7,01 \times (1-0,2) = 1.567.255 lei\ ;$$

$$FN_{FP} = \frac{25.152.100}{90} \times 6.1 \times (1-0,2) = 1.363.802 lei\ ;$$

$$FN_{Clients} = \frac{25.152.100}{90} \times 7,25 \times (1-0,2) = 1.620.913 lei\ .$$

- The financing necessary for quarter IV:

$$FN_{Mat.} = \frac{25.152.100}{90} \times 50,8 \times (1-0,2) = 11.357.570 lei\ ;$$

$$FN_{UP} = \frac{25.152.100}{90} \times 7,01 \times (1-0,2) = 1.567.255 lei\ ;$$

$$FN_{FP} = \frac{25.152.100}{90} \times 6.1 \times (1-0,2) = 1.363.802 lei\ ;$$

$$FN_{Clients} = \frac{25.152.100}{90} \times 7,25 \times (1-0,2) = 1.620.913 lei\ .$$

In Table 8 we compared the financing necessary determined through analytical methods. From this study we can observe that using both methods we can obtain similar results, a fact which influences the use of some or other analytical methods. The analytical methods based on cots, compared to those methods based on turnover, have a higher degree of synthesizing, but are not recommended because of the complexity of calculations and the increased costs which they involve.

Table 8.The compared situation of the financing necessary determined through analytical methods -*thousand lei*-

The current asset	*Analytical methods based on costs*				*Analytical methods based on turnover*			
	Q I	*Q II*	*Q III*	*Q IV*	*Q I*	*Q II*	*Q III*	*Q IV*
Stocks	10.903,30	11.807,00	11.372,60	11.372,60	10.903,30	11.811,90	11.357,60	11.357,60
On-going production	1.505,40	1.630,90	1.568,10	1.568,10	1.504,60	1.629,90	1.567,30	1.567,30
End products	1.309,30	1.418,40	1.363,90	1.363,90	1.309,30	1.418,40	1.363,80	1.363,80
Delivered Products(Clients)	1.555,00	1.684,60	1.619,80	1.619,80	1.553,90	1.685,80	1.620,90	1.620,90
TOTAL	**15.273,00**	**16.540,90**	**15.924,40**	**15.924,40**	**15.271,10**	**16.546,00**	**15.909,60**	**15.909,60**

3. Syntactical methods to determine the financing necessary

3.1 The syntactical methods based on the turnover speed depending on costs

- *The determination of the quarter financing necessary at total current assets, based on the turnover speed from the previous period:*

$$FN_{Quarter} = \frac{V_{Cc}\ forcasted}{90} \times Dr_0 \times (1+K_C)$$

Where:
$\boldsymbol{V_{Cc}forcasted}$ = the quarterly production at complete cost in the forecasted *year;*
$\boldsymbol{Dr_0}$ = the turnover speed from the previous period*;*
$\boldsymbol{K_C}$ = the acceleration coefficient of the current asset turnover through the production cost.

$$Dr_0 = \frac{S_{AC_0}}{V_{Cc_0}} \times 360$$

Where:

S_{AC_0} = the medium stock of current assets from the base year

We have the following information:

- The production in complete cost from the forecasted year 58.312.500 lei (281.250 x 60 + 243.750 x 170), is allocated quarterly as follows:
  - Q I 24% $\rightarrow$ 13.995.000 lei;
  - Q II 26% $\rightarrow$ 15.161.250 lei;
  - Q III 25% $\rightarrow$ 14.578.125 lei;
  - Q IV 25% $\rightarrow$ 14.578.125 lei.
- The production of goods fabricated in the previous year (V_{Cc0}) was 26.573.200 lei.
- K_C= 0,15

a) the determination of the turnover speed from the current period:

$$Dr_0 = \frac{8.529.200}{26.573.200} \times 360 = 115{,}55 zile$$

b) the determination of the quarterly financing necessary on total current assets:

- $FN_{QuarterI} = \frac{13.995.000}{90} \times 115{,}55 \times (1 - 0{,}15) = 15.272.821 lei$;
- $FN_{QuarterII} = \frac{15.161.250}{90} \times 115{,}55 \times (1 - 0{,}15) = 16.545.556 lei$;
- $FN_{QuarterIII} = \frac{14.578.125}{90} \times 115{,}55 \times (1 - 0{,}15) = 15.909.189 lei$;
- $FN_{QuarterIV} = \frac{14.578.125}{90} \times 115{,}55 \times (1 - 0{,}15) = 15.909.189 lei$.

The allocation of the total financing necessary, according to the percentages of the current assets balances in the total annual sold, from the previous period (P_{E_0}).

$$FN_{elements} = \frac{FN_{Quarter} \times P_{E_0}}{100}$$

$$P_{E_0} = \frac{\text{Balance of current assets'elements}}{\text{Balance of current assets}} \times 100$$

a) the determination of the current asset the percentages of the current assets sold in the total annual sold l:

- $P_{Mat.} = \frac{Balance.MaterialsAccount}{Balance.CurrentAssets_0} \times 100 = \frac{6.090.000}{8.529.200} \times 100 = 71.4\%$;
- $P_{UP} = \frac{Balance.PNaccount}{Balance.CurrentAssets_0} \times 100 = \frac{840.000}{8.529.200} \times 100 = 9{,}85\%$;
- $P_{FP} = \frac{Balance.FPaccount}{Balance.CurrentAssets_0} \times 100 = \frac{730.700}{8.529.200} \times 100 = 8{,}57\%$;

- $P_{Clients} = \frac{Balance.ClientsAccount}{Balance.CurrentAssets_0} \times 100 = \frac{868.500}{8.529.200} \times 100 = 10,18\%$.

b) the determination of the financing necessary on elements of current assets:

- The financing necessary on elements in Q I:
  $FN_{Mat} = 15.272.821 \times 71.4 = 10.904.794 lei$
  $FN_{UP} = 15.272.821 \times 9,85 = 1.504.372 lei$
  $FN_{FP} = 15.272.821 \times 8,57 = 1.308.880 lei$
  $FN_{Clients} = 15.272.821 \times 10,18 = 1.554.773 lei$

  The financing necessary on elements in Q II:
  $FN_{Mat} = 16.545.556 \times 71.4 = 11.813.527 lei$;
  $FN_{UP} = 16.545.556 \times 9,85 = 1.629.737 lei$;
  $FN_{FP} = 16.545.556 \times 8,57 = 1.417.954 lei$;
  $FN_{Clients} = 16.545.556 \times 10,18 = 1.684.338 lei$

- The financing necessary on elements in Q III:
  $FN_{Mat} = 15.909.189 \times 71.4 = 11.359.160 lei$
  $FN_{UP} = 15.909.189 \times 9,85 = 1.567.055 lei$
  $FN_{FP} = 15.909.189 \times 8,57 = 1.363.417 lei$
  $FN_{Clients} = 15.909.189 \times 10,18 = 1.619.555 lei$

  The financing necessary on elements in Q IV:
  $FN_{Mat} = 15.909.189 \times 71.4 = 11.359.160 lei$;
  $FN_{UP} = 15.909.189 \times 9,85 = 1.567.055 lei$;
  $FN_{FP} = 15.909.189 \times 8,57 = 1.363.417 lei$;
  $FN_{Clients} = 15.909.189 \times 10,18 = 1.619.555 lei$.

3.2 The syntactical method based on AC/1000 lei fabricated production

$$AC/_{1000} = \frac{S_{AC_0}}{V_{Cc_0}} \times 1000$$

Where:
V_{Cc_0} = *the production of goods fabricated in the previous year*

$$NF_{Trim} = \frac{V_{Cc} Trim.\ previz. \times AC/_{1000} \times 4}{1000} \times (1 - K_C)$$

a) the determination of $AC/_{1000}$ lei production fabricated in the previous year:

$$AC/_{1000} = \frac{8.529.200}{26.573.200} \times 1000 = 320,97 \text{ lei/1000}$$

b) the determination of the quarterly financing necessary in the current assets total:

- $FN_{QuarterI} = \frac{13.995.000 \times 320,97 \times 4}{1000} \times (1 - 0,15) = 15.272.716 lei$
- $FN_{QuarterII} = \frac{15.161.250 \times 320,97 \times 4}{1000} \times (1 - 0,15) = 16.545.441 lei$
- $FN_{QuarterIII} = \frac{14.578.125 \times 320,97 \times 4}{1000} \times (1 - 0,15) = 15.909.079 lei$
- $FN_{QuarterIV} = \frac{14.578.125 \times 320,97 \times 4}{1000} \times (1 - 0,15) = 15.909.079 lei$

3.3 The syntactical method based on the kinetic rate of the current assets (R_C)

$$R_C = \frac{S_{AC_0}}{CA_0} \times 360$$

$$FN_{Quarter} = \frac{CA_{Quarter.}\,forcasted}{90} \times R_C \times (1 - K_{CA})$$

Where:

$\boldsymbol{CA_{quarter}}.forcasted$ = the forecasted quarterly turnover

$\boldsymbol{R_{CA}}$ = the acceleration coefficient of rotation as against the turnover

We have the following information:

- CA_0 = 43.125.000 lei
- $CA_{previz.}$ = 100.608.400 lei, allocated on trimesters as follows:
  Q I: 24% → 24.146.016 lei; Q:II 26% → 26.158.184 lei;
  Q III: 25% → 25.152.100 lei; Q: IV 25% → 25.152.100 lei.
- K_{CA}= 0.20

a) the determination of the kinetic rate for the current period (R_C):

$$R_C = \frac{8.529.200}{43.125.000} \times 360 = 71{,}2 days$$

b) the determination of the financing necessary on the total current assets:

- $FN_{QuarterI} = \frac{24.146.016}{90} \times 71{,}2 \times (1 - 0{,}2) = 15.281.745 lei$;
- $FN_{QuarterII} = \frac{26.158.184}{90} \times 71{,}2 \times (1 - 0{,}2) = 16.555.224 lei$;
- $FN_{QuarterIII} = \frac{25.152.100}{90} \times 71{,}2 \times (1 - 0{,}2) = 15.918.484 lei$;
- $FN_{QuarterIV} = \frac{25.152.100}{90} \times 71{,}2 \times (1 - 0{,}2) = 15.918.484 lei$.

Table 9. The compared situation of the results obtained using the two methods

Quarter	*Analytical methods*		*Syntactical methods*		
	Costs	*Turnover (CA)*	*Turnover speed*	*AC/1000*	*Kinetic rates*
Quarter I	15.273,00	15.271,10	15.272,80	15.272,70	15.281,70
Quarter II	16.540,90	16.546,00	16.545,60	16.545,40	16.555,20
Quarter III	15.924,40	15.909,60	15.909,20	15.909,10	15.918,50
Quarter IV	15.924,40	15.909,60	15.909,20	15.909,10	15.918,50
TOTAL	**63.662,70**	**63.636,30**	**63.636,80**	**63.636,30**	**63.673,90**

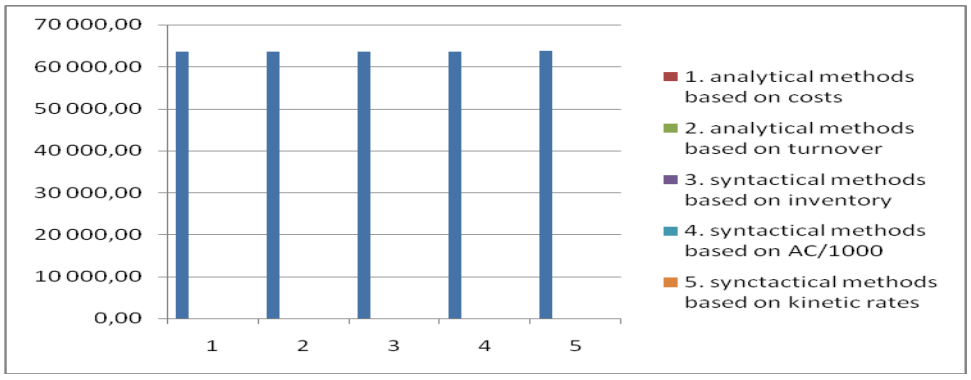


Figure 1. The comparative situation of the results obtained through the analytical methods and those obtained through syntactical methods

Comparing the results obtained through analytical methods with those obtained through syntactical methods, we observe that they are quite similar, both from annual and quarterly point of view.

3.4. The determination of the financing sources in operating cycle

1. The determination of the own sources (the circulating fund)

CF = Permanent capitals – Permanents needs

We will determine the *Circulating fund* based on the data from the balance sheet at 31.12.N:
CF = (4.250.000 + 8.529.000) - 11.250.000= 1.529.200 lei

2. The determination of the passive established according to the category in which the operating debts are part of:

a) The determination of the established passives I (PS I). The method used for their determination is the methods of the daily summing of the balances, method which has 6 stages, presented in Table 10.

We have the following information on the debts and the fixed deadlines:

- salaries 450.000 lei, deadline payment 25th of the current month and 10 of the following month
- tax on salaries 72.000 lei, deadline of payment 10 of the next month;
- contribution to the social insurances and the unemployment contribution 90.000 lei, deadline 10th of the following month;
- energy 50.000 lei, payable on 15th and 30th of the current month for the entire balance of the debt;
- VAT of 540.000 lei, tax on profit260.000 lei, deadline on 25th of the next month.

The PS I calculation from the salaries:

- The total expenses with wages on year were 1.875.000 lei, namely 450.000 lei for the first quarter (1.875.000 x 24%);
- Daily medium expenses 5.000 lei (450.000/90= 5.000 lei/day);
- Initial balance: 5.000 x 15 days= 75.000 lei;
- The day balance of the salaries:

Day 1: 75.000 + 5.000= 80.000 lei
Day 2: 80.000 + 5.000= 85.000 lei
……
Day 10: 120.000 + 5.000 – 75.000 = 50.000 lei
……
Day 15: 70.000 + 5.000 = 75.000 lei
……
Day 25: 120.000 + 5.000 = 50.000 lei
……
Day 30: 70.000 + 5.000 = 75.000 lei

5. The determination of the minimum balance for the day 15th of the month:
75.000 + 12.000 + 15.000 +0 + 270.000 + 135.000 = 507.000 lei

6. Similarly, we calculate the minimum balance for day 25th of the month:
50.000 + 20.000 + 25.000 + 5.000 + 150.000 + 75.000 = 325.000 lei

This balance, of 325.000 lei represents the constant level of the established passives II, for each quarter:

Table 10. The calculation of established passives I - *thousands lei-*

Day	Salaries	Salaries tax	CAS+ Unemployment	Energy	VAT	Profit tax	TOTAL
Total Q I	*450.000*	*72.000*	*90.000*	*45.000*	*540.000*	*270.000*	
Expense./Day	*5.000*	*800*	*1.000*	*500*	*6.000*	*3.000*	
Initial sold	*75.000*	*24.000*	*30.000*	*0*	*180.000*	*90.000*	
1	80	24,8	31	0,5	186	93	417,3
2	85	25,6	32	1	192	96	431,6
3	90	26,4	33	1,5	198	99	447,9
4	95	27,2	34	2	204	102	464,2
5	100	28	35	2,5	210	105	480,5
6	105	28,8	36	3	216	108	496,8
7	110	29,6	37	3,5	222	111	513,1
8	115	30,4	38	4	228	114	529,4
9	120	31,2	39	4,5	234	117	545,7
10	125	8,0	10	5	240	120	508
11	130	8,8	11	5,5	246	123	524,3
12	135	9,6	12	6	252	126	540,6
13	140	10,4	13	6,5	258	129	556,9
14	145	11,2	14	7	264	132	573,2
15	75	12,0	15	0	270	135	507
16	80	12,8	16	0,5	276	138	523,3
17	85	13,6	17	1	282	141	539,6
18	90	14,4	18	1,5	288	144	555,9
19	95	15,2	19	2	294	147	572,2
20	100	16,0	20	2,5	300	150	588,5
21	105	16,8	21	3	306	153	604,8
22	110	17,6	22	3,5	312	156	621,1
23	115	18,4	23	4	318	159	637,4
24	120	19,2	24	4,5	324	162	653,7
25	50	20,0	25	5	150	75	325
26	55	20,8	26	5,5	156	78	341,3
27	60	21,6	27	6	162	81	357,6
28	65	22,4	28	6,5	168	84	373,9
29	70	23,2	29	7	174	87	390,2
30	75	24,0	30	0	180	90	399

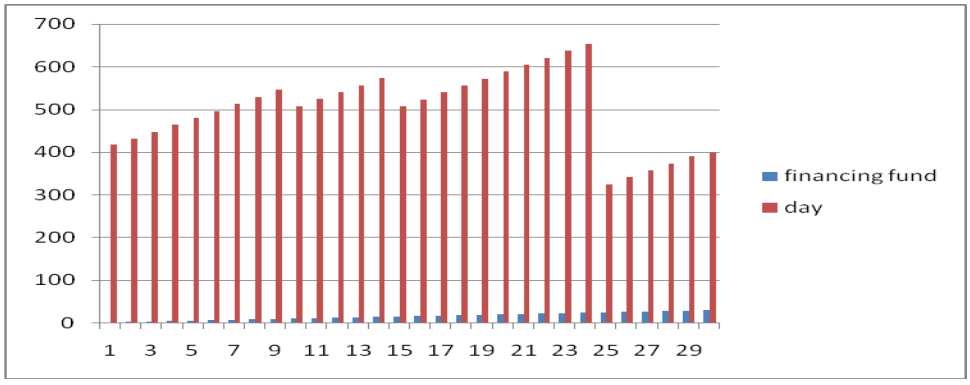


Figure 2. The evolution of the established passives I

1. The determination of the established passives II (PS II)

$$PS\ II = \frac{Quarterly\ level\ of\ payments}{90} \times N_i$$

Where: N_i *= the level of the legal delays on payment* N_i *= 12 days*

Table 11. The calculation of established passives II –*thousands lei*-

Explication	Q I	Q II	Q III	Q IV	Annual
1. Raw materials and materials	12.888,00	13.962,00	13.425,00	13.425,00	53.700,00
2. Other materials	156,60	169,70	163,10	163,10	652,50
3. Inventory items	45,00	48,90	46,80	46,80	187,50
TOTAL MATERIALS	13.089,60	14.180,60	13.634,90	13.634,90	54.540,00
No of days of delays	12	12	12	12	
PS II= $\frac{Debts}{90}$ **x 12 days**	**1.745,30**	**1.890,70**	**1.818,00**	**1.818.00**	**7.272,00**

Table 12. The calculation of the established passives I+II –*thousands lei*-

Explications	*Q I*	*Q II*	*Q III*	*Q IV*
PS I	325	325	325	325
PS II	1.745,3	1.890,7	1.818	1.818
TOTAL PS	**2.070,3**	**2.215,7**	**2.143**	**2.143**

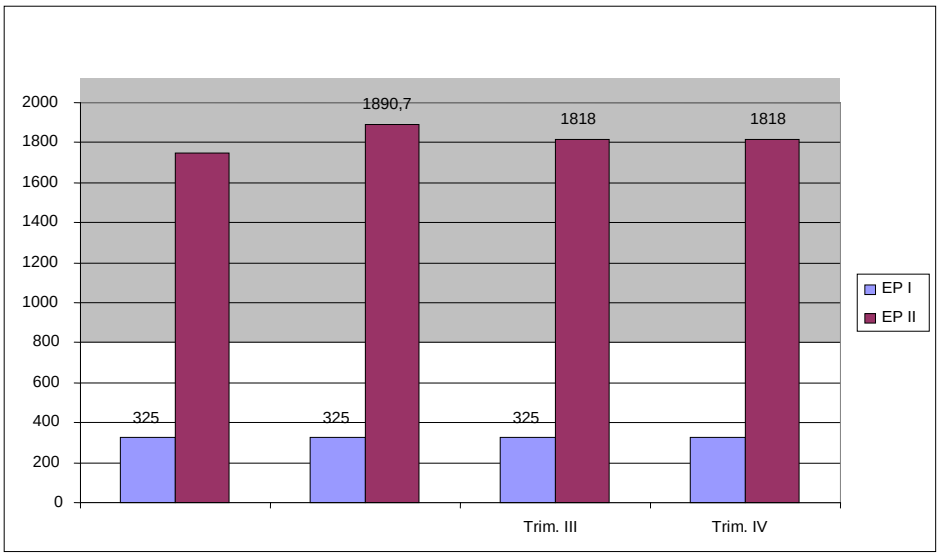


Figure 3. The quarterly evolution of the established passives I+II

2. The determination of the treasury credits (Table 13)

Table 13. Treasury plan – *thousands lei*-

Explications	*Q I*	*Q II*	*Q III*	*Q IV*
1. Stocks, expenses and other assets	15.273,00	16.540,80	15.924,40	15.924,40
2. Expenses for realize the production	13.995,00	15.161,30	14.578,10	14.578,10
I. TOTAL STOCKS and EXPENSES	29.268,00	31.702,10	30.502,50	30.502,50
3. Circulating Fund	1.529,20	1.529,20	1.529,20	1.529,20
4. Established passives	2.070,30	2.215,70	2.143,00	2.143,00
5. Revenues from production sales	24.146,00	26.158,20	25.152,10	25.152,10
6. Treasury credits with balance	2.250,00	1.522,50	1.799,00	1.678,20
I. TOTAL RESOURCES and REVENUES	29.995,50	31.425,60	30.623,30	30.502,50
Treasury deficit (I-II)	**-**	**276,50**	**-**	**-**
Treasury surplus (II-I)	**727,50**	**-**	**120,80**	**-**

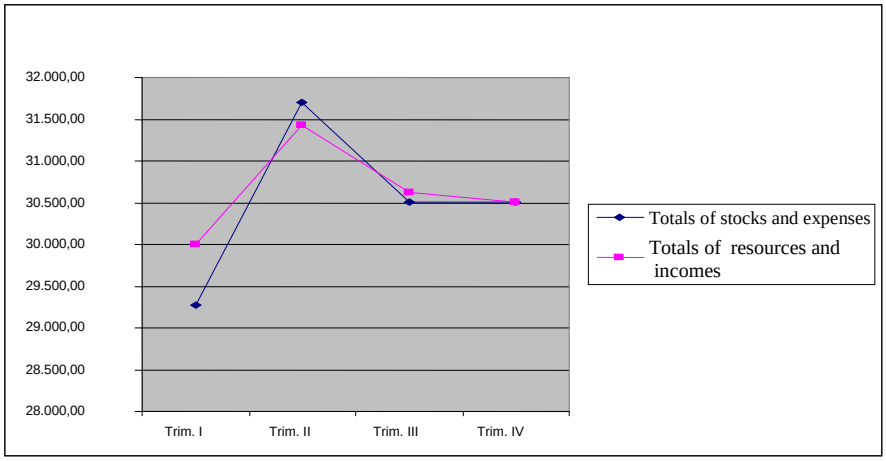


Figure 4. The quarterly evolution of the payments and collections

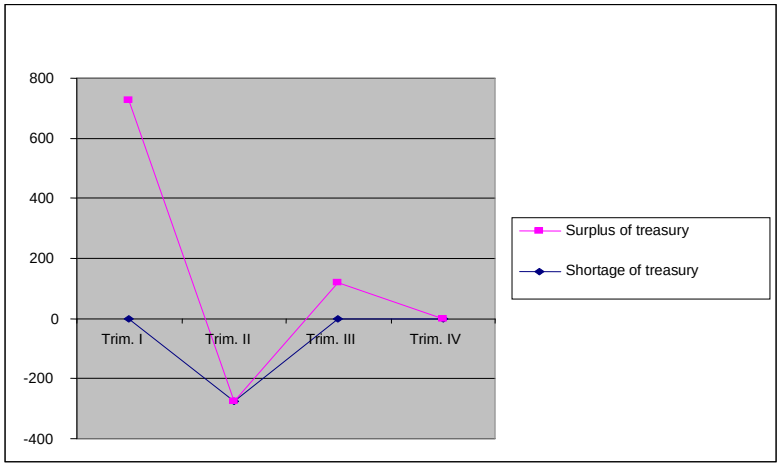


Figure 5. The quarterly evolution of net treasury

Conclusions

The creditor sold of treasury, at the beginning of trimester I (2.250.000 lei), was the one from the balance sheet at 31.XII.N-1. The treasury surplus from quarter I of 727.500 lei represents the volume of credits which are going to be paid in the following quarter. Thus, the level of credits with sold in quarter II will be 1.522.500 lei (2.250.000- 727.500). The treasury deficit from quarter II of 276.500 lei represents the level of new credits that the enterprise can undertake in that period, over the level of those from the previous quarter (1.522.500 lei). In these conditions, the level of treasury credits in quarter III will be 1.799.000 lei (1.522.500 + 276.500). For quarter III, similar as in quarter I, the treasury surplus of 120.800 lei will determine a volume of treasury credits for quarter IV of 1.678.200 lei (1.799.000 -120.800). In these conditions, for quarter IV the financing necessary will become equal to the resources.

Analysing the treasury's activity, on the period analysed, but also the results obtained through the treasury plan, we realized a summary of the weak and forte points and eventual recommendations for the manager that can improve the economic situation of the company generally and the treasury administration especially.

References

[1] Bogdan, A.M. 2011. European Union funds - a solution for the Romanian economic recovery. *Journal of Applied Economic Science*, Vol. VI, Issue 2 (16): 115-120.

[2] Bistriceanu, Gh.D., Adochiţei, M.N., Negrea, E. 2001. *The finances of economic agents*. Economica Publishing House, Bucharest.

[3] Bojian, O. 2004. *The financial accounting of the enterprise*. Universitară Publishing House, Bucharest

[4] Brezeanu, P. (coord.). 2006. *Financial analysis*. Meteor Press Publishing House, Bucharest.

[5] Brezeanu, P. (coord.). 2003. *Financial diagnosis. Tools for financial analysis*. Economica Publishing House, Bucharest.

[6] Bran P. 2003. *The enterprise's finances. The management of the micro financial phenomenon*, Second Edition. Economica Publishing House, Bucharest.

[7] Georgescu, F. 2010. The forecasted analysis and diagnosis of the cash flows, paper published in the *Economic Tribune, No.* 21/May 2010, pp. 62-65 and pp. 69, No. 22/May 2010, pp. 63-65, No. 23/ June 2010, pp. 66-69, No. 24/June 2010, pp. 68-69, Section Efficient.

[8] Helfert, E. 2006. *Financial analysis techniques – a guide to create value*, BMT Publishing House, 11th Edition, pp. 169-198, pp.241-267, pp.415-446.

[9] Ilie, D. 2011. New frontiers in credit risk analysis. *Journal of Applied Economic Science*, Vol. VI, Issue 1 (15): 28-32.

[10] Ilincuță, L.D., Mareș, D.M., Mareș, V. 2010. *Accounting of the withdrawn assets or the non-current assets from the current using and available for sale*, 17th International Economic Conference – IECS 2010, The Economic World' Destiny: Crisis and Globalization, ULB, Sibiu, Romania, May 13-14.

[11] Nicolescu, O., Nicolescu, L. 2006. *The economy, company and management based on knowledge*. Economica Publishing House, Bucharest.

[12] Şerban, M., Ştefan, R.M. 2011. *Project Management Software*. University Alma Mater – Sibiu, International Conference, 24-26 March.

[13] Ştefan, R.M, Şerban, M. 2011. *Simulation modelling as decision-support tools*, Papers of the Sibiu Alma Mater University International Conference, March 2011.

[14] Ştefănescu, A., Ţurlea, E. 2004. *Principles and models to reflect the company performance in the sintetis documents.* ASE Publishing House, Bucharest.

[15] Vintila, G. 2010. *The financial administration of the company*. Didactica şi Pedagogica Publishing House, Bucharest, pp. 329-348.

***The collection of specialized magazines: *Economic Tribune*, *Finances, Credit and Accounting*, *General Magazine on accounting and expertise*, *Accounting, Expertise and Audit of the Business.*

***Ministry of Finances, *Accounting regulations according to the European Directives*, 2008.

*** www.accaglobal.com

*** www.cnp.be

*** www.iasb.org.uk

*** www.accaglobal.com

*** www.focusifrs.com

*** www.iasplus.com

*** www.pwcglobal.com

THE EFFECT OF ACCRUALS ON SECURITY ANALYSTS' TARGET PRICE FORECAST PERFORMANCE

Cho JOONG-SEOK
School of Business Administration, Hanyang University, **Korea**
joongseok@hanyang.ac.kr

Abstract:
Using a sample of U.S. security analysts' target price forecasts issued over the period 2000-2010, we examine how accounting accruals and accrual components affect security analysts' target price forecast performance. In this study, we find that analysts' target price forecasts for firms with higher accruals level are less accurate and have lower possibilities of being met or beat at some time during or at the end of the forecast horizon. With the deposition of accruals into short- and long-term accruals, our results show that both types of accruals lower the possibility of achieving analysts' target prices at the end of the forecast horizon. However, only short-term accruals affect negatively the possibility of achieving analysts' target prices at some time during the forecast horizon. These results suggest that the analysts fail to incorporate correctly the implications of the accrual information.

Keywords: analysts, target price, accounting accruals.

JEL Classification: M4, G17.

1. Introduction

Past research has shown that accrual components of earnings improve cash flows as a measure of firms' performance (e.g. Watts 1977; Watts, and Zimmerman 1986; Dechow 1994; Dechow *et al*. 1998). Through the matching and revenue recognition principles, accruals reflect timing differences of past and future cash flows and incorporate them into current earnings. Accruals are classified as short-term (current) and long-term (non-current) components. Short-term accruals, such as inventory, accounts receivable and accounts payable, are those whose effects generally reverse within one fiscal period. Long-term accruals, such as depreciation and warrant provisions, reflect timing differences that extend beyond two fiscal periods.

Since accruals are an important source of information for analysts in formulating their' equity reports including target prices, we focus on the effect of the level of accruals on analysts' target price forecast performance. Accrual components of earnings improve cash flows as a measure of firms' performance through the matching and revenue recognition principles. The effects of short- and long-term accruals could differ because they have different time horizon in the matching and revenue recognition principles. We compute total accruals and derive short- (current) and long-term (noncurrent) accruals for each firm in year t. We construct three measures to capture target price forecasting performance based on Bradshaw *et al*. (2012).

2. Literature Review

A number of studies find correlations between accounting variables and analysts' price forecasts and recommendations. Bandyopadhyay *et al.* (1995) document that near - and long-term earnings forecast revisions positively influence the variation in price forecast revisions. Block's (1999) survey study shows that analysts consider earnings and cash flow to be more important than dividends and book value in security valuation. It also shows that analysts rely more heavily on earnings multiples versus DCF in valuation, and growth potential and earnings quality are the crucial factors in evaluating P/E ratios. Demirakos *et al.* (2004) find that analysts overwhelmingly refer to simple accounting-based P/E multiples to support their stock recommendations.

Several studies, however, provide evidence that the analysts do not fully incorporate the relevant accounting information into their forecasts. Dechow (1994) hypothesizes and finds that although accruals improve earnings' association with stock returns, certain accruals, long-term accruals, are less likely to mitigate timing and matching problems in realized cash flows. Sloan (1996) finds that stocks prices act "as if" investors do not anticipate the future earnings declines associated with unusually high level of accruals, implying that the investors do not fully understand the persistence of the accruals. Stober (1992) constructs the "Pr measure," a summary financial statement

measure based on Ou, and Penman (1989), to compare the accounting information and the information content contained in analyst forecast of earnings. He finds that the analysts do not fully reflect the relevant accounting information into their forecasts. Abarbanell, and Bushee (1997) study whether the detailed financial statement information is incorporated into analyst forecast of earnings and find that the analysts do not fully understand the information about the future earnings. Bradshaw *et al.* (2001) show that that analysts' earnings forecasts do not incorporate the predictable future earnings declines associated with high accruals.

Recently, security analysts have increasingly disclosed target prices along with their stock recommendations and earnings forecasts. Despite the most concise and explicit statement on the firm's expected value, research on target prices has remained largely unexplored. Brav, and Lehavy (2003) report that two-thirds of all analyst reports include target prices. They examine the informativeness of target price forecast revisions and document a significant market reaction to the information contained in analysts' target prices, unconditionally and conditional on simultaneous recommendation and earnings forecast revisions. Asquith *et al.* (2005) show that the addition of both target prices and analyst justifications is important in explaining the market's reaction to analyst reports. They report significant incremental reactions to target prices and provide evidence that target price forecasts are valuable to investors.

Overall, these extant studies suggest that accounting information affects security analysts' forecasts and their forecasting ability. These studies show that analysts' forecasts are positively related to stock value-relevant fundamental such as earnings expectations. However, there exist some studies that cast doubt about the efficiency of the analyst forecasts and raise possibility that the market may not fully reflect the fundamental analysis information.

3. Sample and methodology

The initial sample of target price forecasts is drawn from the publicly traded U.S. firms in I/B/E/S database from 2000-2010. We obtain stock price and return data from CRSP and firm-related information from COMPUSTAT database, respectively. We retain 12-month-ahead target prices issued by identifiable analysts within the 45-day period immediately after the release of previous year's earnings announcement.[2] For these target prices, we require the closing share price prior to the target price forecast announcement month and the actual share price as of the end of the forecast horizon. To mitigate the effects of extreme observations, we truncate observations with (Target price/Closing share price) ratio at the 1st and 99th percentiles.[3] Our final sample consists of 11,780 firm-years from 2000-2010.

Table 1. Distribution of number of firms

Year	No. of firms	Percent
2000	691	5.87
2001	595	5.05
2002	933	7.92
2003	903	7.67
2004	1,080	9.17
2005	1,064	9.03
2006	1,153	9.79
2007	1,250	10.61
2008	1,363	11.57
2009	1,239	10.51
2010	1,509	12.81
Total	**11,780**	**100.00**

The variables used in our analyses are stated in Table 2.

[2] We test a 30-day period and the results are identical.
[3] We later truncate accounting accrual components at the 1st and 99th percentiles

Table 2. Variables used in the analyses

Variable	Definition
TAi,t	Total Accruals for firm i in year t
EARNi,t	Earnings before extraordinary items and discontinued operations for firm i in year t
CFOi,t	Cash flows from operations for firm i in year t
STAi,	Total short-term accruals firm i in year t
LTAi,t	Total long-term accruals firm i in year t
ΔARi,t	Accounts receivable at year t less accounts receivable at year t-1 for firm i
ΔINVi,t	Inventory at year t less inventory at year t-1 for firm i
ΔOCAi,t	Other current assets at year t less other current assets at end year t-1 for firm i
ΔAPi,	Accounts payable at year t less accounts payable at year t-1 for firm i
ΔTXPi,t	Tax payable at end year t less tax payable at year t-1 for firm i
ΔOCLi,t	Other current liabilities at end year t less other current liabilities at year t-1
TP	Target price
MTP	Mean value of 12-month-ahead target prices
CP	Closing price prior to the target price release month
ATA	Absolute value of total accruals
ASTA	Absolute value of short-term accruals
ALTA	Absolute value of long-term accruals
ADiff	Absolute value of (AP12-MTP)/CP, where AP12 is the actual stock price 12-months following the target price release date
Hpass	Hpass = 1 if the mean value of target prices is met at any time during the 12-month forecast horizon
Epass	Epass = 1 if the mean value of target prices beats the actual closing price as of the end of the 12-month forecast horizon
PreRet	Six-month buy-and-hold raw return prior to the target price release month
PrcStd	Standard deviation of closing prices over the one-year period ending prior to the target price release month
MarketRet	12-month buy-and-hold value-weighted market return following the target price release
SIZE	Natural logarithm of price per share multiplied by shares outstanding prior to the target price release date

Source: I/B/E/S, CRSP and COMPUSTAT database.

Previous studies have provided the definition of accrual components (Dechow 1994; Loftus, and Sin 1997). Following their definition, we compute total accruals each firm and derive short-(current) and long-term (noncurrent) accruals for firm *i* in year *t* prior to the analysts' target price forecasts.

First, we define total accruals variable as following:

$$TA_{i,t} = EARN_{i,t} - CFO_{i,t} \quad (1)$$

Then, we calculate short-term and long-term accruals using the statement of cash flow:

$$STA_{i,t} = \Delta AR_{i,t} + \Delta INV_{i,t} + \Delta OCA_{i,t} - \Delta AP_{i,t} - \Delta TXP_{i,t} - \Delta OCL_{i,t} \quad (2)$$

$$LTA_{i,t} = ACC_{i,t} - STA_{i,t} \quad (3)$$

Accruals may be either positive or negative. Consequently, it is the magnitude rather than the direction of the accruals that is of interest. The absolute value of the accruals is used to measure the level of accruals. High level accruals are more likely to be reversed. Therefore, if analysts do not fully understand the persistence of the accruals, their forecasts do not incorporate the predictable future earnings declines associated with high level of accruals. We construct three accrual component measures: (i) ATA, the absolute value of total accruals, (ii) ASTA, the absolute value of short-term accruals, and (iii) ALTA, the absolute value of long-term accruals.

Following Bradshaw *et al.* (2012), we adopt three measures to capture analysts' target price performance (hereafter, TPP): (i) *ADiff*, (ii) *Hpass*, and (iii) *Epass*. *ADiff* is calculated as the absolute value of (AP12-MTP)/CP, where AP12 is the actual stock price 12-months following the target price

release date, MTP is the mean value of 12-month-ahead target prices, and CP is the closing price prior to the target price release month. *ADiff* measures the degree of the accuracy of analysts' 12-month-ahead target price compared to the actual stock price. The second and third TPP, *Hpass* and *Epass*, are indicator variables. If the mean value of target prices is met at any time during the 12-month forecast horizon, *Hpass* equal to 1. At the token, if the mean value of target prices beats the actual stock price as of the end of the 12-month forecast horizon, *Epass* equal to 1. These two indicator TPP measures show whether analysts' 12-month-ahead target price forecasts actually beat the actual stock price during or at the end of the forecast horizon.[4]

4. Empirical results

Table 3 provides descriptive statistics. The mean (median) number of target prices issued per firm is 4.408 (3.000). On average, the 12-month-ahead target price is 24.4 percent higher than the current market price (MTP/CP = 1.244). 67.9 percent of firm-year observations meet or beat target price forecasts at some time during the forecast horizon (*Hpass* = 0.679) and 35.7 % of them as of the end of the 12-month forecast horizon (*Epass* = 0.357).

Table 3. Descriptive statistics of firm characteristics (n=11,780)

Variable	Mean	Std. dev	Q1	Q2	Q3
# of TPs issued	4.408	2.893	2.000	3.000	5.000
MTP/CP	1.244	0.257	1.098	1.185	1.315
ATA	0.092	0.131	0.034	0.065	0.113
ASTA	0.042	0.072	0.009	0.023	0.049
ALTA	0.087	0.119	0.039	0.063	0.101
Hpass	0.679	0.467	0.000	1.000	1.000
Epass	0.357	0.479	0.000	0.000	1.000
ADiff	0.426	0.459	0.135	0.309	0.586
PreRet	0.063	0.415	-0.156	0.042	0.227
MarketRet	0.037	0.229	-0.120	0.086	0.191
PrcStd	5.262	6.301	2.171	3.536	5.944
SIZE	14.368	1.587	13.232	14.217	15.363

Table 4 reports the correlation structure of the variables of interest. There is a significantly correlation between accrual components and target price performance measures. The correlation between ATA and *ADIFF* is positive and the one between ATA and *Hpass* (*Epass*) is negative. Similar relationship exists between accrual components, ASTA (ALTA) and three target price performance measures. These results suggest that the analysts fail to incorporate correctly the implications of the accrual information. The correlations between among other variables of interest are consistent with results reported in the extant literature.

Table 4. Correlations of firm characteristics (n=11,780)

	ATA	ASTA	ALTA	Hpass	Epass	ADiff	PreRet	MarketRet	PrcStd
ASTA	0.451***	1.000							
ALTA	0.826***	0.166***	1.000						
Hpass	-0.018**	-0.037***	-0.018**	1.000					
Epass	-0.024***	-0.054***	-0.023**	0.512***	1.000				
ADiff	0.134***	0.098***	0.143***	-0.187***	-0.059***	1.000			
PreRet	0.018**	0.062***	-0.015*	-0.059***	-0.101***	-0.129***	1.000		
MarketRet	-0.011	-0.042***	-0.013	0.214***	0.447***	-0.158***	-0.067***	1.000	
PrcStd	0.103***	0.072***	0.116***	-0.038***	-0.029***	0.137***	-0.025***	-0.045***	1.000
SIZE	-0.127***	-0.155***	-0.110***	-0.072***	-0.038***	-0.201***	0.059***	-0.085***	0.235***

*, **, and *** indicate statistical significance at the 10, 5, and 1% level, respectively.

[4] We use target price forecasts and actual stock prices converted to the same split-adjusted basis.

We run the following OLS (logistic) regressions to investigate the relation between accruals and analysts' target price performance.

$$TPP_{i,t} = \delta_0 + \delta_1 AC_{i,t} + \beta\delta_2 PreRet_{i,t} + \delta_3 \Delta PrcStd_{i,t} + \delta_4 \Delta MktRet + \delta_5 LogMV_{i,t} + \sum Year + \sum Industry + \varepsilon_{i,t} \quad (4)$$

TPP, our measure of analysts' target price performance, is the dependent variable in our regression analyses. It is measured as either a continuous variable, *ADiff*, or an indicator variable, *Hpass* and *Epass*. Our main variable of interest, AC, is accruals and accrual component measures: ATA, ASTA, and ALTA. High level accruals reveal deviations between earnings and operating cash flows and as a result, it makes difficult for analysts to reliably interpret and incorporate accounting information into their forecasts. Short- and long-term accruals are expected to play different roles in mitigating timing and matching problems. We expect high AC measures to affect negatively analysts' target price forecast performance.

Following previous research, we include these variables, as defined as follows, to control for possible biases. Jegadeesh *et al.* (2004) shows that analysts' recommendations are associated with past momentum. We include price momentum (*PreRet*), which is measured as the six-month buy-and-hold raw return prior to the target price release month. Volatile stock prices make price forecasts more unpredictable. We, therefore, include as the second control variable stock price volatility (*PrcStd*), which is the standard deviation of closing prices over the one-year period ending prior to the target price release month. The third control variable, the *ex post* market return (*MarketRet*) is measured as the 12-month buy-and-hold value-weighted market return following the target price release. To proxy for any omitted variables associated with firm size, we include size (*SIZE*), which is calculate as the natural logarithm of price per share multiplied by shares outstanding prior to the target price release date. Finally, we include *Year and industry Dummies* to control for time-period and industry specific effects

Table 5 reports the results of our regression analyses. The first regression results show the relation between AC and *Adiff*. As shown in model 1-1, the coefficient of ATA is positive and significant. The ATA coefficient is 0.261 and significant at the 1 percent level, consistent with our univariate results showing that the accrual level affects negatively analysts' target price performance. These results indicate that analysts' 12-month-ahead target price forecasts for firms with lower level of accruals are closer to the actual stock price 12-months following the target price release. In other words, the lower level of accruals results in more accurate target price forecasts. For model 1-2, we decompose accruals into short- and long-term accruals. The coefficients of ASTA and ALTA are positive and significant at the 1 percent level, respectively. These results verify that regardless of accrual type, the high level of accruals affects negatively analysts' target price performance.

For model 2-1 and 3-1, when indicator dependent variables, *Epass* and *Hpass*, are dependent variables, the coefficient of ATA is negative and significant at the 1 percent level, respectively. These results show that when analysts forecast 12-month-ahead target prices for firms with higher level of accruals, they have lower possibilities of meeting or beating their forecasts during or by the end of their forecast period. These results verify the finding from model 1-1, whose dependent variable is a continuous one. In model 2-2 when *Epass* is the dependent variable, the decomposition of accruals gives the same result as model 1-2. The higher levels of short- and long-term accruals deteriorate analysts' target price performance. Interesting, as we can see in model 3-2, only short-term accruals affect negatively analysts' target price performance at the 1 percent level and long-term accruals are insignificant. The results for the control variables are similar to those of previous research.

Combined, our results indicate that target firms' accrual level negatively affects security analysts' target price performance. We find that the higher accrual level results in less accurate target price forecasts. These results show that security analysts do not fully understand the persistence of accruals and their forecasts do not incorporate the predictable future earnings declines associated with high accruals.

Table 5. Regression analysis (n=11,780)

	Model 1-1	Model 1-2	Model 2-1	Model 2-1	Model 3-1	Model 2-2
Dependent	ADiff		Epass		Hpass	
	Coefficient	Coefficient	Coefficient	Coefficient	Coefficient	Coefficient
Intercept	1.125***	1.086***	-1.149***	-0.983***	2.065***	2.172***

ATA	0.261***		-0.509**		-0.265*	
ASTA		0.277***		-1.197***		-0.798***
ALTA		0.279***		-0.525**		-0.191
PreRet	-0.081	-0.080	-0.300***	-0.297***	-0.108**	-0.101*
PrcStd	0.007***	0.006***	-0.014***	-0.012***	-0.002	-0.002
MarketRet	-0.265*	-0.258*	4.659***	4.655***	1.211***	1.200***
SIZE	-0.057***	-0.055***	0.026*	0.017	-0.071***	-0.077***
Year Dummies	No	No	Yes	Yes	Yes	Yes
Industry Dummies	Yes	Yes	Yes	Yes	Yes	Yes
Adj. Or pseudo R^2	0.127	0.130	0.303	0.304	0.109	0.110

*, **, and *** indicate statistical significance at the 10, 5, and 1% level, respectively.

Conclusion

We study the relation between firms' accrual level and security analysts' target price forecast performance. Recently, security analysts have increasingly disclosed target prices along with their stock recommendations and earnings forecasts. Despite the most concise and explicit statement on the firm's expected value and popularity, research on target prices has remained largely unexplored.

Since accruals are an important source of information for analysts in formulating their' equity reports including target prices, we focus on the effect of the level of accruals on analysts' target price forecast performance. Accrual components of earnings improve cash flows as a measure of firms' performance through the matching and revenue recognition principles. The effects of short- and long-term accruals could differ because they have different time horizon in the matching and revenue recognition principles. If security analysts do not fully understand the persistence of the accruals and their forecasts do not incorporate the predictable future earnings declines associated with high accruals, their target price forecast performance will suffer.

Using a sample of U.S. security analysts' target price forecasts issued over the period 2000-2010, we compute total accruals and derive short- (current) and long-term (noncurrent) accruals for each firm in year t. We construct three measures to capture target price forecasting performance based on Bradshaw *et al.* (2012).

Our study shows that analysts' target price forecasts for firms with higher level of accruals are less accurate and have lower possibilities of being met or beat at some time during or at the end of the forecast horizon. With the deposition of accruals into short- and long-term accruals, our results show that both types of accruals lower the possibility of achieving analysts' target prices at the end of the forecast horizon. However, only short-term accruals affect negatively the possibility of achieving analysts' target prices at some time during the forecast horizon.

These results are consistent with that the level of accruals has a significant impact on analysts' target price performance and that the lower level of accruals results in more accurate target price forecasts. They show that analysts do not fully understand the persistence of accruals and suggest that they fail to incorporate correctly the implications of the accrual information into their target price forecasts.

References

[1] Abarbanell, J.S., Bushee, B.J. 1997. Fundamental analysis, future earnings and stock prices. *Journal of Accounting Research* 35: 1-24.

[2] Asquith, P., Mikhail, M., Au, A. 2005. Information content of equity analyst reports. *Journal of Financial Economics*, 75: 245−282.

[3] Bandyopadhyay, S., Brown, L., Richardson, G. 1995. Analysts' use of earnings forecasts in predicting stock returns: forecast horizon effects. *International Journal of Forecasting*, 11:429−445.

[4] Block, S. 1999. A study of financial analysts: practice and theory. *Financial Analysts Journal*, 55: 86−95.

[5] Bradshaw, M.T., Lawrence, D.B., Kelly, H. 2012. Do sell-side analysts exhibit differential target price forecasting ability? *Working Paper*, Boston College, Boston: 1-41.

[6] Bradshaw, M.T., Richardson, S., Sloan, R. 2001. Do analysts and auditors use information in accruals? *Journal of Accounting Research* 39: 45-74.

[7] Brav, A., Lehavy, R. 2003. An empirical analysis of analysts' target prices: short-term informativeness and long-term dynamics. *Journal of Finance*, 58: 1933−1968.

[8] Dechow, P. 1994. Accounting earnings and cash flows as measures of firm performance: The role of accounting accruals. *Journal of Accounting and Economics*, 18: 3-42.

[9] Dechow, P., Kothari, S., Watts, R. 1998. The relation between earnings and cash flows, *Journal of Accounting & Economics* 25: 133-168.

[10] Dechow, P., Sloan, R., Sweeney, A. 1995. Detecting earnings management. *The Accounting Review*, 70 (2): 193-225.

[11] Demirakos, E., Strong, N., Walker, M. 2004. What valuation models do analysts use? *Accounting Horizons*, 18(4): 221−240.

[12] Fama, E.F., French, K. 1997. Industry costs of equity. *Journal of Financial Economics*, 43: 153-193.

[13] Jegadeesh, N., Kim, J., Krische, S.D., Lee, C. 2004. Analysing the analysts: when do recommendations add value? *The Journal of Finance*, 59: 1083–1124.

[14] Loftus, J.A., Sin, S. 1997. The role of current and non-current accruals in the relation between stock returns and earnings. *Accounting and Finance* 37: 147-161.

[15] Ou, J., Penman, S. 1989. Financial statement analysis and the prediction of stock returns, *Journal of Accounting & Economics* 11: 295-329

[16] Previts, G., Bricker, R., Robinson, T., Young, S. 1994. A content analysis of sell - side financial analyst company reports. *Accounting Horizons*, 8: 55−70.

[17] Sloan, R.G. 1996. Do Stock Prices Fully Reflect Information in Accruals and Cash Flows about Future Earnings? *The Accounting Review* 71: 289-315.

[18] Stober, T.L. 1992. Summary Financial Statement Measures and Analyst Forecast of Earnings. *Journal of Accounting and Economics* 15: 347-372.

[19] Watts, R.L. 1977. Corporate financial statements, a product of the market and political processes. *Australian Journal of Management* 2 (April): 53-75.

[20] Watts, R.L., Zimmerman, J.L. 1986. *Positive Accounting Theory*. Englewood Cliffs, NJ: Prentice-Hall.

TESTING WEAK FORM MARKET EFFICIENCY OF EMERGING MARKETS: A NONLINEAR APPROACH

Ece C. KARADAGLI
Cankaya University, Faculty of Economics and Administrative Sciences, **Turkey**
ece@cankaya.edu.tr
Nazlı C. OMAY
Cankaya University, **Turkey**
nazli.sungur@hotmail.com

Abstract

This paper examines weak form efficiency in eight CEE emerging markets by testing whether the stock price series of these markets contain unit root. The unpredictability of stock returns indicates that stock prices follow random walk and hence are characterized by a unit root. For this purpose, we employ unit root and nonlinear unit root tests along with their panel extensions. The results indicate weak form efficiency in linear sense. However the findings of nonlinear unit root test suggest inefficiencies for Russian, Romanian and Polish stock markets. Furthermore, nonlinear panel unit root test support inefficiency for the sample we investigated.

Keywords: emerging markets, market efficiency, linear and nonlinear unit root and linear and nonlinear panel unit root

JEL Classification: G14, C3

1. Introduction

The Efficient Market Hypothesis states that security prices fully reflect all available information at any time and the concept of market efficiency is mainly based on the reaction of stock price to new information. Since the market absorbs all relevant information as it becomes available, a stock price change requires a new information release. Following the argument that the stock prices already incorporate all available information and the stock price changes require a news release which is itself unpredictable by definition, then price changes should be unpredictable and random. Then, it follows that as in an efficient market prices reflect all the available information, investors are unlikely to beat the market, except by chance. Thus, in an efficient market, price changes can be argued to follow a "random walk". Because new information is randomly favourable or unfavourable relative to expectations, changes in stock prices in an efficient market should be random, resulting in the well-known "random walk" in stock prices (Jones, and Netter 2008). If stock prices follow a random walk which is satisfied by the unpredictability of stock returns, then stock prices are characterized by a unit root (Hasanov, and Omay 2007).

2. Emerging Stock Markets and Market Efficiency

The liberalization of financial markets and advances in technology coupled with lower costs of investing in international markets has created an increased demand for such transactions in emerging markets. As argued by Magnusson, and Wydick (2002), the financial systems and hence the development of financial institutions is also critical in the process of economic development and in the context of an increasingly liberalized and integrated global financial network, an increasing emphasis on the performance of financial systems in developing countries has arisen. The rapid integration of these markets increasingly attracted the international investors hoping to earn excess returns and benefit from portfolio risk diversification (Hasanov, and Omay 2007). The study of efficient markets hypothesis has valuable implications for understanding the price formation in capital markets and may prove to be a worthy weapon to develop trading strategies as well as building a general idea of the investor's behaviour in a market. As put forward by Jones, and Netter (2008), the informational efficiency of stock prices matters in two main ways: investors care about whether various trading strategies can earn excess returns, and if stock prices accurately reflect all information, new investment capital goes to its highest-valued use. In both ways, a well-functioning stock market is an important ingredient.

Well-functioning equity markets are also argued to provide beneficial effects on the economic growth process in developing countries (Atje, and Jovanovic 1993; Levine, and Zervos 1998;

Magnusson, and Wydick 2002; Obstfeld 1994). Moreover, market efficiency or inefficiency provide considerable implications for all market participants, especially hardworking financial analysts, about whether they have a chance to outperform the market by analysing the past price information and/or publicly available information. Besides, market efficiency has important implications for managerial decisions, especially those pertaining to common stock issues, stock repurchases, and tender offers (Brigham, and Gapenski 1994). Actually, as Seiler, and Rom (1997) discussed, market efficiency is directly or implicitly tested at any time a study is performed to identify stock price reactions to certain events such as dividend announcements (Bajaj, and Vijh 1995; 1990), earnings announcements (Bamber 1987), stock splits (Copeland 1979), large block transactions (Holthausen *et al.* 1987; Kraus, and Stoll 1972), repurchase tender offers (Lakonishok, and Vermaelen 1990), and other public announcements (Kim, and Verrecchia 1991a; 1991b). However, a broader evaluation of market efficiency can be reached by testing whether the returns in a market follow a random walk process over a longer period of time.

Although, market efficiency of emerging markets has been researched substantially in recent years (e.g. Emerson *et al*. 1997; Dockery, and Vergari 1997; Liu *et al*. 1997; Zalewska-Mitura, and Hall 1999; Rockinger, and Urga 2001; Mobarek, and Keasey 2002; Magnusson, and Wydick 2002; Gilmore, and Mcmanus 2003; Smith, and Ryoo 2003; Harrison, and Paton 2004; Moustafa 2004; Cajueiro, and Tabak 2006; Celik, and Tas 2007; Legoarde-Segot, and Lucey 2008; Atan *et al.* 2009), no consensus could have been reached yet. So one of the contributions aimed with this paper is to provide additional empirical evidence for the contradictory literature on market efficiency of emerging markets by focusing on Central and East Europe (CEE) stock markets, specifically the Bulgarian, Greek, Hungarian, Polish, Romanian, Russian, Slovenian and Turkish stock markets. Since, some of those markets are also among the so called transition markets, it also contributes to the relatively limited literature on the transition economies.

We concentrate on these markets due to various reasons. First of all, the countries in the CEE region keep close investment and trade relations with the West Europe countries. The majority of the examined countries (actually all except Russia) are either EU members or candidates (Turkey). Hence, their markets are considerably integrated with the developed markets, and should be of interest of especially European investors and policy makers. Although most of the selected countries have relatively young and small stock markets, they undertook considerable developments in terms of financial liberalization, market capitalization and corporate governance issues such as financial regulations and minority shareholder rights, as well as transparency of information. Furthermore, when we consider the limited existing empirical studies concentrating on the emerging stock markets of Europe, they provide highly controversial results and it is not possible to obtain any consensus as well. Among the empirical evidence, a considerable number of studies provide support for weak form market inefficiency for these countries (Gilmore, and McManus 2003; Smith, and Ryoo 2003; Hassan *et al.* 2006; Kahraman, and Erkan 2005; Celik, and Tas 2007). However a vast empirical research have found out the opposite results that they support weak form market efficiency for these markets (Smith, and Ryoo 2003; Abrosimova *et al.* 2005; Hassan *et al*. 2006; Aga, and Kocaman 2006; 2008; Atan *et al.* 2009; Celik, and Tas 2007; Dima, and Milos 2009). Among all these studies, the common assumption is linearity. This restricted assumption leads to insufficient specification for a model builder.

Therefore, another important contribution of this research lies in the employed methodology for which a brief discussion is provided in the following section. A common feature of the existing empirical evidence on the efficiency of emerging markets is that possible nonlinearities in conditional mean of the series have not been taken into account in testing efficiency of these markets (Hasanov, and Omay 2007). But as very well argued (Granger, and Teräsvirta 1993; Campbell *et al.* 1997; Franses, and Van Dijk 2000; Hasanov, and Omay 2007; Yılancı 2012) many economic variables, as well as financial time series contain sources of nonlinearity and track nonlinear processes. Thus, in analysing financial time series, potential nonlinearities in conditional mean should carefully be considered in order to prevent mis-specified models (Omay 2010). Hence, during the analysis, in addition to the conventional ADF (Dickey, and Fuller 1981) and PP (Phillips, and Perron 1988) unit root tests, we employed the IPS (Im *et al.* 2003) panel unit root test as well. On the other hand, nonlinear unit root test proposed by Kapetanios *et al.* (2003) and nonlinear panel unit root test (UO Test) proposed by Ucar, and Omay (2009) are used to extend the existing literature by using the

nonlinearity assumption. By applying the nonlinear and panel version of the unit root tests, we attempt to improve the power of the tests as much as possible by combining cross-sectional information with nonlinearities in the data. Hence, nonlinear panel version of these tests gives us more vigorous result with respect to market efficiency. Another contribution of this study is that, it is the first time a nonlinear panel unit root test is used in the market efficiency literature. Besides, we have explicitly dealt with the cross section dependency problem in linear and nonlinear panel unit root tests which are again a considerable contribution to existing literature.

The remaining of the study is organized as follows. The following section provides the methodology of test procedure. In section 3 data and unit root test results are discussed. Finally, section 4 concludes.

3. Methodology

The economic theory suggests a number of sources of nonlinearity in the financial data such as market frictions and transaction costs like existence of bid-ask spread, short selling and borrowing constraint which render arbitrage unprofitable for small deviations from the fundamental equilibrium (Hasanov, and Omay, 2008). Therefore, as argued by He, and Modest (1995), the fundamental equilibrium could be retained if the deviations are large enough to make arbitrage activities profitable. Consequently, Omay (2010) argues that the dynamic behaviour of returns will depend on the size of the deviation from the equilibrium which will then cause the asymmetric dynamics for returns to be of differing sizes (e.g. Dumas 1992; Shleifer 2000). Hasanov, and Omay (2008) further argue that, if dynamics of the market differ according to the size of deviations from equilibrium, as the economic theory suggests, then such nonlinearities are more suitably modelled by an exponential smooth transition autoregressive (ESTAR) model[5], which have extensively been used in empirical literature to test nonlinear mean reversion of financial time series. For example Hasanov, and Omay (2008) have shown that the predictability of Greek, and Turkish stock markets is enhanced when these markets are modelled by a STAR model. This result is a confirmation of nonlinearity in financial data.

The classical linear unit root tests hypothesize the mean reversion by testing the null hypothesis of non - stationarity with respect to alternative of stationary series. However, by introducing nonlinearity into analysis mean reversion concept is changed with respect to linear counterpart. Moreover, the null and the alternative hypothesis are changed with the inclusion of nonlinearities into the analysis. Accordingly new unit root test procedures are developed in an ESTAR framework such as Kapetanios *et al*. (2003) (henceforth, KSS test), which can be argued to have a better power than conventional linear unit root tests. Furthermore, Ucar, and Omay (2009) (henceforth, UO test) have developed a panel unit root test procedure which also uses ESTAR framework like KSS test. UO test can be regarded as the panel extension of KSS test with using the IPS methodology in panel setting. As in the time series counterpart, UO test has a better power than linear IPS test. In this paper we apply KSS (nonlinear unit root) and UO (nonlinear panel unit root) tests respectively to eight emerging markets, namely, Bulgarian, Greek, Hungarian, Polish, Romanian, Russian, Slovenian and Turkish stock price indices to test whether the series contain unit root. To provide basis for comparing the results of nonlinear unit root tests, we also apply unit root tests that do not take account of nonlinearity in the series, namely ADF, PP and IPS.

It is better to briefly discuss KSS test at first[6]. However, we mentioned that UO test can be regarded as panel extension of KSS test with using the IPS methodology in panel setting. Hence, UO test is a more general testing procedure which nests the KSS test. Therefore, we limit theoretical explanation of unit root tests with UO test[7]. A brief review of the UO test can be given as follows.

As suggested by Ucar, and Omay (2009), let y_{it} be panel exponential smooth transition autoregressive process of order one (PESTAR(1)) on the time domain t = 1,2,…,T for the cross-section units i = 1,2,…,N. Consider y_{it} is generated by the following PESTAR process with fixed effect parameter α_i:

[5] For a discussion of STAR models see Granger, and Teräsvirta (1993), and Teräsvirta (1994).
[6] A more detailed explanation can be followed from Hasanov, and Omay (2007).
[7] For a more detailed discussion see Hasanov, and Omay (2007).

$$\Delta y_{it} = \alpha_i + \phi y_{it-1} + \gamma_i y_{it-1}\left[1-\exp(-\theta_i y_{it-d}^2)\right] + \varepsilon_{it} \quad (1)$$

where $d \geq 1$ is the delay parameter and $\theta_i \geq 0$ represents the speed of revision for all units; ε_{it} is a serially and cross - sectionally uncorrelated disturbance term with zero mean and variance σ_i^2. Following previous literature, Ucar, and Omay (2009) set $\phi_i = 0$ for all i and d=1 which gives specific PESTAR(1) model:

$$\Delta y_{it} = \alpha_i + \gamma_i y_{it-1}\left[1-\exp(-\theta_i y_{it-d}^2)\right] + \varepsilon_{it} \quad (2)$$

Non-linear panel data unit root test based on "Eq. (2)" with augmented lag variables in empirical application is simply to test the null hypothesis $\theta_i = 0$ for all i against $\theta_i > 0$ for some i under the alternative. However, since γ_i is not identified under the null hypothesis, directly testing it inherits some drawbacks which can be solved by taking first-order Taylor series expansion to the PESTAR(1) model around $\theta_i = 0$ for all i. Hence the obtained auxiliary regression is given by:

$$\Delta y_{it} = \alpha_i + \delta_i y_{it-1}^3 + \varepsilon_{it} \quad (3)$$

where $\delta_i = \theta_i \gamma_i$. Based on "Eq. (3)" which is augmented by lagged variables of dependent variable by using AIC and SIC criteria, the hypothesis for unit root testing is

$H_0 : \delta_i = 0$, for all i,(Linear Non stationary)
$H_0 : \delta_i < 0$, for all i,(Non-linear Stationary)

The UO test is constructed by standardizing the average of individual KSS statistics across the whole panel. First, the KSS test for the i^{th} individual is the t-statistics for testing $\delta_i = 0$ in "Equation (3)" defined by:

$$t_{i,NL} = \frac{\Delta y_i^{'} M_t y_{i,-1}^3}{\hat{\sigma}_{i,NL}\left(y_{i,-1}^{'} M_t y_{i,-1}\right)^{3/2}} \quad (4)$$

Furthermore, when the invariance property and the existence of moments are satisfied, the usual normalization of z_{tbar} statistic is obtained[8].

One of the contemporary problems of panel data estimation is cross-section dependency. Most of the panel data models assume that disturbances in panel models are cross - sectionally independent. However, cross-section dependence may arise for several reasons which are given in most of the studies (e.g. Pesaran 2004; Omay, and Kan 2010). As it is well known, ignoring cross-section dependency can lead to biased estimates and can cause misleading inference. Thus, following Omay, and Kan (2010), we have made a diagnostic for cross-section dependency for non-linear panel models. The Cross-Section Dependency (CD) test of Pesaran (2004) which can be applied to a wide variety of models, including both small and large panels, is based on simple average of all pair-wise correlation coefficients of the OLS residuals from the individual regressions in the panel:

$$\Delta y_{it} = \mu_i + \beta_i^{'} x_{it} + u_{it} \quad (5)$$

where t denotes the time domain and i denotes the cross-section units. Hence, $x_{i,t}$ is a kx1 vector of observed time-varying regressors. The intercept (μ_i) and the slope (β_i) are defined on a

[8] The normalization formula and the table values can be followed from Ucar, and Omay (2009).

compact set allowed to differ across i. For each i, $u_{it} \sim iid(0, \sigma_{i,u}^2)$, for all t although they could be cross-sectionally correlated. The sample estimate of the pair-wise correlation of the residuals is given by:

$$\hat{\rho}_{ij} = \hat{\rho}_{ji} = \frac{\sum_{t=1}^{T} e_{it} e_{jt}}{\left(\sum_{t=1}^{T} e_{it}^2\right)^{1/2} \left(\sum_{t=1}^{T} e_{jt}^2\right)^{1/2}} \quad (6)$$

and the e_{it} is the OLS estimates of u_{it} defined by:

$$e_{it} = \Delta y_{it} - \hat{\mu}_i - \hat{\beta}_i^{'} x_{\text{it}} \quad (7)$$

The CD test proposed by Pesaran (2004) is provided by:

$$CD_{LM} = \sqrt{\frac{2T}{N(N-1)}} \left(\sum_{i=1}^{N-1} \sum_{j=i+1}^{N} \hat{\rho}_{ij} \right) \quad (8)$$

The second CD test which is used in Pesaran (2004) is proposed by Breusch, and Pagan (1980):

$$CD_{LM1} = T. \left(\sum_{i=1}^{N-1} \sum_{j=i+1}^{N} \hat{\rho}_{ij} \right) \quad (9)$$

For large N and T, scaled version of CD_{LM1} can be considered for testing the hypothesis of cross dependency as follows:

$$CD_{LM2} = \sqrt{\frac{1}{N(N-1)}} \left(\sum_{i=1}^{N-1} \sum_{j=i+1}^{N} (T. \hat{\rho}_{ij}^2 - 1) \right) \quad (10)$$

4. Data and empirical results

In this paper, major European emerging markets are tested for weak form stock market efficiency. The investigated markets are Bulgarian, Greek, Hungarian, Polish, Romanian, Russian, Slovenian and Turkish markets. The data are monthly and sourced from Datastream. To test the weak form of market efficiency in these markets, stock prices in those markets are searched for whether they contain unit root. A finding of unit root would imply that stock prices follow random walk processes, and thus, weak form efficient. For this purpose we carried out not only the conventional ADF and PP unit root tests as well as KSS nonlinear unit root test, but also their panel extensions namely the IPS and UO tests.

Series names, periods, and Datastream codes for the data are provided in Table 1.

Table 1. Description of Stock Price Series

Description of Stock Price Series				
Country	Series	Datastream Code	Period covered	Number of observations
Bulgaria	BSE Sofia Lazard	BSLAZ10	2002:01 – 2010:05	101
Greece	Total Market PI	TOTMKGR	2002:01 – 2010:05	101
Hungary	BUX	BUXINDX	2002:01 – 2010:05	101
Poland	Total Market PI	TOTMKPO	2002:01 – 2010:05	101
Romania	Total Market PI	TOTMKRM	2002:01 – 2010:05	101
Russia	AKM Composite	RSAKMCO	2002:01 – 2010:05	101
Slovenia	Total Market PI	TOTMKSL	2002:01 – 2010:05	101
Turkey	ISE 100	TOTMKTK	2002:01 – 2010:05	101

It is not unusual for stock prices to contain time trend (Beechey *et al.* 2000), but for a market to be efficient, fluctuations in the stock prices away from the trend should be unpredictable. Therefore, in conducting the pre-described nonlinear unit root test, the de-meaned and the de-trended series should be considered which can be obtained by regressing the natural logarithms of index series on a constant and a linear time trend.

The preliminary tests for non-stationarity of the series and their differences are provided in Table 2. Both the ADF and PP test results indicate that all stock price indices are *I(1)* processes, consistent with the efficient market hypothesis.

Table 2. Linear Unit Root Test Results

Linear Unit Root Test Results				
	ADF		PP	
Country	Log Level[a]	First Difference[b]	Log Level[a]	First Difference[b]
Bulgaria	-0.785	-6.983*	-0.874	-7.314*
Greece	-0.841	-6.890*	-1.739	-6.890*
Hungary	-1.651	-7.773*	-1.541	-7.765*
Poland	-1.186	-8.469*	-1.469	-8.465*
Romania	-1.445	-7.890*	-1.770	-7.899*
Russia	-2.142	-4.560*	-1.182	-7.356*
Slovenia	-1.722	-5.632*	-2.015	-5.686*
Turkey	-1.887	-9.719*	-2.015	-9.721*

To carry out the nonlinear unit root tests, following Hasanov, and Omay (2007) procedure, we firstly estimated an AR(12) model for each series and omitted insignificant augmentation terms at 10% significance level. Then, by selecting the delay parameter *d* that maximized R^2 over $d = \{1,2,...,12\}$, the efficiency of the test is enhanced. Moreover, since the t_{NL} test does not have an asymptotic standard normal distribution, we bootstrapped the t_{NL} test statistic with 10,000 replications.

Table 3. KSS Nonlinear Unit Root Test Results

KSS Nonlinear Unit Root Test Results	
Country	t_{NL}
Bulgaria	-1.324
Greece	-2.821
Hungary	-3.044
Poland	-3.138***
Romania	-3.217***
Russia	-3.203***
Slovenia	-1.754
Turkey	-2.230

Notes: The t_{NL} statistic has computed by bootstrapping with 10,000 replications. Asymptotic critical values of the t_{NL} statistic at 1%, 5% and 10% significance levels are -3.93, -3.40 and -3.13. These values are taken from Table 1, Kapetanios et al. (2003, p. 364). * and ** denote significance at 1% and 5% levels, respectively.

As the Table 3 reveals, the null hypothesis of unit root is rejected at 10% significance level for Russian, Romanian and Polish series suggesting that these markets are not efficient. The null of unit root is not rejected at conventional levels for the Bulgarian, Greek, Hungarian, Slovenian and Turkish series, implying that these markets are weak form efficient. Now it is time to deal this group of markets in panel unit root context. The linear and nonlinear panel unit root tests statistics are as follows:

Table 4. Linear and nonlinear panel Unit Root Test results without cross section dependency

Linear and Nonlinear Panel Unit Root Test Results without Cross Section Dependency				
	IPS		UO	
	Log Level[a]	First Difference[b]	Log Level[a]	First Difference[b]
t_{NL}	-1.458	-7.240*	-2.583***	-9.721*
z_{tbar}	2.598	-18.816*	-3.912***	-24.564*

Notes 1: a) Regressions include an intercept and linear time trend. b) Regressions include only intercept. Optimal lag length in IPS and UO tests were selected using AIC with maximum lag order of 12. *, ** and *** indicate significance at 1%, 5% and 10% significance levels, respectively.

Notes 2: asymptotic critical values of $\bar{t}NT$ for UO test statistics at 1%, 5% and 10% significance levels are −2.44, −2.21, and −2.08 and for trend-intercepts are −2.94,−2.72, and −2.57. For intercept only, the values are taken from Table 2 of Ucar, and Omay (2009, p: 6). Asymptotic critical values of t-bar statistics at 1%, 5% and 10%significance levels are−2.20,−1.95 and−1.85 and for the trend-intercepts are−4.50,−3.35, and −3.02. These values are taken from Table 2 IPS (2003, p 61–62). *, **, and *** denote significance at 1%, 5% and 10% levels, respectively. Besides, optimal lag lengths in these tests were selected using AIC with maximum lag order of 8.

The test of panel unit root explained in the previous section was based on the assumption of independence over cross-section units. However, we see from the below misspecification test that this assumption is violated.

Table 5. Cross Section Dependency Test

	Test statistics	P value
CD_{LM1}	44.933	0.000
CD_{LM2}	5.465	0.000
CD_{LM3}	4.492	0.000

Notes: Under the null hypothesis the CD statistics converge to a normal standard distribution. The values in the parentheses are *p* values.

To overcome the cross-section dependency problem, we implemented Sieve bootstrap approach which is very well outlined in Ucar, and Omay (2009). The test results for the UO and IPS with Sieve bootstrap is given in the below Table 6:

Table 6. Linear and nonlinear panel Unit Root Test Results with cross section dependency

	IPS		UO	
	Log Level[a]	First Difference[b]	Log Level[a]	First Difference[b]
t_{NL}	-1.377 (0.18)	-6.744* (0.000)	-1.857*** (0.09)	-8.623* (0.000)
z_{tbar}	3.184 (0.18)	-17.108* (0.000)	-4.852*** (0.09)	-26.891* (0.000)

Notes:
a) Regressions include an intercept and linear time trend.
b) Regressions include only intercept.
Optimal lag length in IPS and UO tests were selected using AIC with maximum lag order of 12. *, ** and *** indicate significance at 1%, 5% and 10% significance levels, respectively.

As can be seen from Table 6, the UO and IPS tests have different results with respect to weak form market efficiency. With regard to the IPS test, this group of emerging countries failed to reject the null hypothesis of unit root which means that they are efficient as a group. On the other hand, UO test rejected the null hypothesis that this group does not constitute a group of efficient market. This result may be due to the fact that the IPS test has a low power against non-linear stationary process. Hence, the linear unit root and the panel unit root tests suggest that the markets under consideration are both individually and as a group efficient in the weak form. But nonlinear unit root and panel unit

root tests suggest that some of them are individually efficient but as a group they seem to be inefficient in the weak form sense.

From the test results in Table 4 and Table 6 we obtained some conclusions which show us that cross section dependency does not create a serious problem for the sample we select. However the results which are given in Table 4 are biased due to the test results given in Table 5. In Table 5 we have shown that the sample in this study violates the assumption of cross section independency.

Conclusion

In this paper we have tested whether Bulgarian, Greek, Hungarian, Polish, Romanian, Russian, Slovenian and Turkish stock price series contain unit root, consistent with the weak form market efficiency and attempt to contribute to the limited and controversial literature on the efficient market hypothesis which carries important implications for all economic agents. The weak form market efficiency requires the security prices to be characterized by random walk based on past price movements. For this purpose we carried out conventional ADF and PP unit root tests as well as KSS nonlinear unit root test. The results of ADF and PP indicate that Bulgarian, Greek, Hungarian, Polish, Romanian, Russian, Slovenian and Turkish stock price series contain unit root. However KSS nonlinear unit root test suggests weak form inefficiencies for Russian, Romanian and Polish stock price series. Moreover, we applied linear and nonlinear panel unit root tests to this group of countries. The linear panel unit root test suggests that as a group, they form a weak form efficient market where as nonlinear panel unit root test suggests the combined market is inefficient.

Thus, one of the findings of our study is that it may be possible to outperform the market by analysing the past price information and hence technical analysis may work in Russian, Romanian and Polish stock markets while for the Bulgarian, Greek, Hungarian, Slovenian and Turkish stock markets past price information is found to be already reflected into the stock price so technical analysis seems to provide no extra return in these markets. But this result should be concluded preciously and consciously, as nonlinear panel unit root test suggests that these markets when considered together are not weak form efficient. Anyway, one important conclusion that can be drawn from the results of this study is that, it would be wiser to employ nonlinear methods in stock price forecasting in the emerging markets of the CEE countries, as linear methods seems to provide no room, other than by chance, to beat the market and earn speculative gains.

An important implicit conclusion that can be argued from the results of this study by comparing the findings obtained by the nonlinear unit root and nonlinear panel unit root tests is that, since nonlinear unit root test indicates that only Russian, Romanian and Polish markets are inefficient, the major source of inefficiency of European emerging markets is due to the inefficiencies pertaining in the structural characteristics of the so called transition economies. So, it can be argued that any market that has structural similarities to transition economies carry a high potential of market inefficiency, especially inherited in the sources of nonlinearity in the financial data.

Following the argument that well-functioning equity markets provide beneficial effects on the economic growth of developing countries, another implicit implication of our results that may worth noting is that the Bulgarian, Greek, Hungarian, Slovenian and Turkish economies can be argued to have stronger growth opportunities.

Another overall conclusion in accordance with the above arguments can be the fact that, although almost all of the examined countries experienced rapid developments in the corporate governance aspects, they still have to take further measures to overcome market imperfections.

References

[1] Abrosimova, N., Dissanaike, G., and Linowski, D. 2005. Testing the weak form efficiency of the Russian Stock Market. Working Paper, Available at http://papers.ssrn.com/sol3/papers.cfm?abstract_id=302287 (accessed April 25, 2011).

[2] Aga, M., and Kocaman, B. 2006. An empirical investigation of the relationship between inflation, P/E ratios and stock price behaviours using a new series called Index-20 for Istanbul Stock Exchange. *International Research Journal of Finance and Economics* 6: 133-165.

[3] Aga, M., and Kocaman, B. 2008. Efficient market hypothesis and emerging capital markets: empirical evidence from Istanbul Stock Exchange. *International Research Journal of Finance and Economics* 13: 131-144.

[4] Atan, M., Atan, S., and Ozdemir, Z. A. 2009. Hisse Senedi Piyasasında Zayıf Formda Etkinlik: IMKB Uzerine Ampirik Bir Calısma. *Dokuz Eylül Üniversitesi İktisadi ve İdari Bilimler Fakültesi Dergisi* 24 (2): 33-48.

[5] Atje, R., and Jovanovic, B. 1993. Stock markets and development. *European Economic Review* 37: 632-640.

[6] Bajaj, M., and Vijh, A. 1990. Dividend clienteles and the information content of dividend changes. *Journal of Financial Economics* 26: 193-219.

[7] Bajaj, M., and Vijh, A. 1995. Trading behaviour and the unbiasedness of the market reaction to divided announcements. *Journal of Finance* 50: 255-279

[8] Bamber, L. 1987. Unexpected earnings, firm size, and trading volume around quarterly earnings announcements. *The Accounting Review* 62: 510-532

[9] Breusch, T.S., and Pagan, A.R. 1980. The Lagrange multiplier test and its application to model specifications in econometrics. *Review of Economic Studies*, 47: 239-253.

[10] Brigham, E.F., and Gapenski, C.G. 1994. *Financial Management: Theory and Practice.* The Dryden Press: U.S.A.

[11] Cajueiro, D.O., and Tabak, B.M. 2006. Testing for predictability in equity returns for European transition markets. *Economic Systems* 30: 56-78.

[12] Campbell, J.Y., Lo A.W., and MacKinlay A. C. 1997. *The Econometrics of Financial Markets*. Princeton University Press: NJ, U.S.A.

[13] Celik, T.T., and Tas, O. 2007. Etkin Piyasa Hipotezi ve Gelişmekte olan Hisse Senedi Piyasaları. *Istanbul Teknik Universitesi Dergisi/b Sosyal Bilimler* 4(2): 11-22.

[14] Copeland, T. 1979. Liquidity Changes Following Stock Splits. *Journal of Finance* 34: 115-141.

[15] Dickey, D.A., and Fuller, W. A. 1981. Likelihood Ratio Statistics for Autoregressive Time Series with a Unit Root. *Econometrica* 49: 1057–1072.

[16] Dima, B., and Milos, L.R. 2009. Testing the efficiency market hypothesis for the Romanian stock market. *Annales Universitatis Apulensis Series Oeconomica* 11(1): 402-415.

[17] Dockery, E., and Vergari, F. 1997. Testing the random walk hypothesis: evidence for the budapest stock exchange. *Applied Economics Letters* 4: 627-629.

[18] Dumas, B. 1992. Dynamic equilibrium and the real exchange rate in a spatially separated world. *Review of Financial Studies* 5: 153–180.

[19] Emerson, R., Hall, S.G., and Zalewska-Mitura, A. 1997. Evolving market efficiency with an application to some Bulgarian shares. *Economics of Planning* 30: 75–90.

[20] Franses, P.H., and van Dijk, D. 2000. *Non-Linear Time Series Models in Empirical Finance.* Cambridge University Press: Cambridge.

[21] Gilmore, C.G., and McManus, G.M. 2003. Random Walk and Efficiency Tests of Central European Equity Markets. *Managerial Finance* 29(4): 42-61.

[22] Granger, C.W.S., and Terasvirta, T. 1993. *Modelling Nonlinear Economic Relationships*. Oxford University Press: Oxford.

[23] Harrison, B., and Paton, D. 2004. Transition, the evolution of stock market efficiency and entry into eu: the case of Romania. *Economics of Planning* 37: 203-223.

[24] Hasanov, M., and Omay, T. 2007. Are the transition stock markets efficient? Evidence from non-linear unit root tests. *Central Bank Review* 2: 1-12.

[25] Hasanov, M., and Omay, T. 2008. Non-linearities in emerging stock markets: evidence from europe's two largest emerging markets. *Applied Economics* 40(23): 2645-2658.

[26] Hassan, K.M., Haque, M., and Lawrence, S. 2006. An empirical analysis of emerging stock markets of Europe. *Quarterly Journal of Business and Economics* 45 (1): 31-52.

[27] He, H., and Modest, D. 1995. Market frictions and consumption-based asset pricing, *Journal of Political Economy* 103: 94-117.

[28] Holthausen, R., Leftwich, R., and Mayers, D. 1987. The effect of large block transactions on security prices: a cross-sectional analysis. *Journal of Financial Economics* 19: 237-267.

[29] Im, K.S., Pesaran, H., and Shin, Y. 2003. Testing for Unit Roots in heterogeneous panels. *Journal of Econometrics* 115: 53–74.

[30] Jones, D.S., and Netter, J.M. 2008. *Efficient Capital Markets*, The Concise Encyclopedia of Economics. David R. Henderson, ed. Liberty Fund, Inc., Library of Economics and Liberty Available at http://www.econlib.org/library/Enc/EfficientCapitalMarkets.html (accessed August 10, 2011).

[31] Kahraman, D., and Erkan, M. 2005. Istanbul Menkul Kıymetler Borsası'nda Tesadüfi Yürüyüş Testi. *Yönetim ve Ekonomi* 12(1): 11-24.

[32] Kapetanios, G., Shin, Y., and Snell, A. 2003. Testing for a Unit Root in the nonlinear STAR Framework. *Journal of Econometrics* 112: 359-379.

[33] Kim, O., and Verrecchia, R. 1991a. Trading volume and price reactions to public announcements. *Journal of Accounting Research* 29: 302-321.

[34] Kim, O., and Verrecchia, R. 1991b. Market reaction to anticipated announcements. *Journal of Financial Economics* 30: 273-309.

[35] Kraus, A., and Stoll, H. 1972. Price impacts of block trading on the New York stock exchange. *Journal of Finance* 27: 569-588.

[36] Lakonishok, J., and Vermaelen, T. 1990 Anomalous Price Behaviour around Repurchase Tender Offers. *Journal of Finance* 45: 455-478.

[37] Legoarde-Segot, T., and Lucey, B.M. 2008. Efficiency in Emerging Markets - Evidence from MENA Region. *Journal of International Financial Markets, Institutions and Money* 18(1): 94-105.

[38] Levine, R., and Zervos, S. 1998. Stock Markets, Banks and Economic Growth, *American Economic Review* 88: 537-558.

[39] Liu, X., Song, H., and Romilly, P. 1997. Are Chinese Stock Markets Efficient? A Cointegration and Causality Analysis. *Applied Economics Letters* 4: 511-515.

[40] Magnusson, M.A., and Wydick, B. 2002. How Efficient are Africa's Emerging Stock Markets? *The Journal of Development Studies* 38: 141-156.

[41] Mobarek, A., and Keasey, K. 2002. Weak Form Market Efficiency of an Emerging Market: Evidence from Dhaka Stock Market of Bangladesh. Available at http://www.pdf4me.net/pdf-data/weak-form-emerging-market.php (accessed May 2, 2011).

[42] Moustafa, M.A. 2004. Testing the Weak Form Efficiency of the United Arab Emirates Stock Market. *International Journal of Business* 9(3): 31-52.

[43] Obstfeld, M. 1994. Risk-Taking, Global Diversification and Growth. *American Economic Review* 84: 1310-1329.

[44] Omay, T. 2010. A Nonlinear New Approach to Investigating Crisis: A Case from Malaysia," MPRA Paper 20738, University Library of Munich: Germany.

[45] Omay, T., and Kan, E.O. 2010. Re-Examining the Threshold Effects in the Inflation–Growth Nexus with Cross-Sectionally Dependent Non-Linear Panel: Evidence from Six Industrialized Economies. *Economic Modelling* 27(5): 996-1005.

[46] Pesaran, M.H. 2004. General Diagnostic Tests for Cross-Section Dependence in Panels. Cambridge Working Papers in Economics CWPE 0435. Available at http://www.econ.cam.ac.uk/dae/repec/cam/pdf/cwpe0435.pdf (accessed December 10, 2011).

[47] Phillips, P.C.B., and Perron, P. 1988. Testing for Unit Root in Time Series Regression. *Biometrica* 75: 335-346.

[48] Rockinger, M., and Urga, G. 2001. A Time Varying Parameter Model to Test for Predictability and Integration in Stock Markets of Transition Economies. *Journal of Business and Economic Statistics* 19: 73-84.

[49] Shleifer, A. 2000. *Inefficient Markets: An Introduction to Behavioural Finance*. Clarendon Lectures in Economics. Oxford University Press: Oxford.

[50] Seiler, M.J., and Rom, W. 1997. A Historical Analysis of Market Efficiency: Do Historical Returns Follow a Random Walk. *Journal of Financial and Strategic Decisions* 10: 49-57.

[51] Smith, G., and Ryoo, H.J. 2003. Variance Ratio Tests of the Random Walk Hypothesis for European Emerging Stock Markets. *The European Journal of Finance* 9: 290-300.

[52] Teräsvirta, T. 1994. Specification, Estimation, and Evaluation of Smooth Transition Autoregressive Models. *Journal of the American Statistical Association* 89: 208-218.

[53] Uçar, N., and Omay, T. 2009. Testing for Unit Root in Non-linear Heterogeneous Panels. *Economics Letters* 104(1): 5-8.

[54] Yılancı, Veli. 2012. Detection of Nonlinear Events in Turkish Stock Market. *Journal of Applied Economic Sciences Vol VII*, 1(19)/Spring: 93-96.

[55] Zalewska-Mitura, A., and Hall, S.G. 1999. Examining the First Stages of Market Performance: A Test for Evolving Market Efficiency. *Economics Letters* 64: 1-12.

PREDICTING AUDITOR SWITCHES BY APPLYING DATA MINING

Efstathios KIRKOS
Department of Accounting, ATEI of Thessaloniki, **Greece**
stkirk@acc.teithe.gr

Abstract:

Auditor dismissals are considered to be a threat to audit quality. Several studies have examined auditor switches by applying typical statistical analysis. In the present study we deal with the auditor switching problem by applying data mining methodologies. Publicly available financial statement and auditing data are used as predictors. The optimum vector of significant input variables is defined by employing feature selection. A number of data mining classification methods are used to develop models capable of predicting the auditor change cases. The methods are compared against the widely used Logistic Regression. According to the results, all the data mining methods outperform Logistic Regression. Significant factors associated with auditor changes are revealed. The results can be useful to auditing firms, managers, investors, creditors and corporate regulators.

Keywords: Auditor switching, auditing, data mining.

JEL Classification: C38, C45, M42.

1. Introduction

Modern corporations separate ownership and management. This separation creates incentives for non-owner managers to act in their own interests at the expense of shareholders and creditors. In order to reduce information asymmetry among managers, shareholders and creditors, companies hire independent auditors. However, the conduct of an external audit does not ensure that all material misstatements have been reported. In fact, auditing can be of varying quality. DeAngelo (1981) defines audit quality as the probability that an auditor will both discover a breach in the accounting system and report the breach. When accomplishing their tasks, the auditors may be influenced by several factors which constitute corresponding threats for audit quality. The ICAEW (Institute of Chartered Accountants in England and Wales, Members Handbook 2001) categorizes these threats as 1) the self-interest threat, i.e. the interest of not losing the client 2) the self-review threat, when reviewing prior-year's audits 3) the advocacy threat, when the auditor advocates the position of a client, and 4) the familiarity threat, when the auditor is over-influenced by senior executives. The self-interest threat arises from a very real and certain fact. This fact is that, although the auditor must remain independent and protect investors and creditors, it is the auditor's management that determines the appointment, retention and audit fees.

Since auditor dismissal constitutes a threat for audit quality, the auditor switching problem is a well-recognized research topic. In the past, several studies have addressed the auditor change problem (Johnson, and Lys 1990; DeFond 1992; Krishnan *et al.* 1996; Lennox 2000; Carcello, and Neal 2003; Hudaib, and Cooke 2005; Lin, and Liu 2010). All these studies employ traditional statistical techniques like Principal Components Analysis, Probit or Logistic Regression. However, the new Data Mining (DM) techniques offer considerable advantages over the statistical ones. Studies that applied DM techniques in several auditing related fields report better accuracy rates (Lin, and McClean 2001; Tsakonas *et al.* 2006; Boyacioglou *et al.* 2009; Koh 2004; Kirkos *et al.* 2007a; Gaganis *et al.* 2007; Fanning, and Cogger 1998; Kotsiantis *et al.* 2006; Kirkos *et al.* 2007b; Kirkos *et al.* 2010). Traditional data analysis formulates a hypothesis and tests this hypothesis against the data, whereas the new techniques extract the patterns directly from the data. In addition, DM proposes methods that cover all the stages of the knowledge discovery process, including the selection of the task relevant features, the development of models, the evaluation of the models' performance against unknown data and the interpretation of the models. Such methodologies have not yet been applied in the field of auditor switching research.

The motivation of the present study is to assess the applicability of DM methodologies for the purpose of predicting auditor switching cases. We claim that the publicly available financial statement and auditing data contain enough information to develop models capable of predicting auditor switching cases. Financial ratios and auditing data are used to formulate an initial set of independent

variables. Feature selection is applied to select an optimum set of predictors. Several classification methods, including decision trees, neural networks, Bayesian networks, k-nearest neighbours and support vector machines, are employed and corresponding models are developed. These models are tested against the widely used Logistic Regression. The results provide evidence that the DM models outperform Logistic Regression. The performance is evaluated against previously unseen patterns. Decision trees, which provide an interpretable model, highlight significant factors associated with auditor switching practices. The data set contains data about 338 publicly traded British and Irish companies half of which changed auditor during the period 2003-2005. This study adds to the understanding of the auditor procurement process by proposing models capable of predicting the auditor switching cases. The results can be useful to auditing firms, managers, investors, creditors and corporate regulators.

The paper is organized as follows: Section 2 reviews relevant former research. Section 3 includes a brief presentation of the employed classification methods. Section 4 presents the research methodology and the results. Finally, Section 5 comprises the concluding remarks.

2. Prior research

In the past, several studies have addressed the auditor switching problem. Johnson, and Lys (1990) examined whether changes in clients' financial, investing and operating characteristics are related to voluntary auditor realignments. Their sample contained 603 auditor changes in the US during 1973-1982. They employed multiple regression and logit regression. According to their results the client's enterprise growth and financial activities were found to be associated with the relative audit firm size. DeFond (1992) examined 131 auditor switches for an association between changes in auditor quality and changes in agency conflicts. Agency conflicts are proxies by leverage, management ownership and size of short-term accruals. He applied Principal Components Analysis. The selection of independent variables was based on previous studies. His results provided support that changes in management ownership and leverage are associated with changes in the auditor's ability to alleviate agency conflicts independently of changes in firm growth and securities issues.

Beattie, and Fearnley (1995) explored the importance of audit firm characteristics and the factors motivating auditor changes. Their study was based on questionnaire responses from 210 UK companies. Two thirds of the companies had recently considered changing auditors. They analysed the data by using t-test and factor analysis. According to their results, audit fees were the principal cause of consideration of auditor change. Changes in the structure of the audit firm, changes in the personnel of the audit team and top management changes within the auditee were also common destabilizing influences. Krishnan, and Stephens (1995) examined for a relation between audit qualifications and auditor switches. They compared the audit opinions of the predecessor and successor auditors for clients who switched, relative to auditors' treatment of non-switching clients. The sample contained 4,208 US firms, where the switching rate was 6.46%. The employed method was Probit. The selection of the independent variables was based on previous research. The results suggested no difference in the treatment of clients who switched in the pre-switch and post-switch years relative to non-switching clients.

Krishnan *et al*. (1996) tested the two-way causation between auditor switching and audit opinion. They developed two probit equations, one for qualifications and one for switching. The sample contained 1,878 US companies for fiscal years 1986 through 1988. Previous studies were used to identify significant input variables. They found that a client receiving a qualified opinion is more likely to switch auditor. Their results did not support that switching may cause auditors to issue qualified opinions less often. DeFond, and Subramanyam (1998) tested if auditor changes were motivated by auditors' conservative accounting choices. The sample contained 503 auditor changes in the US. They developed a regression model to test the auditee's discretionary accruals. The selection of input variables was based on previous research. They found that discretionary accruals were income decreasing during the last year with the predecessor auditor and, after controlling for financial distress, were generally insignificant during the first year with the successor auditor.

Lennox (2000) tested for opinion-shopping by predicting the opinions companies would have received had they made opposite switch decisions. The audit opinion and audit switching models were estimated by probit analysis. The sample contained 949 UK companies and 5.441 observations. He concluded that companies do successfully engage in opinion-shopping. Carcello, and Neal (2003)

examined auditor dismissals following new going concern reports that Big 6 issued between 1988 and 1999. By using characteristics of the audit committee as independent variables they applied logistic regression to model auditor dismisses. They found that the higher the percentage of affiliated directors on the audit committee, the more likely a client will dismiss its auditor following the receipt of a new going-concern report. They also found that the probability the client dismisses the auditor increases as audit committee ownership of client stock increases. Branson, and Breesch (2004) performed a study concerning the Belgian economy. They used questionnaires to gather information about auditor switches. They found that subsidiaries tend to appoint the same auditor as the parent companies.

Hudaib, and Cooke (2005) studied the impact of changing the managing director and of financial distress on audit qualifications and auditor switching. The sample contained 297 publicly listed companies. The selection of input variables was based on findings of previous studies. The method used was logistic regression. They found that auditors have a tendency to switch auditor after receiving a qualified audit opinion. In addition, distressed auditors with a qualified report and who change their managing director are most likely to switch their auditors. Nasser *et al*. (2006) examined auditor changes in Malaysia. They applied logistic regression to develop an auditor-switching model. The independent variables used were found significant in previous studies. According to the conclusions the retention of audit firms depends on the size of the clients based on total assets, level of financial risk and type of audit firm. The likelihood of non-distressed large client audited by large audit firm to switch is significantly less compared with distressed small client audited by small audit firms. Lin, and Liu (2010) studied the association between firms' internal corporate governance mechanisms and their auditor switch decisions in China. They modelled auditor switches by applying logistic regression. The selection of independent variables was based on previous studies. The findings suggested that firms with weak internal corporate governance mechanism tend to switch to smaller or more pliable auditors. With the improvement of corporate governance, firms should be more likely to choose large (high quality) auditors.

By observing the collected literature we note that all related studies perform typical statistical analysis. Up to now, no study approaches the auditor switching problem in the context of data mining. Data mining provides a range of methodologies and techniques that deal with all the steps of the knowledge discovery process. These steps include the definition of the optimum set of independent variables (features), the development and evaluation of the models and the interpretation of the models. Data mining classification methodologies enjoy a very good reputation for their predicting capabilities and their high performances.

3. Methods

In the present study five data mining classification methods are employed. The methods used are Decision Trees, Neural Networks, Support Vector Machines, k-Nearest Neighbours and Bayesian Networks.

3.1 Decision trees

A decision tree (DT) is a tree structure, where each node represents a test on an attribute and each branch represents an outcome of the test. In this way, the tree attempts to divide observations into mutually exclusive subgroups. The goodness of a split is based on the selection of the attribute that best separates the sample (Han, and Kamber 2000). There are several proposed decision tree algorithms. In the present study we use C4.5 decision trees where the selection of the splitting variable is based on an entropy-based measure, called information gain. In a binary class example, entropy E(S) is defined as:

$$E(S) = -p_+ * \log_2(p_+) - p_- * \log_2(p_-) \quad (1)$$

where S is the set of observations, p+ is the proportion of positive observations in S, and p- is the proportion of negative observations in S. If the class attribute can obtain c alternative values, then entropy is defined as:

$$E(S) = -\sum_{i=1}^{c} p_i * \log_2(p_i) \quad (2)$$

where pi is the proportion of observations which belong to class i. The notion of information gain G(S,A) represents the reduction in entropy in S, if the attribute A is selected as a splitter. Information gain is defined as:

$$G((S,A)) = E(S) - \sum_{u \in Values(A)} \frac{|S_u|}{|S|} * E(S_u) \quad (3)$$

where E(S) is the entropy of S, A is the splitting attribute, Values(A) are the values of A, Su is the proportion of observations with A=u and E(Su) is the entropy of the observations with A = u.

According to these principles the sample is successively divided into subsets, until either no further splitting can produce statistically significant differences or the subgroups are too small to undergo similar meaningful division. The successive division of the sample may produce a large tree. Some of the tree's branches may reflect anomalies in the training set, like false values or outliers. For that reason tree pruning is required. Tree pruning involves the removal of splitting nodes in a way that does not significantly affect the model's accuracy rate.

Decision Trees offer considerable advantages. They make no assumptions about the independence of the input variables or the distribution of the data. They produce comprehendible models which can be easily converted to a set of If-Then rules. Decision Trees are immune to the presence of irrelevant input variables or the presence of missing values and outliers. Their learning algorithm is very fast. A major disadvantage of decision trees is that they are sensitive to changes of the sample.

3.2 Neural networks – multilayer perceptron

A Multilayer Perceptron (MLP) is a feed forward neural network. Feed forward neural networks are ideally suitable for modelling relationships between a set of predictor variables and a response variable. A MLP consists of a number of neurons, i.e. interconnected processing units. Each neuron is connected to other neurons with feed forward links. Associated with each connection is a numerical value, called "weight". Each neuron receives signals from connected neurons and the combined input signal is calculated. The total input signal for neuron j is:

$$u_j = \sum_i w_{ij} * x_i + b_j \quad (4)$$

where x_i is the output of neuron i, w_{ij} is the weight of the connection between neuron i and neuron j and b_j is the bias of neuron j. If the combined input signal strength exceeds a threshold, then the input value is transformed by the transfer function of the neuron and finally the neuron fires (Han, and Kamber 2000). The typical transformation function used in MLP is the sigmoid function

$$x_j = \frac{1}{1 + e^{-u_j}} \quad (5)$$

The neurons are arranged into layers. A layered network consists of at least an input (first) and an output (last) layer. Between the input and output layer there may exist one or more hidden layers. A MLP has at least on hidden layer.

After the network architecture is defined, the network must be trained. MLP uses the Back propagation algorithm. In Back propagation networks, a pattern is applied to the input layer and a final output is calculated at the output layer. The output is compared with the desired result and the errors are propagated backwards in the NN by tuning the weights of the connections. This process iterates until an acceptable error rate is reached. The error of a hidden layer neuron is calculated as

$$Err_j = x_j * (1 - x_j) * \sum_k Err_k * w_{jk} \quad (6)$$

where w_{jk} is the weight of the connection from neuron j to neuron k in the next layer and Err_k is the error of neuron k. The weights are updated by the following equation

$$\Delta w_{ij} = l * Err_j \quad (7)$$

$$w_{ij} = w_{ij} + \Delta w_{ij} \quad (8)$$

where Δw_{ij} is the change in the weight w_{ij} and l is the learning rate.

One of the major advantages of NNs is that they do not assume a linear relationship between the independent (or the log of the independent) variable and the dependent variable. NNs are also capable of handling noisy or inconsistent data and they are a suitable alternative for problems where an algorithmic solution is not applicable. Another advantage is their predictive performance. Major disadvantages of neural networks are their slow learning algorithm, their poor interpretability and the experience required for the definition of their topology.

3.3 Support vector machines

Support Vector Machines (SVMs) is a classification method developed by Vapnik (1995). The key idea is to transform the input space to a higher dimensionality feature space and create a maximum-margin hyper plane that splits the example classes. The margin is defined as the minimum distance of an example to the hyper plane. Let the n training samples are denoted as $X=\{(x,y)|(x_1,y_1)\ldots(x_n,y_n\}$where $x_k \in R^d$ is the kth training sample, d is the dimension of input space and y_k is the class value of the k_{th} training sample. If x_k belongs to class 1 then y_k=+1, otherwise y_k=-1. If the training data are linearly separable in the feature space then the decision function is given by Eq. Xxx

$$f(x) = w^T \phi(x) + b \quad (9)$$

where w is a weight vector, ϕ (x) is the mapping function, b is the bias and $y_k f(x_k) > = 1$. In order to classify an unknown observation x, f(x) is calculated and according to a positive or negative result the new observation is assigned to the proper class value. A learning machine must find the hyperplane with the maximum margin. This hyperplane is called the optimal separating hyperplane. Constructing an optimal separating hyperplane implements the principle of structural risk minimization.

In real world problems a separating hyperplane may not exist and some examples may be misclassified. In order to relax the hard margin constraints, Vapnik introduced the slack variables ξ_k. The error term ξ_k of instance k is defined as follows:

$$y_k \left[w^T \phi(x_k) + b \right] \geq 1 - \xi_k \quad , \quad \xi_k \geq 0, \quad k=1,\ldots,n \quad (10)$$

The trained classifier should maximize the margin and simultaneously minimize the sum of the slacks. One possible formulation is to minimize the following function:

$$\min_{w,b,\xi} \frac{1}{2} w^T w + C \sum_{k=1}^{n} \xi_k \quad (11)$$

where C the regularization constant to trade off the empirical error and the complexity term. SVM gain popularity due to its solid theoretical foundation and high performance.

3.4 k-Nearest neighbours

According to the k-Nearest Neighbours (k-NN) method, a sample containing objects with n attributes is considered as a n-dimensional space. Each object is one point in the n-dimensional space. k-NN introduces a similarity metric for the objects. When an unknown observation is given, a k-NN classifier searches the sample space for the k training cases that are closest to the unknown observation. These k cases are the k nearest neighbours of the new observation. The classifier assigns the new observation to the most common class among the k nearest neighbours.

In its simplest version, k-NN requires arithmetic input variables. The similarity of two objects is calculated as their Euclidean distance. For two objects X=(x1, x2,…,xn) and Y=(y1, y2,…,yn) their Euclidean distance is defined as:

$$d(X,Y)=\sqrt{\sum_{i=1}^{n}(x_i-y_i)^2} \tag{12}$$

One well known problem with the Euclidean distance is that attributes that have big value range contribute more than attributes with small value range. Main advantages of the k-NN classifier are its simplicity and performance. Disadvantages are its sensitivity to the participation of irrelevant attributes and the need for efficient indexing techniques

3.5 Bayesian networks

Bayesian classification is based on the statistical theorem of Bayes. According to Bayes theorem, if H is a hypothesis then the probability that the hypothesis holds is

$$P(H\,|\,\mathrm{X})=\frac{\mathrm{P}(\mathrm{X}\,|\,\mathrm{H})*P(H)}{P(X)} \tag{13}$$

If an object X belongs to one of i alternative classes, in order to classify the object, a Bayesian classifier calculates the probabilities P(Ci|X) for all the possible classes Ci and assigns the object to the class with the maximum probability P(Ci|X).

Naive Bayesian classifiers make the class condition independence assumption, which states that the effect of an attribute value on a given class is independent of the values of the other attributes. This assumption simplifies the calculation of P(Ci|X). If this assumption holds true, the Naive Bayesian classifiers have the best accuracy rates compared to all other classifiers. However, in many cases this assumption is not valid, since dependencies can exist between attributes.

Bayesian Networks (BN) allow for the representation of dependencies among subsets of attributes. A BN is a directed acyclic graph, where each node represents an attribute and each arrow represents a probabilistic dependence. If an arrow is drawn from node A to node B, then A is parent of B and B is a descendant of A. In a Bayesian Network, each variable is independent of its non-descendants, given its parents.

For each node X there exists the Conditional Probability Table, which specifies the conditional probability of each value of X for each possible combination of the values of its parents. The probability of a tuple (x_1,..., x_n) having n attributes is

$$P(x_1..x_n)=\prod\prod P(X_i\,|\,Parents(x_i)) \tag{14}$$

The network structure can be defined in advance or can be inferred from the data. For classification purposes, one of the nodes can be defined as the class node. The network can calculate the probability of each alternative class. Bayesian Belief Networks offer significant advantages. BBNs are very suitable in cases where complex interrelationships exist between the dependent and independent variables or even among the dependents themselves. BBNs are highly interpretable and achieve good accuracy rates. Perhaps the most significant disadvantage of an approach involving Bayesian Networks is the fact that there is no universally accepted method for constructing the graph from data. More detailed but still brief presentation of the employed methods can be found in Han, and Kamber (2000), and Maimon, and Rokach (2005).

4. Research methodology and models

4.1. Data set construction

The data used in this study come from the FAME (Financial Analysis Made Easy) Data Base. FAME contains data about UK and Irish firms. Initially we selected the companies which are publicly traded and changed their auditor during the years 2003-2005. Companies activated in the sector of finance present peculiar characteristics. Dopuch *et al*. (1987) claims that the financial variables used in audit qualification studies may be inappropriate in the financial industry. Ohlson (1980) also excludes financial companies for similar reasons. We selected the companies activated in the sectors of Manufacturing, Construction, Mining and Computers (UK SIC Codes 10-45 & 72). A number of the selected companies contained a disproportional number of missing values. These companies were considered non informative and were removed. Some of the selected companies did not actually changed auditor. However, due to auditing firm merges, they appeared mistakenly to have changed auditor. These companies were removed. A number of companies hired Arthur Andersen in year 2002. Arthur Andersen collapsed after the Enron scandal and thus, these companies were forced to change auditor in year 2003. These companies were also removed. Finally, the companies Royal Dutch Shell and British Petroleum changed their auditor during 2003-2005. However, due to their size, these companies could bias the sample. These two companies were considered outliers and were also removed. In total we kept 169 corporations that switched auditor in the data set. The remaining observations were matched with an equal number of publicly listed companies which did not change auditor for at least three successive years. The matched has been performed in terms of industry (four digits SIC Code) and fiscal year to eliminate macroeconomic influences. The final sample contained 338 company-year observations.

4.2. Input variables selection

The research literature provides insights relevant to factors affecting the auditor switching decisions. Johnson, and Lys (1990) claim that changes in the client's operations can erode the incumbent auditor's competitive advantage. The rapid growth entails increases in transaction volume and accounting complexity, in the geographical dispersion of activities and in the decentralization of financial reporting and control systems. Rapid growth may trigger client-auditor realignments. Sinanson *et al*. (2001) found that audit tenure is affected by client's growth rate. We test several trend variables for their applicability in the auditor switching prediction. These variables are Total Assets Trend, Current Assets Trend, Fixed Assets Trend, Long Term Liabilities Trend, Current Liabilities Trend and Increase in Cash.

Schwartz, and Menon (1985) suggest that financially distressed companies are more likely to change auditors. In the present study we use the Altman's ZScore. Altman (1983) proposed ZScore as a surrogate for the probability of bankruptcy. FAME also includes the Quiscore. Quiscore, provided by CRIF, is a measure of the likelihood of default. We test Quiscore as a candidate variable. The choice of audit firm can be related to the size of the auditee and the type of services needed (Nasser *et al*. 2006). Larger auditees, due to the complexity of their operations and the increase in the separation between management and ownership, demand highly independent audit firm to reduce agency cost (Watts, and Zimmerman 1986) and the auditor's self-interest threat (Hudaib, and Cooke 2005). We include several corporation size relevant variables i.e. Total Assets, Fixed Assets and Current Assets.

The most common factor for switching cited in the literature is audit qualification. Chow, and Rice (1982) found a significant positive association between qualified opinions and subsequent auditor switching. Citron, and Taffler (1992) found association between 'going-concern' qualifications and auditor switching. We test the qualifications of previous year with a binary variable which takes the value 1 if a qualified report was issued for the previous year and the value 0 otherwise. In order to test for associations between auditor changes and modifications in the auditors' opinions we created four dummy variables each of which expresses a possible combination between the qualification of the year of change and the qualification of the previous year. These variables are Unqualified-Unqualified, Unqualified-Qualified, Qualified-Unqualified and Qualified-Qualified. For each observation the variable which depicts the qualifications cases obtains the value 1 whereas the other three dummy variables obtain the value 0.

Audit fees are a major criterion for selecting an auditor. The findings of Johnson, and Lys (1990) support the view that realignments can be attributes to changes in client characteristics and

differences in audit firm cost structures. Branson, and Breesch (2004) list several studies that associate auditor changes with audit fees. We use the variables Audit Fees and Audit Fees to Total Assets. In UK there is no legal restriction concerning the provision of both audit and non-audit services. In many cases auditors provide audit and consultancy services. DeBerg *et al*. (1991) found evidence that the level of non-audit services purchased declines following auditor change. We use the variable non-Audit Fees. Auditor switching may signal changes to the markets. Lin, and Liu (2010) use the variable Market to Book Ratio as an independent variable in their auditor switching model. We check the variables Market Capitalization, Market to Book Ratio and Market Price of Current Year minus Market Price of Previous Year to Market Price of Previous Year. Companies with many subsidiaries are more complex. This complexity may affect the auditor choice. We test the variable Number of Subsidiaries. Big auditing firms are identified in the literature as higher quality auditors (DeAngelo 1981). Since audit quality is a consideration when selecting an auditor, the type of auditor may be a significant criterion. We use the binary variable IfBig which takes the value 1 if the auditor is one Big4 auditor and the value 0 otherwise.

There are mixed research results regarding leverage and auditor changes. Eichenseher, and Shields (1989) report a positive association between client leverage and changes to big auditing firms, whereas no leverage effects were found by Palmrose (1984). Reed *et al*. (2000) found that firms selecting Big 6 auditors tend to be highly leveraged. The findings of DeFond (1992) provide evidence that changes in leverage are positively associated with changes in audit quality. Lin, and Liu (2010) use leverage as an independent variable in an auditor-switching regression model. In the present study we include the variables Total Debt, Total Debt to Total Assets, Long Term Debt, Long Term Debt to Total Assets, Gearing and Short Term Loans. Johnson, and Lys (1990) include profitability in the clients' characteristics that influence auditor costs. Willenborg (1999) provides evidence that corporations audited by large auditing firms are more profitable ceteris paribus. We check the profitability variables Gross Profit, Operating Profit, Profit before Interest and Tax, Retained Profit, Profit Margin, Return on Shareholders' Funds, Return on Total Assets, EBIT Margin, Operating Profit to Total Assets, Profit Before Interest to Total Assets and Profit Before Interest to Sales.

Inventory and Accounts Receivable need audit adjustments (Icerman, and Hillison 1991). We include the variables Account Receivable, Stock and Work in Progress, Account Receivable plus Inventory to Total Assets, Account Receivable to Sales, Inventory to Sales and Inventory to Total Assets. Liquidity is another financial aspect tested for its association with auditor changes. The liquidity variables used are Working Capital, Current Ratio, Liquidity Ratio, Solvency Ratio, Quick Ratio, and Working Capital to Total Assets. Finally, some additional variables collected from FAME are included. These are Shareholders' Funds, Current Liabilities, Long Term Liabilities, Fixed Assets to Total Assets, Turnover and Sales to Total Assets. The binary variable Change indicates the auditor switching cases.

4.3. Feature selection

The studies mentioned in the relevant literature section adopt an approach which predefines the independent variables. The researchers recall the results of previous research in order to find factors and variables associated with the auditor change decision. In many cases the focus is to introduce a new factor and highlight its importance. This way, a hypothesis is initially formulated and then tested against a data set. However, there may be additional influencing factors that have not yet been discovered.

Data mining methodologies have a reverse logic. The notion is that there are vast amounts of data and the knowledge must be extracted directly from them. In this sense, data mining provides techniques that assess the significance of features and select, among many others, the task relevant ones. This process, known as feature selection, is a standard data preprocessing step in data mining. In a typical data base there are too many attributes. These attributes can be irrelevant, redundant or useful. Feature selection is the process of identifying and removing as much of the irrelevant and redundant attributes as possible. Reducing the dimensionality of the data reduces the size of the hypothesis space and allows algorithms to operate faster and more effectively. In some cases, accuracy on future classification can be improved. There are several feature selection techniques.

In the present study we collected 59 variables referring to several aspects of a firm's financial status. Descriptive statistics of these variables can be found in Table 1.

Table 1. Univariate statistics

Variable	Change		Not Change	
	Average	Std-dev	Average	Std-dev
Turnover	424633,5	2640365,6	661961,3	1449086,9
Gross Profit	175413,2	1211523,9	217322,5	775130,4
Operating Profit	44331,2	331700,9	68768,9	249580,4
Profit Before Interest	62665,6	439751,5	79539,1	287748,3
Retained Profit	12976,4	103188,2	20147,2	96829,8
Audit Fee	246,3	1189,1	442,5	944,4
Non Audit Fee	294,4	1189,7	349,4	683,3
Fixed Assets	432545,0	2643848,3	509654,1	1943903,4
Current Assets	162952,2	958241,7	265264,0	635296,7
Current Liabilities	159960,3	1089053,6	204334,9	512747,4
Short Term Loans	80356,4	457017,1	39875,9	157742,0
Working Capital	54134,5	315640,5	71378,1	155952,7
Total Assets	594314,3	3560772,7	771902,3	25216681,7
Long Term liabilities	276857,3	1274297,7	330657,6	1510101,1
Long Term Debt	202681,0	694264,6	237677,7	969208,0
Shareholders' Funds	219742,8	1398608,9	262345,1	837560,3
Increase in Cash	-10,8	59561,8	3377,0	57676,4
Current Ratio	3,2	5,7	2,4	3,7
Liquidity Ratio	2,9	5,6	2,1	3,7
Solvency Ratio	49,8	35,8	46,4	27,5
Gearing	71,7	105,0	93,3	193,2
Fixed Assets Trend	411,9	2400,9	77,7	370,6
Current Assets Trend	298,9	3033,6	34,1	181,3
Total Assets Trend	460,4	4551,6	28,3	118,3
Current Liabilities Trend	36,3	133,6	27,4	87,5
Long Term Liabilities Trend	74,8	518,9	179,1	994,8
Profit Margin	-4,0	21,8	2,1	20,3
Return on Shareholders' Funds	-1,2	123,4	10,2	76,9
Return on Total Assets	-17,9	65,3	-2,2	29,1
EBIT Margin	-533,1	5871,1	-25,0	192,5
Quiscore	58,7	24,4	58,4	24,0
Qualifications	0,1	0,4	0,1	0,2
UnQualifiedUnQualified	0,8	0,4	0,9	0,3
UnQualifiedQualified	0,0	0,2	0,0	0,2
QualifiedUnQualified	0,1	0,3	0,0	0,2
QualifiedQualified	0,1	0,3	0,0	0,2
IfBig	0,3	0,5	0,8	0,4
Stock&WIP	65282,8	287773,4	56994,7	110496,3
Market Capitalization	463,8	2332,4	747,3	2054,3
Price to Book Ratio	3,7	5,3	3,0	2,5
Number of Subsidiaries	18,2	51,7	27,2	41,7
Total Debt	283037,4	1108456,1	277553,6	1116458,6
ZScore	43,4	211,2	32,0	189,8
Audit Fee to TA	5,4	8,3	3,5	5,7
Accounts Receivable	97669,4	677160,5	208269,2	567465,4
L.T .Liabilities to TA	427,1	1476,5	206,4	1254,0
Current Assets. to TA	5,8	2,9	5,3	2,5
Operating Profit to TA	-1,7	6,2	-1,3	14,7
Sales to TA	36,0	206,4	22,6	175,1
Quick Ratio	-103,3	472,6	-29,6	197,8
Profit before Int. to TA	-1,6	6,2	-1,2	14,4
Profit before Int. to sales	-68,7	785,9	-2,5	19,3
Acc. Receivable to sales	-4016,8	49716,9	-88,0	617,2
Fixed Assets to TA	69,2	844,5	96,4	1191,3
Inventory to sales	40820,1	502236,9	960,6	6283,9
Inventory to TA	115,6	358,2	36,0	165,7

Total Debt to TA	431,3	1476,4	210,4	1255,7
Working Capital to TA	10,7	76,1	8,3	86,9
Market Price Modif	3,9	43,2	2,8	9,7

Notes: TA indicates Total Assets

We employ the CFS SubsetEvaluator (Correlation Based Feature Selection). This technique belongs to the filter methods. Filter methods operate independently of any learning algorithm. CFS uses a correlation based heuristics to evaluate the worth or merit of a subset of features. The heuristics takes into account the usefulness of individual features for predicting the class label along with the level of intercorrelation among them. Good feature subsets contain features highly correlated with the class, yet uncorrelated with each other (Hall 1998). We applied CFS to our data and we obtained a features subset with six member variables. The method evaluated 601 candidate subsets. The selected variables are depicted in Table 2.

Feature selection reveals factors strongly associated with auditor switches. Two of the selected variables (Gross Profit and Profit Margin) refer to profitability. Two other variables (Short Term Loans and Long Term Debt) refer to the auditee's debt structure. The variable Stock and Work in Progress refers to inventory. Finally, the variable IfBig indicates if the auditor is a Big 4 auditor or not. According to our results profitability, debt, inventory and the type of the auditor constitute the optimum set of predictors. Remarkably, several other factors which have been used in previous studies have been excluded from our final input vector. All the trend variables that depict the auditee's growth dynamics have been discarded. The variables ZScore and Quiscore which are proxies for financial distress have been rejected. Neither the variable Previous Year Qualifications nor the four dummy variables that indicate the combination of previous and current year qualifications participate in the final input vector, thus providing indications that factors other than the pursuance of opinion shopping are more influencing. Finally, all the variables related to the auditee's size have been excluded.

Table 2. Feature selection result

The Selected Variables
Gross Profit
Short Term Loans
Long Term Debt
Profit Margin
IfBig
Stock & Work in Progress

4.4. Models' development

After performing feature selection, we employed data mining classification methods in order to develop and compare the models. All the models were developed and tested by using the whole data set. The first method used was C4.5 Decision Trees. The tree was built with confidence factor 0.25 and with the pruning option activated. The model achieved an accuracy rate of 82.84%. The second method employed was Back propagation Multilayer Perceptron. We tested several alternatives in terms of number of hidden neurons, learning rate, epochs and momentum. Best performance was achieved by a network with 5 hidden neurons. The accuracy rate was 73.7%. The next method was k-Nearest Neighbours. A variety of neighbours' numbers was tested. By setting the numbers of neighbours to 10 we obtained the best performance (75.4%). Our next model was a Bayesian Network. The Bayesian Network outperformed all the other methods managing to classify 88.2% of the total cases. Finally, we employed the Support Vector Machine method. Several alternatives for the kernel function and the C parameter were tested. The best accuracy was achieved with a polynomial kernel function with exponent 1 and C value equal to one. The average accuracy rate of the model was 71.9%. We compared these results against the performance of the widely used Logistic Regression. The total accuracy rate of Logistic Regression is 71.6%, which is lower than the performance of all the other methods. Detailed accuracies by class and total accuracy rates are summarized in Table 3.

Table 3. Accuracy against the training set

Method	Change %	Not Change %	Total %
Bayes Net	88.8	87.6	88.2
C4.5	77.5	88.2	82.8
k-NN	75.1	75.7	75.4
MLP	75.7	71.6	73.7
SVM	68.6	75.1	71.9
Logistic	69.8	73.4	71.6

One of the major advantages of Decision Trees is interpretability. The DT models can be easily understood and transformed to a set of meaningful rules. Figure 1 depicts the Decision Tree model. As can be seen the variable Gross Profit is used as first level splitter. According to the DT algorithm which employs the entropy based Information Gain measure, this means that this variable best separates the two class values. In this sense and according to this measure, Gross Profit is the strongest predictor for identifying the auditor switching cases. The variables Short Term Loans and Stock & WIP are used as second level splitters. Firms with Gross Profit < 182562, Short Term Loans <= 69000 which hire a Big 4 auditor do not change auditor. The number of observations that belong in this category is 116. Also, firms with Gross Profit > 182562 and Stock & WIP < 835000 do not change auditor (57 observations). Firms with Gross Profit < 182562 and Short Term Loans > 69000 change their auditor (49 observations).

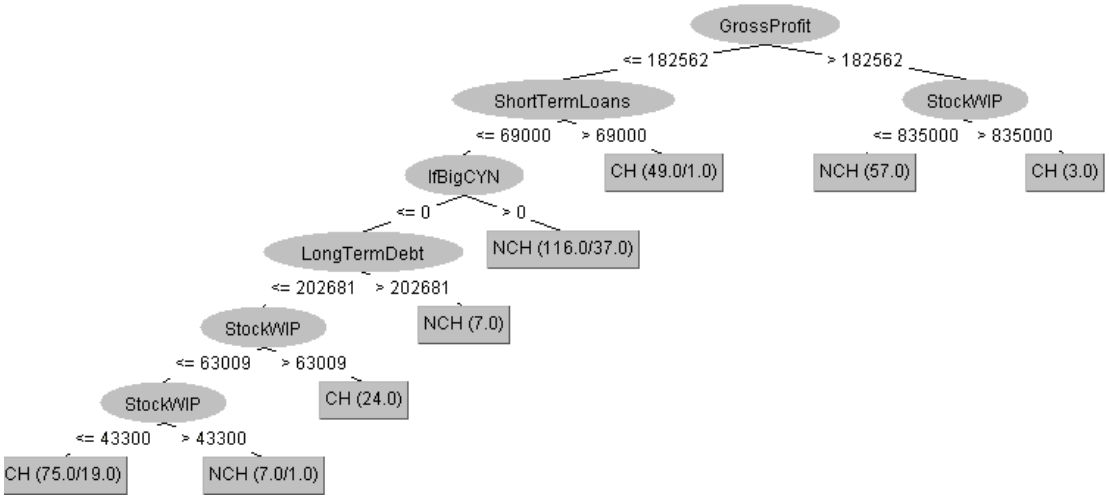


Figure 1. The decision tree model

4.5. Performance metrics

The performance of a classifier can be presented by the confusion matrix. For a dichotomous class, like the one in the auditor change problem, the confusion matrix is a 2X2 matrix as shown in Table 4.

Table 4. The confusion matrix

		Predicted class value	
		Change	Not Change
Actual class value	Change	TP	FN
	Not Change	FP	TN

The entries in the confusion matrix TP, FP, FN and TN stand for True Positive, False Positive, False Negative and True Negative respectively. True Positive is the number of correct predictions for auditor-change cases, where True Negative is the number of correct predictions for not-auditor-change cases. False Positive is the number of misclassified not-auditor-change case and False Negative is the number of misclassified auditor-change cases. The entries of the confusion matrix can be used to define the following performance measures:

• Accuracy is the percentage of correctly classified observations. Accuracy is the most common performance measure.

$$Accuracy = \frac{TP + TN}{TP + FP + FN + TN} * 100 \quad (15)$$

• Precision is the proportion of the correct positive predictions to the total positive predictions

$$\Pr ecision = \frac{TP}{TP + FP} * 100 \quad (16)$$

• Sensitivity refers to the proportion of correct positive predictions to the total positive instances

$$Sensitivity = \frac{TP}{TP + FN} * 100 \quad (17)$$

• Specificity refers to the proportion of correct negative predictions to the total negative predictions

$$Specificity = \frac{TN}{TN + FP} * 100 \quad (18)$$

• F-measure characterizes the performance in a precision-sensitivity space

$$F - measure = \frac{2 * \Pr ecision * Sensitivity}{\Pr ecision + Sensitivity} = \frac{2TP}{2TP + FP + FN} \quad (19)$$

The above mentioned performance metrics are used to evaluate the performance of the employed classifiers.

4.6. Models' validation and performances

In Data Mining it is an established practice to estimate the performance of the models against observations not included in the training set. The reason for such a practice is that in many cases the models tend to memorize the samples instead of "learning". This means that the models incorporate in the decision making mechanism peculiar characteristics of exceptions or outliers. The phenomenon is known as 'data overfitting'. The result of data overfitting is that the models succeed very high accuracy rate against the training set, but disproportional lower performance against out-of-the-training-set observations. However, when applied in the real world, the model will face new patterns and thus a model suffering from data overfitting will present weaknesses. The process of testing a model's performance against unknown patterns is called validation. There is a number of validation techniques. It is worth to mention that the studies conducted so far in the field of auditor switching prediction did not validate the proposed models against new observations.

In order to validate our models we employ 10-fold cross validation. This validation method is the one proposed in the relevant literature (Han, and Camber 2000). In 10-fold cross validation, the data set is divided into ten folds. For each fold, a model is trained by using the remaining nine folds and tested by using the hold-out fold. Finally, the average performances are calculated. The results of the 10-fold cross validation are summarized in Table 5.

Table 5. The models' performance

Method	Accuracy		Precision		Sensitivity		Specificity		F-Measure	
	fs	nfs	fs	nfs	fs	nfs	fs	nfs	fs	nfs
Bayes Net	84.6	74.0	86.3	74.0	82.2	74.0	87.0	74.0	84.2	74.0
C4.5	78.7	74.3	80.5	76.3	75.7	70.4	81.7	78.1	78.0	73.2
k-NN	72.5	68.9	72.9	67.4	71.6	73.4	73.4	64.5	72.2	70.3
SVM	71.9	71.0	73.4	72.3	68.6	68.0	75.1	74.0	70.9	70.1
MLP	71.3	69.8	72.8	71.6	68.0	65.7	74.6	74.0	70.3	68.5
Logit	69.8	66.6	70.3	66.9	68.6	65.7	71.0	67.5	69.5	66.3

Notes: fs indicates feature selection (6 input variables) - nfs indicates no feature selection (59 input variables)

As can be seen all the models achieve satisfactory accuracy rates. Moreover, the reported performances are marginally lower than the performances against the training set, which means that the models do not suffer from data overfitting. The Bayesian Network outperforms all the other methods and achieves an accuracy rate of 84.6%. The Decision Tree model follows with accuracy rate 78.7%. The k-NN, SVM and MLP models achieve comparable accuracies. All the data mining techniques outperform Logistic Regression.

From the viewpoint of Precision measure, a high precision rate indicates a reduced likelihood of misclassifying not-auditor-change cases as auditor-change cases. In consistence with the accuracy results, the Bayesian Network outperforms the other methods, followed by the Decision Tree. The k-NN, SCM and MLP models have comparable precision rates, where Logistic Regression comes behind. A higher Sensitivity measure indicates lower misclassifying of auditor-change cases as not-auditor-change cases. Again the Bayesian Network achieves the highest sensitivity rate followed by the Decision Tree and the k-NN classifier. The SVM, MLP and Logistic Regression models have comparable sensitivity rates.

The Specificity measure indicates the ability of the classifiers to identify the not-auditor-change cases. Best performances are achieved by the Bayesian Network and the Decision Tree models. The k-NN, SVM and MLP models have comparable specificity rates. The worse performance is that of the Logistic Regression. The F-measure combines Precision with Sensitivity and is used as a measure of the overall performance. The Bayesian Network has the best F-measure. The Decision Tree and the k-NN classifiers follow. The SVM and the MLP models outperform Logistic Regression.

According to the empirical results, the application of the data mining methodologies for the prediction of auditor changes constitutes an improvement over the widely used Logistic Regression. With the exception of the sensitivity measure, where Logistic Regression achieves comparable rates with the MLP and SVM models, the data mining classifiers outperform Logistic Regression in terms of all performance measures. In all cases the Bayesian Network succeeds the best rates.

For comparison reasons we repeated the experiments by using all the 59 variables in the input vector. The results are summarized in Table 5. The comparison demonstrates interesting findings. First, with the exception of the k-NN classifier for the sensitivity measure, in all cases the results are better for the reduced input vector. These results provide evidence that feature selection was successful and that a small set of appropriate predictors can improve performances. Second, the results confirm the findings of the previous experiments that the data mining techniques outperform the traditional Logistic Regression which, up to now, is the only method employed for the prediction of auditor switches.

Conclusions

In order to reduce information asymmetry among managers, shareholders and creditors, companies hire independent auditors. However, it is the auditee's management that determines the appointment, retention and audit fees. The threat of a potential dismissal may act as an incentive for auditors to compromise their independence and report favourably in order to retain clients. Moreover, a company may switch auditor if expects that the new auditor will issue a more friendly report. Since auditor dismissal constitutes a threat for audit quality, several studies have examined the auditor switching problem. These studies performed typical statistical analysis.

In the present study we deal with the auditor switching problem by employing data mining methodologies. Our sample contains data about 338 UK and Irish companies half of which changed auditor during 2003-2005. The initial independent variables concern account values and financial ratios, audit qualifications and the type of the auditing firm. By applying feature selection we obtained the optimum set of independent variables which can be used as predictors. These variables refer to profitability, debt, inventory and the type of the auditor.

Data mining classification methods have been applied in order to develop models capable of predicting the auditor switching cases. These methods are Decision Trees, Neural Networks, Bayesian Networks, k-Nearest Neighbours and Support Vector Machines. The models are compared against the widely used Logistic Regression in terms of several performance measures. According to the results of the 10-fold cross validation evaluation, all the data mining methods outperform Logistic Regression. The Bayesian Network achieves the highest accuracy rate, followed by the Decision Tree model

(84.6% and 78.7% respectively). The Decision Trees method, which provides an interpretable model, highlights the variable Gross Profit as the variable that best separates the two class values.

The present study can be used as a stepping stone for further research. All the independent variables used are publicly available financial statement and auditing data. By enriching the input vector with variables referring to corporate governance characteristics and other managerial issues the performance of the models may be improved. Higher accuracies could also be achieved with the employment of performance improvement techniques like bagging or the development of more elaborated classifiers like ensembles. Industry-specific studies could reveal industry-specific indicators. We hope that the research presented in this paper will therefore stimulate additional work regarding these important topics

References

[1] Altman, E. 1983. *Corporate Financial Distress: A Complete Guide to Predicting, Avoiding, and Dealing with Bankruptcy*, John Wiley, New York, USA.

[2] Beattie, V., and Fearnley, S. 1995. The Importance of Audit Firm Characteristics and the Drivers of Auditor Change in UK Listed Companies. *Accounting and Business Research*, 25: 227-239.

[3] Boyacioglou, M.A., Kara, Y., and Baykan, O. 2009. Predicting bank financial failures using neural networks, support vector machines and multivariate statistical methods: A comparative analysis in the sample of savings deposit insurance fund (SDIF) transferred banks in Turkey. *Expert Systems with Applications*, 36: 3355-3366.

[4] Branson, J., and Breesch, D. 2004. Referral as a determining factor for changing auditors in the Belgian auditing market: An empirical study. *The International Journal of Accounting*, 39: 307-326.

[5] Carcello, J.V., and Neal, T.L. 2003. Audit Committee Characteristics and Auditor Dismissals following 'New' Going-Concern Reports. *The Accounting Review*, 78: 95-117.

[6] Chow, C., and Rice, S. 1982. Note: Qualified Audit Opinions and Auditor Switching. *The Accounting Review*, 37: 326-335.

[7] Citron, D., and Taffler, R. 1992. The Audit report under going concern uncertainties: An empirical analysis. *Accounting and Business Research*, 22: 337-345.

[8] DeAngelo, L. 1981. Auditor size and audit quality. *Journal of Accounting and Economics*, 3: 183-199.

[9] DeBerg, C.L., Kaplan, S.E., and Pany, K. 1991. An Exanimation of some Relationships between Non-Audit Services and Auditor Change. *Accounting Horizons*, 5: 17-28.

[10] DeFond, M.L. 1992. The Association between Changes in Client Firm Agency Costs and Auditor Switching. *Auditing: A Journal of Practice and Theory*, 11: 16-31.

[11] DeFond, M.L., and Subramanyam, K.R. 1998. Auditor changes and discretionary accruals. *Journal of Accounting and Economics*, 25: 35-67.

[12] Dopuch, N., Holthausen, R.W., and Leftwich, R.W. 1987. Predicting Audit Qualifications with Financial and Market Variables. *The Accounting Review*, 62: 431-454.

[13] Eichenseher, J.W., and Shields, D. 1989. Corporate capital structure and auditor 'fit'. *Advances in Accounting (*Supplement*)*: 39-56.

[14] Fanning, K.M., and Cogger, K.O. 1998. Neural Network Detection of Management Fraud Using Published Financial Data. *Intelligent Systems in Accounting Finance and Management*, 7: 21-41.

[15] Gaganis, C., Pasiouras, F., Spathis, C., and Zopounidis, C. 2007. A comparison of nearest neighbors, discriminant and logit models for auditing decisions. *Intelligent Systems in Accounting Finance and Management*, 15: 23-40.

[16] Hall, M.A. 1998. *Correlation-based Feature Subset Selection for Machine Learning*, Hamilton, New Zealand.

[17] Han, J., and Camber, M. 2000. *Data Mining Concepts and Techniques*, Morgan Kaufman, San Diego, USA.

[18] Hudaib, M., and Cooke, T.E. 2005. The impact of managing Director Changes and Financial Distress on Audit Qualification and Auditor Switching. *Journal of Business Finance and Accounting*, 32: 1703-1739.

[19] Icerman, R., and Hillison, W. 1991. Disposition of auditor–detected errors: some evidence on evaluative materiality. *Auditing: A Journal of Practice and Theory*, 10: 22-34.

[20] Johnson, W.C., and Lys,T. 1990. The market for audit services evidence from voluntary auditor changes. *Journal of Accounting and Economics*, 12: 281-308.

[21] Kirkos, E., Spathis, C., Nanopoulos, A., and Manolopoulos, Y. 2007a. Predicting Qualified Auditors' Opinions: A Data Mining Approach. *Journal of Emerging Technologies in Accounting*, 4: 183-197.

[22] Kirkos, E., Spathis, C., and Manolopoulos, Y. 2007b. Data mining techniques for the detection of Fraudulent Financial Statements. *Expert Systems with Applications*, 32: 995-1003.

[23] Kirkos, E., Spathis, C., and Manolopoulos, Y. 2010. Audit-firm group appointment: an artificial intelligence approach. *Intelligent Systems in Accounting, Finance and Management*, 17: 1-17.

[24] Koh, H.C. 2004. Going concern predictions using data mining techniques. *Managerial Auditing Journal*, 19: 462-476.

[25] Kotsiantis, S., Koumanakos, E., Tzelepis, D., and Tampakas, V. 2006. Predicting fraudulent financial statements with machine learning techniques. *Lecture Notes in Computer Science*, 3955: 538-542.

[26] Krishnan, J., Krishnan, J., and Stephen, R.G. 1996. The Simultaneous relation between auditor switching and audit opinion: An empirical analysis. *Accounting and Business Research*, 26: 224-236.

[27] Krishnan, J., and Stephens, R.G. 1995. Evidence on opinion shopping from audit opinion conservatism. *Journal of Accounting and Public Policy*, 14: 179-201.

[28] Lennox, C. 2000. Do companies successfully engage in opinion-shopping? Evidence from the UK. *Journal of Accounting and Economics*, 29: 321-337.

[29] Lin, F.Y., and McClean, S. 2001. A data mining approach to the prediction of corporate failure. *Knowledge Based Systems*, 14: 189-195.

[30] Lin, Z.J., and Liu, M. 2010. The determinants of auditor switching from the perspective of corporate governance in China. *Advances in Accounting, incorporating Advances in International Accounting*, 26: 117-127.

[31] Nasser, A.T., Wahid, E.A., Nazri, S.N., and Hudaib, M. 2006. Auditor - client relationship: the case of auditor tenure and auditor switching in Malaysia. *Managerial Auditing Journal*, 21: 724-737.

[32] Maimon, O., and Rokash, L. (eds). 2005. *The data mining and knowledge discovery handbook*, Springer, New York, USA.

[33] Ohlson, J. 1980. Financial ratios and the probabilistic prediction of bankruptcy. *Journal of Accounting Research*, 18: 109-131.

[34] Palmrose, Z. 1984. The demand for quality-differentiated audit services in an agency-cost setting: An empirical investigation. *Proceedings of the Sixth Symposium on Auditing Research*, Champaign, Illinois, USA: 229-252.

[35] Reed, B., Trombley, M.A., and Dhaliwal, D.S. 2000. Demand for audit quality: The case of Laventhol and Horwath's auditees, *Journal of Accounting, Auditing and Finance*, 15: 183-206.

[36] Schwartz, K.B., and Menon, K. 1985. Auditor Switches by Failing Firms. *The Accounting Review*, 60: 248-261.

[37] Sinanson, D.H., Jones, J.P., and Shelton, S.W. 2001. An investigation of auditor and client tenure. *Mid-American Journal of Business*, 16: 31-40.

[38] Tsakonas, A., Dounias, G., Doumpos, M., and Zopounidis, C. 2006. Bankruptcy prediction with neural logic networks by means of grammar-guided genetic programming. *Expert Systems with Applications*, 30: 449-461.

[39] Vapnik, V.N. 1995. *The nature of statistical learning theory*, Springer Verlag, New York, USA.

[40] Watts, R.L., and Zimmerman, J.L. 1986. *Positive accounting theory*, Prentice Hall Inc, Engelwood Cliffs, USA.

[41] Willenborg, M. 1999. Empirical analysis of the economic demand for auditing in the initial public offering market. *Journal of Accounting Research*, 37: 225-239.

***Institute of Chartered Accountants in England and Wales. 2001. *Members Handbook 2001*, ICAEW, London, UK.

A CASE STUDY ON INVESTORS' FINANCIAL LITERACY IN INDIAN SCENARIO

K. Senthil KUMAR
School of Management, *SASTRA* University, **Thanjavur**
ksenthilresearch@gmail.com
C. VIJAYABANU
SASTRA University, **Thanjavur**
vijayabanu@mba.sastra.edu
R. AMUDHA
SASTRA University, **Thanjavur**
amudha@mba.sastra.edu

Abstract

Financial literacy is the ability of the individual to make appropriate financial decisions personally. The ability includes understanding the financial products, financial concepts, discussing the financial problems, making choices between managing, spending and saving money and responding to the current reforms in financial market. With the increased risk of global markets and introduction of more innovative financial products, investors are required to make well informed decisions with their money. So, financial Literacy had gained its importance across the globe. The objective of the study is to analyse the influence of the financial literacy level on individual investment decisions. A sample of 469 investors from Tiruchirapalli was selected by way of stratified random sampling method. The primary data collected were analysed with the help of percentage analysis and chi-square test using MS Excel. The result shows that except the gender, there are relationships between the socio-economic factors and the level of financial literacy possessed by the respondents. Following the age and health, responsibilities come as a third factor, which is clubbed with the family commitments. This clearly states that our Indian society is always built based on love and affection bound with generations.

Keywords: Financial literacy, financial objectives, investment avenues and investment decisions.

JEL Classification: G02

1. Introduction

Financial literacy is the ability to understand finance. More specifically, it refers to the set of skills and knowledge that allows an individual to make informed and effective decisions through their understanding of finances. Adequate financial knowledge if improved to investors can result in good and uniform benefit among gender and geographical regions. Financial knowledge equips the individual to distribute his/her wealth according to the nature of his/her risk taking ability, prevailing economic condition and other personal factors. Moreover financial literacy helps to keep ones retirement life in a comfortable manner. Morris (2001) states that in a world of escalating financial complexity, there is an increasing need for financial knowledge and at least basic financial skills.

Basu (2005) quotes the definition of financial literacy given by the US Financial Literacy and Education Commission as "the ability to make informed judgments and to take effective actions regarding the current and future use and management of money". It had gained its importance after the deregulation of the financial markets and introduction of new financial product. Financial knowledge also helps investors to save their taxes on the returns from their investments and for a smart retirement life. In today's financial world, lot of ability is needed by the investor to navigate through the life cycle of a financial product in vagaries of economic condition. With good knowledge about the financial product it is even better to understand the analysis and advice of experts.

Shalini Kalra Sahi (2009) states that the need for promoting financial education among Indians arises on account of various demographic, market driven (economic and financial), technological and social factors. Imparting financial literacy education is very important for the nation's economic growth and development and hence the successful implementation of the financial literacy programmes would lead to various benefits such as increase in financial confidence, better planning for future needs, consumer protection and financial inclusion.

According to ING Consumer Resourcefulness Survey conducted in January 2011, Indians have better financial literacy levels than most others globally and rank second out of 10 leading nations in having a basic financial literacy level. The nations under study covers India, the USA, Mexico, The Netherlands, Romania, Poland, Belgium, Spain, Korea and Japan. Indians literacy level is 55% just behind Japanese. A majority of Indian consumers have not only shown better skills in managing their household financial budget but are also confident of facing any financial impediments in future as compared to citizens of nine other countries. The survey shows that 84% of Indians prefer buying life insurance products as compared to 54% globally. 87% of the households in India have an emergency fund for two months or more as against 33% globally.

Spisak, and Sperka (2011) say that the transaction costs can be increased by the off-market regulation (in the form of taxes) on market stability, the overall volume of trade and other market characteristics. S. Sveshnikov, and Bocharnikov (2009) state that behaviour of financial indexes depends on psychological sentiments of players (investors, traders) and their inclination to buy or sell financial tools.

Boujelbene Abbes, M., Boujelbene, Y., and Bouri, A. (2009) state that self-attribution bias, conditioned by right forecasts, increases investors overconfidence and trading volume. F. Mierzejewski (2009) says that macroeconomics; financial economics and actuarial sciences fuse together in a unified theoretical framework, which can be applied as an alternative to the utility maximisation approach. L. Ungureanu, and I.V. Matei (2008) state that since money has a capacity to connect the present and the future, conflicts among long-run and short-run economic goals and uncertainties of the future make economic decisions very complicated.

2. Uniqueness of the study

The present study on individual investment decision includes various distinct unique features. The study has been done covering both the rural and urban places. So the outcome of the study reflects the entire district. It has nearly all-common investment products that the individuals usually invest. The study has been done across the gender, almost all professionals, business class, self-employed and especially the retired. The study has also been done on the information sources or channels through which the individuals will decide their investment on a particular investment product. The study has also covered the impact of individual's personality on their investment decisions. The switching behaviour of the individual if any between the various investment products has also been studied. The essential characteristic of a financial investment product has been analysed on the entire product under study. The study has been done on the reasons for the preclosure if any on a particular investment product. The factors that are responsible for the satisfaction and dissatisfaction of an investment product have also been studied

3. Methodology

The survey was conducted in both rural and urban paces of Tiruchirappalli district. To conduct the survey in the urban place, the respondents were selected from the professional taxpayers list of Trichirapalli Corporation. Prior permission was obtained from the commissioner of the Trichirapalli Corporation to get the taxpayers list of the four zones of the Tiruchirappalli Corporation. Trichirapalli Corporation consists of four zones namely Ariyamangalam in east, K. Abhishekapuram in west and Srirangam in north and Ponmalai in south. Survey was conducted in all the four zones of the Trichirapalli Corporation. About 3% of the population of professional taxpayers from each zone was selected to conduct the survey.

The professional taxpayers list were prepared and maintained by a separate clerk of the local administration office. The list was computerized and also maintained in a separate register. The register contained all details of the professional tax payers like name, age, occupation, assessment number, address, income earned, tax due if any. The professional taxpayers are obliged to pay the professional tax every six months to the local administration office. A separate register was maintained for the professional taxpayers. The details in the register were same as that of the Trichirapalli Corporation. About 8% of the population was fixed to conduct the survey in each of the special village Panchayath. Questionnaires were administered to collect the primary data. The secondary data includes the various journals, websites of financial service companies, websites on economy and websites of government departments.

The questionnaires were mailed to the addresses of the professional taxpayers provided by the respective local administration office along with a stamped self-addressed cover. The filled in questionnaires were received through the self-addressed cover. If the questionnaire was returned stating the reason that the taxpayer has retired, then the addresses of the retired were traced with the help of their last worked department. So the Questionnaires were again mailed to the residence of the retired employees along with a stamped self-addressed cover As per the sample size fixed for the places, about 559 questionnaires and 153 questionnaires were dispatched for the urban and rural place respectively. Of which 337 from urban and 132 from rural area were received. Therefore, the total sample size of 469 is arrived with 66% as response rate. The objective of the study is to analyse the influence of the financial literacy level on individual investment decisions.

4. Analysis and discussion

The primary data collected were analysed with the help of percentage analysis and chi-square test using MS Excel.

Table 1. Level of financial literacy among respondents using Chi-square analysis

Particulars		Low	Medium	High	Total	Grand Total	Calculated value	Table Value	Result
Gender	Male	50(19%)	174(69%)	27(12%)	251				
	Female	56(25%)	138(63%)	24(12%)	218	469	2.359	5.99	Accepted
Place	Rural	48(36%)	64 (48%)	20 (16%)	132				
	Urban	58 (17%)	248 (73%)	31 (10%)	337	469	27.472	5.99	Rejected
Age (years)	15-30	25(25%)	65(65%)	9(10%)	99				
	30-45	39(23%)	117(70%)	10(7%)	166	469	9.599	9.488	Rejected
	Above 45	42(21%)	130(64%)	32(15%)	204				
Occupational status	Business/Professional	16(12%)	91(69%)	25(19%)	132	469	51.382	12.592	Rejected
	Govt. Employee	37(21%)	128(74%)	8(5%)	173				
	Retired	12(30%)	16(40%)	12(30%)	40				
	Self employed	41(33%)	77(62%)	6(5%)	124				
Educational qualification	Post graduate	28(33%)	55(64%)	3(3%)	86				
	Professional	9(10%)	77(90%)	0(0%)	86				
	School level	24(22%)	75(70%)	8(8%)	107	469	53.137	12.592	Rejected
	Under graduate	45(24%)	105(55%)	40(21%)	190				
Annual income ₹	Up to ₹ 2 lacs	56(24%)	158(67%)	23(9%)	237				
	2 – ₹ 3 lacs	11(8%)	101(77%)	19(15%)	131	469	30.706	9.488	Rejected
	Above ₹ 3 lacs	39(39%)	53(52%)	9(9%)	101				

Source: Primary data

A hypothesis has been set to study the relationship between the socio-economic factors and the level of literacy about various investment avenues and tested by way of chi-square test. Except the gender, there exists a relationship between the socio-economic factors and the level of financial literacy possessed by the respondents. This result has been further illustrated by the following explanation. The above table clearly indicates that 69% of the total male respondents and 63% of the total female respondents possess medium level of financial literacy. The female respondents possess low financial literacy compared to the male respondents. This is due to the poor exposure to the financial environment, lack of reading or analysing the financial products through the magazines or depending more on others for financial information by them. 48% of rural and 63% of urban respondents possess medium level of financial literacy. The rural respondents lag behind the urban respondents in the level of financial literacy and this due to the penetration of media and internet in rural places. Cutler (1997) was one of the earliest researchers to find that Americans were not well informed about financial matters. Lusardi (2010) found that many people who are unaware of basic economics and finance fall short of gain and make serious and irreversible mistakes.

65% of the total respondents belonging to the age group of 15-30 years, 70% of the total respondents belonging to the age group of 30-45 years and 64% of the total respondents who are

above 45 years possess only medium level of financial literacy. The Adult financial literacy Advisory group (AdFLAG 2000) in its study had found and recommended that need of financial literacy will grow because individuals were expected to become self-reliant. The financial literacy programmes could tackle changing work patterns of the population, ageing population and increasing of the complex nature of the financial product.

Chen, and Volpe (2005) studied the importance of financial literacy in work place and found that "better off" employees were financially knowledgeable and made informed investment decisions. It is inferred that more than three-fifth of the respondents possess medium level of knowledge because of the different sources of information available to them about various investment avenues. 69% of the respondents who are businessmen and professionals, 74% of the respondents who are Government employees, 40% of the respondents who are retired people and 62% of the respondents who are self-employed people possess medium level of knowledge about the investment avenues. 64% of the respondents are postgraduates, 90% of the respondents are professionally qualified, 70% of the respondents who have school level education and 55% of the respondents who are under graduates possess medium level of knowledge about the investment avenues. Lusardi, and Tufano (2009) found that low literacy individuals are more exposed to high debt. Van Rooji (2011), Christelis (2010) in their study observed that more qualified individuals will have share market instruments in their portfolio, as they have better understanding about the risk diversification. Schagen, and Lines (1996) indicated in their study that higher educated individuals were expected to have better financial skills and knowledge than those who are less educated. Similarly, Anderson (2004) found that individuals having no wealth or low income are particularly succumbs to financial crisis. 67% of the total respondents who are earning above ₹ 2 lakhs, 77% of the total respondents belonging to the income group of ₹ 2-3 lakhs and 52% of the total respondents who are earning above ₹ 3 lakhs possess only medium level of financial literacy.

Table 2. Financial objectives and percentage of income towards investment decisions of inviduals

Financial Objectives	No. of respondents	Percentage to total	Number of dependents	No. of respondents	Percentage to total
Repayment of debt	312	66.52	Nil	120	25.6
Funding education	282	60.13	1 to 3	155	33.0
Comfortable retirement life	209	44.56	4 to 6	127	27.1
Emergency health needs	242	51.60	More than 6	67	14.3
Entertainment	137	29.21	Total	469	100.0
Appreciation in value	106	22.60	Willingness to take risk	No. of respondents	Percentage to total
To offset inflation in future	119	25.37	Nil	73	15.6
Percentage of income to investment	No. of respondents	Percentage to total	Average	146	31.1
1 to 5	81	17.3	Above average	145	30.9
6 to 10	112	23.9	Substantial	105	22.4
11 to 15	132	28.1	Total	469	100.0
16 to 20	71	15.1	Change in plan	No. of respondents	Percentage to total
More than 20	73	15.6	Yes	343	73.1
Total	469	100.0	No	126	26.9
			Total	469	100.0

Source: Primary data

Indian society is family oriented society with full of family commitments like marriage expenses, savings for the educational expenses of the children, expenses for taking care of parents and savings for the older age. Indian culture is strict social hierarchy and children are reminded of their roles and places in the society from their early age. The responsibility and the accountability imparted on the generations in the society makes the respondents to have the repayment of the debt as the foremost financial objective. The subsequent objective is the education of the children followed by the comfortable and contended retirement life. Meeting of emergency in case of health problems for the

family members is also the considered to be the main objective. Entertainment, appreciation in value of the investment and the strategy formulated to offset the inflation in future are considered to be the least important factors than to the factors discussed above. This again shows that Indian society is highly conservative and they want to be safe and secure throughout their life rather than securing speculative profits.

Singh, J.P. (2004) says that family is fundamental to society, as the society begins and ends with the family because of its special role in the processes of biological and social reproduction. The family as a social institution or as a primary group assumes a special significance, especially in case of traditional society. It is commonly believed that joint family has been the characteristic feature of Indian society. The 1981 census data have revealed that it is the nuclear family, not the joint one, which predominantly characterizes the Indian family system. This is revealed by the above table that one-fourth of the respondents have no dependents and one-third of the respondents have less than three dependents. The rest of the respondents have more than four respondents. The size of the family greatly influences the investment pattern of the respondents. Nearly 52% of the respondents have invested 6% to 15% of their income and only 17% have invested less than 5%. 30% of the respondents have invested more than 15% of their income. Nearly three-fourth of the respondents has invested more than 5% of their income in various avenues and it shows the savings pattern of an Indian families. Irrespective their levels of income, the respondents are very much concerned about their future and the life of their siblings. 16% of the respondents are not willing to take risk and 31% of the respondents are willing to take average risk. 53% of the respondents are willing take risks in their investment. This shows that nearly half of the respondents are said to be risk-aversive and the rest are said to be risk-bearing. Depending on the income and unexpected family commitments, the respondents wish to change their investment plan. 73% of the respondents are willing to change their plan and 27% of the respondents are not willing to change their plan often.

Table 3. Comparative ranking of Investment avenues based on information influences

Source of information	Post office	Mutual Fund	Gold	Shares	Bank Deposit	Real Estate
Friends/relatives/family	1	1	1	2	1	1
Media	3	3	2	4	2	3
Financial Advisor	2	2	3	1	4	4
Literature/Newspaper	4	4	4	3	3	2
Internet	5	5	5	5	5	5

Source: Primary data

The above table shows the comparative ranking of the influence of source of information used to decide about the investment avenues. It is evident that the respondents give first preference to the advice of friends, relatives and family members to invest in all above mentioned avenues except shares. For all the six investment avenues, they rank the internet as the last rank. The respondents prefer the personal advice from friends, relatives, family members and the financial advisors for the purpose of investing in post office and mutual funds. For the purpose of investing in Gold, the respondents prefer the suggestions from their family members depending upon the family circumstances and depend on the information provided by the media like television. For investing in shares, the respondents prefer to depend on the advice of the financial advisors and the personal source of information namely, friends and relatives who have also experienced in dealing with the shares. For investing in bank deposits and real estates, the respondents prefer the advice of the friends, relatives and family members. The secondary source of information preferred by them for investing in real estate is the media and the information from the newspaper.

Table 4. Influence of personal factors, situation for plan review and problems towards investment decisions

Personal factors	Weighted average	Rank
Age	3.000	1
Health	2.672	2
Responsibilities	2.670	3
Income	2.386	4
Liquidity	2.079	5
Attitude towards risk	2.070	6
Personal Taxation status	1.680	7
Situation for plan review	Weighted Average	Rank
Investment Environment	2.15	4
Tax Laws	2.70	1
Economic Events	1.73	5
New product awareness	2.21	3
Major life events	2.27	2
Problems faced	Weighted Average	Rank
Reduced cash flow	2.37	2
Less Mobility	1.93	4
Complex Calculation	2.31	3
Improper tax planning	2.57	1

Source: Primary data

Family plays a predominant role in the Indian culture. For generations, India has a tradition of joint family system with extended members like parents, children, the children's spouses and their offspring. Hilgert, and Hogarth (2003) found that the level of financial knowledge of the family member affects the inhabitants financial investment behaviour. The eldest male member is the head of the family and he is responsible for all decisions, which are followed by others. This is established from the above table that the respondents consider their age as the prime factor among the personal factors. Kinnunen, and Pulkkinen, (1998) found that financial literacy skills is essential basis for both avoiding and solving financial problems. Wolcott, and Hughes (1999) found that financial hardship can increase isolation, emotional stress, depression and lower self-esteem.

Health is taken as second factor because the people have to take care of contingencies in health conditions of their own and family members. Harvey, S. Rosen, Stephen, Wu (2004) have stated that health is a significant predictor of both the probability of owning different types of financial assets and the share of financial wealth held in each asset category.

Following the age and health, responsibilities come as a third factor, which is clubbed with the family commitments. This clearly states that our Indian society is always built based on love and affection bound with generations.

Income stands as a fourth factor as it is an added one for decision regarding the investments. This shows that irrespective of the level of income, the Indians give more importance to the family commitments. However, they manage to fulfil their family commitments though they don't maintain their personal liquidity. Many respondents are risk averse and they consider the risk bearing capacity as the sixth factor in the selection of the investment avenues. The least importance is given to taxation status because the Indians are very much concerned about the responsibilities towards their family and they are less inclined to tax planning.

From the above table it is clear that Tax Laws play an important role in plan review of the respondents because Tax Laws acts as a scope and periphery for the employed persons in terms of their tax planning. Major life events like marriage, house construction, religious and cultural events influence the plan review as it affects the liquidity of the investment. The availability of the various investment products and the introduction of the new products in the market influence the review of the plan as a third rank. The macro events like investment environment and economic events play a minor role in influencing the plan review.

The respondents consider improper tax planning as a major factor as they lack awareness in tax planning and they have to get the help of the auditors and other agents in proper tax planning.

Hastings, and Tejeda (2008) found that high literate individuals will invest in financial products that have low fees. So they concluded that there is strong relationship between higher financial literacy and low cost funds. Some of the respondents feel that they have a reduced cash flow in their superannuation period and this affects their investment planning at their old age. Reduced cash flow is also due to the continuous commitment in their families during their middle age. Complex calculations in tax planning are also another factor considered by the respondents as a major problem in their investment planning. Less mobility of funds due to the reduced cash flow also affects the investment planning by the respondents.

Conclusion

Financial literacy is the ability of the individual to make appropriate financial decisions personally. The ability includes understanding the financial products, financial concepts, discussing the financial problems, making choices between managing, spending and saving money and responding to the current reforms in financial market. The sophisticated financial markets offer continuously new financial products in the market. The increase in the level of financial literacy will also result in the financial inclusion which is the need of the present Indian economy.

Case Questions:

1. How do the socio-economic factors influence the level of financial literacy?
2. Which source of information influence the decision of individuals in different investment avenues?
3. Which personal factor influences the decision of individuals in investing?
4. Elucidate the problems faced by individuals and the situations which need an investment plan review.

References

[1] Anderson, S.G., Zhan, Min, and Scott, J. 2004. Targeting Financial Management Training at Low income Audiences: Bits, Briefs, and Applications. *Journal of consumer affairs*, Vol. 38, No. 1, pp. 167-177.

[2] Basu, S. 2005. *Financial literacy and the life cycle*. Washington, DC: Financial Planning Association.

[3] Boujelbene Abbes, M., Boujelbene, Y., and Bouri, A. 2009. Overconfidence bias: Explanation of market anomalies French market case. *Journal of Applied Economic Sciences*, Vol. IV, Issue 1(7) Spring, pp.12-25.

[4] Chen, H., and Volpe, R.P. 2005. Financial literacy, education and services in the workplace. A Journal of Applied Topics in Business and Economics, (online), (Accessed: 2 Feb 2006) http://www.westga.edu/~bquest/2005/workplace.pdf.

[5] Cutler, N.E. 1997. The false Alarms and Blaring Sirens of Financial Literacy: Middle - Agers Knowledge of Retirement income, Health finance and long term care. *Generations*, Vol. 21, No.2, pp. 34-40.

[6] Dimitris, C., Jappelli, T., and Padula, M. 2010. Cognitive abilities and portfolio choice. *European Economic Review*, Vol. 54, pp.18-38.

[7] Hastings, J., and Tejeda-Ashton, L. 2008. Financial literacy, information and demand Elasticity: Survey and Experimental Evidence from Mexico. NBER Working paper No. 14538.

[8] Hilgert, M.A., and Hogarth, J.M. 2003. Household Financial Management: The connection between Knowledge and Behaviour. *Federal Reserve Bulletin* July, pp. 309-22.

[9] Kinnunen, U, and Pulkkinen, L. 1998. Linking economic stress to marital quality among finish marital couples. *Journal of Family Issues*, 1998; 19(6):705- 724.

[10] Lusardi, A., and. Mitchell, O.S. 2007a. Baby boomer retirement security: The role of planning, financial literacy and housing wealth. *Journal of Monetary Economics*, Vol. 54, pp. 205-224.

[11] Lusardi, A., and. Tufano, P. 2009. Debt literacy, financial experiences, and overindebtedness. NBER Working paper no. 14808.

[12] Mierzejewski, F. 2009. Towards a general theory of liquidity preference. *Journal of Applied Economic Sciences*, Vol. IV, Issue 2(8) Summer, pp.261-272.

[13] Morris, L. 2001. *An investigation into the financial knowledge levels of New Zealand senior secondary school students*, Wellington: Enterprise New Zealand Trust.

[14] Rosen, H.S., Wu, S. 2004. Portfolio choice and health status. *Journal of Financial Economics*, Vol.72, No.3, pp. 457-484.

[15] Sahi, S.K. 2009. Financial literacy education for the Indian consumer: the road to economic development. *International Journal of Indian Culture and Business Management*, Vol. 2, No. 5, pp. 493-518.

[16] Schagen, S, and Lines, A. 1996. Financial Literacy in Adult life: A Report to the NAtwestGroup Charitable Trust, Slough, Berkshire: National Foundation for Educational Research.

[17] Singh, J.P. 2004. *The contemporary Indian Family*, *Handbook of world families*, Bert N. Adams, Jan Trost, (Eds.), Sage Publications India Private Ltd, New Delhi, pp129-166.

[18] Spisak, M., and Sperka, R. 2011. Financial market simulation based on intelligent agents- case study. *Journal of Applied Economic Sciences*, Vol. VI, Issue 3(17) Fall, pp.249-256.

[19] Sveshnikov, S., and Bocharnikov, V. 2009. Forecasting financial indexes with model of composite events influence. *Journal of Applied Economic Sciences*, Vol. IV, Issue 3(9) Fall, pp. 425-440.

[20] Ungureanu, L., and Matei, I. V. 2008. Advances in decision analysis. Efficient methods in finance. *Journal of Applied Economic Sciences*, Vol. III, Issue 4(6) Winter, pp. 471-478.

[21] van Rooij, M., Lusardi, A., and Alessie, R. 2011. Financial literacy and stock market participation. *Journal of Financial Economics, forthcoming*.

[22] Wolcott, I., and Hughes, J. 1999. Towards understanding the reasons for divorce, Working paper No. 20, Australian Institute of Family Services, Melbourne.

***Adult Financial literacy Advisory group (Adflag). 2000. Report to the secretary of state for Education and employment (online), department of Education and skills, London, available: http://www.dfes.gov.uk/adflag/(accessed 10 Sep, 2005).

***http://www.financialexpress.com/news/financial-literacy-india-is-worlds-no.-2/737508/1

***http://en.wikipedia.org/wiki/Financial_literacy

SOURCES OF EXCHANGE RATE VOLATILITY IN THE EUROPEAN TRANSITION ECONOMIES. EFFECTS OF ECONOMIC CRISIS REVEALED

Rajmund MIRDALA
Faculty of Economics, Technical University of Kosice, **Slovakia**
rajmund.mirdala@tuke.sk

Abstract:

Negative macroeconomic performance issues represent one of the key effects of crisis period. Due to many economic crisis related side effects countries became more vulnerable to various types of endogenous and exogenous shocks. Exchange rates of the European transition economies became much more volatile as a result of increased uncertainty on the financial markets as well as changed behaviour of structural shocks affecting exchange rates path during the crisis period. As a result we expect a contribution of the structural shocks to the exchange rates path has changed.

In the paper we analyse sources of exchange rate fluctuations in the European transition economies. We estimate the contribution of nominal, supply and demand shocks to NEER and REER variability implementing SVAR methodology. Long run restrictions are applied to unrestricted VAR model to identify structural shocks. Variance decomposition and impulse-response functions are computed for each individual country for the period 2000-2007 and 2000-2011. Comparison of results for both periods is crucial for identification of the role of economic crisis in determining exchange rate volatility in the European transition economies.

Keywords: exchange rates, exogenous structural shocks, structural vector autoregression, variance decomposition, impulse-response function.

JEL Classification: C32, E52

1. Introduction

Current economic crises deteriorated overall macroeconomic performance of the European transition economies. At the same it caused their exchange rates to become much more volatile as a result of increased uncertainty on the financial markets as well as changed behaviour of structural shocks affecting exchange rates path during the crisis period.

Decreased predictability of (especially) short-term exchange rates path affected not only countries with their own currencies (Bulgaria, Czech Republic, Estonia, Latvia, Lithuania, Hungary, Poland and Romania in our sample) but also member countries of the Economic and Monetary Union (EMU) (Slovak Republic and Slovenia in our sample). In general, exchange rate stability is considered to be one of the most significant outcomes of the Eurozone membership especially for smaller and opened transition economies. On the other hand economic and debt crisis related problems negatively contributed to the exchange rate stability of the euro. Under such circumstances exogenous character of sudden exchange rate shifts in currency unions become a viable vehicle of undesired external shocks especially in small open economies.

In the paper we analyse sources of exchange rate fluctuations in the European transition economies. We estimate the contribution of nominal, demand and supply shocks to NEER and REER variability implementing SVAR methodology. Long run restrictions are applied to unrestricted VAR model to identify structural shocks. Variance decomposition and impulse-response functions are computed for each individual country for the period 2000-2007 and 2000-2011. Comparison of results for both periods is crucial for identification of the role of economic crisis in determining exchange rate volatility in the European transition economies.

2. Overview of the literature

Empirical studies dealing with effects of structural shocks on the exchange rate leading path are usually based on SVAR methodology. Structural shocks are obviously isolated implementing long-run (rarely short-run) identifying restrictions. Determining forces affecting exchange rate path are then decomposed to temporary and permanent components.

Kutan, and Dibooglu (1998) analysed sources of exchange rates volatility in Poland and Hungary decomposing nominal and real shocks. Fidrmuc, and Korhonen (2001) investigated mutual

correlations between supply and demand shocks in the Czech republic, Hungary, Poland and the Slovak republic. Hamori, and Hamori (2007) analysed sources (supply, demand and nominal shocks) of nominal and real euro exchange rate movements. Stazka (2006) examined sources of real exchange rates volatility on the sample of nine Central and Eastern European countries. Chowdhury (2004) investigated sources (real and nominal shocks) of bilateral exchange rates fluctuations in the selected developing countries vis-a-vis USD. Enders, and Bong-Soo (1997) decomposed sources of real and nominal exchange rates movements to real and nominal components focusing on bilateral exchange rates USD/CAD and JPY/DEM. Lastrapes (1992) analysed sources (nominal and real shocks) of real and nominal Exchange rates fluctuations in U.S.A., Germany, Great Britain, Japan, Italy and Canada. Structural shocks were isolated using short-run identifying restrictions.

3. Econometric model

Vulnerability of the exchange rates to the exogenous shocks came to the center of an academic discussion shortly after a break-down of a Bretton Woods system of fixed exchange rates at the beginning of the 1970s. Uncertainty on the foreign exchange markets together with higher volatility of exchange rates increased a sensitivity of domestic economies to the foreign partners' economic development as well as to the world leading economies' exchange rate movements.

Main contribution to the analysis of structural exogenous shocks is addresses to Byoumi, and Eichegreen (1993) who pioneered an identification scheme of underlying supply and demand shocks using technique introduced by Blanchard, and Quah (1989). Their model considered two types of structural shocks (supply shocks and demand shocks) hitting an economy. So called primitive shocks were identified using long-run restrictions based on long-run neutrality of the real output to demand shocks, while it is suggested the supply shocks have permanent influence on the real output development (Fidrmuc-Korhonen 2001).

The methodology we use in our analysis to recover nominal (liquidity), demand and supply shocks is based upon a SVAR model introduced by Clarida, and Gali (1994), which implements a long-run identifying restrictions to the unrestricted VAR models pioneered by Blanchard, and Quah (1989).

Unrestricted form of the model is represented by the following infinite moving average representation:

$$X_t = A_0\varepsilon_t + A_1\varepsilon_{t-1} + A_2\varepsilon_{t-2} + \ldots = \sum_{i=0}^{\infty} A_i\varepsilon_{t-i} = \sum_{i=0}^{\infty} A_i L^i \varepsilon_t \qquad (1)$$

where X_t is a vector of the endogenous macroeconomic variables, $A(L)$ is a polynomial variance-covariance matrix (represents impulse-response functions of the shocks to the elements of X) of lag-length l, L is lag operator and ε is a vector of identically normally distributed, serially uncorrelated and mutually orthogonal white noise disturbances (vector of reduced form shocks in elements of X). The vector X_t of the endogenous variables of the model consists of the following three elements: real exchange rate (er_r), nominal exchange rate (er_n) and real output (y_r).

In our tri-variate model we assume three exogenous shocks that determine endogenous variables - nominal shock (ε_n), demand shock (ε_d) and supply shock (ε_s). Our model then becomes

$$\begin{bmatrix} \Delta er_{rt} \\ \Delta er_{nt} \\ \Delta y_{rt} \end{bmatrix} = \sum_{i=0}^{\infty} \begin{bmatrix} a_{11i} & a_{12i} & a_{13i} \\ a_{21i} & a_{22i} & a_{23i} \\ a_{31i} & a_{32i} & a_{33i} \end{bmatrix} \begin{bmatrix} \varepsilon_{nt} \\ \varepsilon_{dt} \\ \varepsilon_{st} \end{bmatrix} \qquad (2)$$

The framework of the model implies that only supply shocks have a permanent effect on all endogenous variables. Demand shocks have permanent effect on the real and nominal exchange rate while its impact on the real output is only temporary. Nominal shocks have permanent effect only on the nominal exchange rate while its impact on the real exchange rate and the real output is considered to be temporary. Identification of temporary impacts of selected exogenous shocks on the endogenous variables is represented in the model by the following long-run identifying restrictions.

$$\sum_{i=0}^{\infty} a_{11i} = 0, \sum_{i=0}^{\infty} a_{31i} = 0, \sum_{i=0}^{\infty} a_{32i} = 0 \quad (3)$$

The model defined by equations (2) and (3) we estimate using a vector autoregression. Each element of X_t can be regressed on lagged values of all elements of X. Using B to represent these estimated coefficients, the estimated equation becomes

$$\begin{aligned} X_t &= B_1 x_{t-1} + B_2 x_{t-2} + \ldots B_n x_{t-n} + e_t = \sum_{i=1}^{n} B_i L^i X_t + e_t = B(L) X_t + e_t \\ &= (I - B(L))^{-1} e_t \\ &= \left(I + B(L) + B(L)^2 + \ldots\right) e_t \\ &= e_t + D_1 e_{t-1} + D_2 e_{t-2} + D_3 e_{t-3} + \ldots \end{aligned} \quad (4)$$

where e_t represents the residuals from the equations in the vector autoregression.

In order to convert equation (4) into the model defined by the equations (2) and (3), the residuals from the vector autoregression, e_t, must be transformed into nominal, demand and supply shocks, ε_t. Imposing $e_t = C\varepsilon_t$, it is clear, that nine restrictions are necessary to define nine elements of the matrix C. Three of these restrictions are simple normalizations, which define the variance of the shocks $\varepsilon_{n,t}$, $\varepsilon_{d,t}$ and $\varepsilon_{s,t}$ (it follows the assumption, that each of the disturbances has a unit variance, $\text{var}(\varepsilon) = 1$. Another three restrictions comes from an assumption that identified shocks are orthogonal. Normalization together with an assumption of the orthogonally implies $C'C = \Sigma$, where Σ is the variance covariance matrix of e_n, e_d and e_s. The final three restrictions, which allow the matrix C to be uniquely defined, reflect the long-run identifying restrictions mentioned in the equation (3). In terms of our vector autoregression model it implies

$$\sum_{i=0}^{\infty} \begin{bmatrix} d_{11} & d_{12} & d_{13} \\ d_{21} & d_{22} & d_{23} \\ d_{31} & d_{32} & d_{33} \end{bmatrix} \begin{bmatrix} c_{11} & c_{12} & c_{13} \\ c_{21} & c_{22} & c_{23} \\ c_{31} & c_{32} & c_{33} \end{bmatrix} = \begin{bmatrix} 0 & . & . \\ . & . & . \\ 0 & 0 & . \end{bmatrix} \quad (5)$$

Final three long-run restrictions allows the matrix C to be uniquely defined and the nominal, demand and supply shocks to be correctly identified - recovered from the residuals of the estimated VAR model. The system is now just-identified and can be estimated using structural vector autoregression, so that we can compute variance decomposition that represents the contribution of each shock to the variability in each endogenous variable (we do this for the real output only) and impulse-response functions that represent the short-run dynamics of each endogenous variable (we do this for the real output only) in response to all identified structural shocks.

If the exogenous structural shocks are correctly identified, we might expect the following results:

- In the short-run a positive relative nominal shocks leads to NEER and REER depreciation. In the long run, there should be no effect on the REER path.
- In the short-run NEER and REER should appreciate after a positive relative demand shock. If the shock is permanent, REER should appreciate after a positive demand shock in the long-run.
- The effect of a positive relative supply to REER and NEER path should be ambiguous in the short-run, while in the long-run we expect an ambiguous effect only on REER.

4. Data and results

The methodology we use in our analysis to recover nominal (liquidity), demand and supply shocks is based upon a SVAR model introduced by Clarida, and Gali (1994), which implements a long-run identifying restrictions to the unrestricted VAR models pioneered by Blanchard, and Quah (1989).

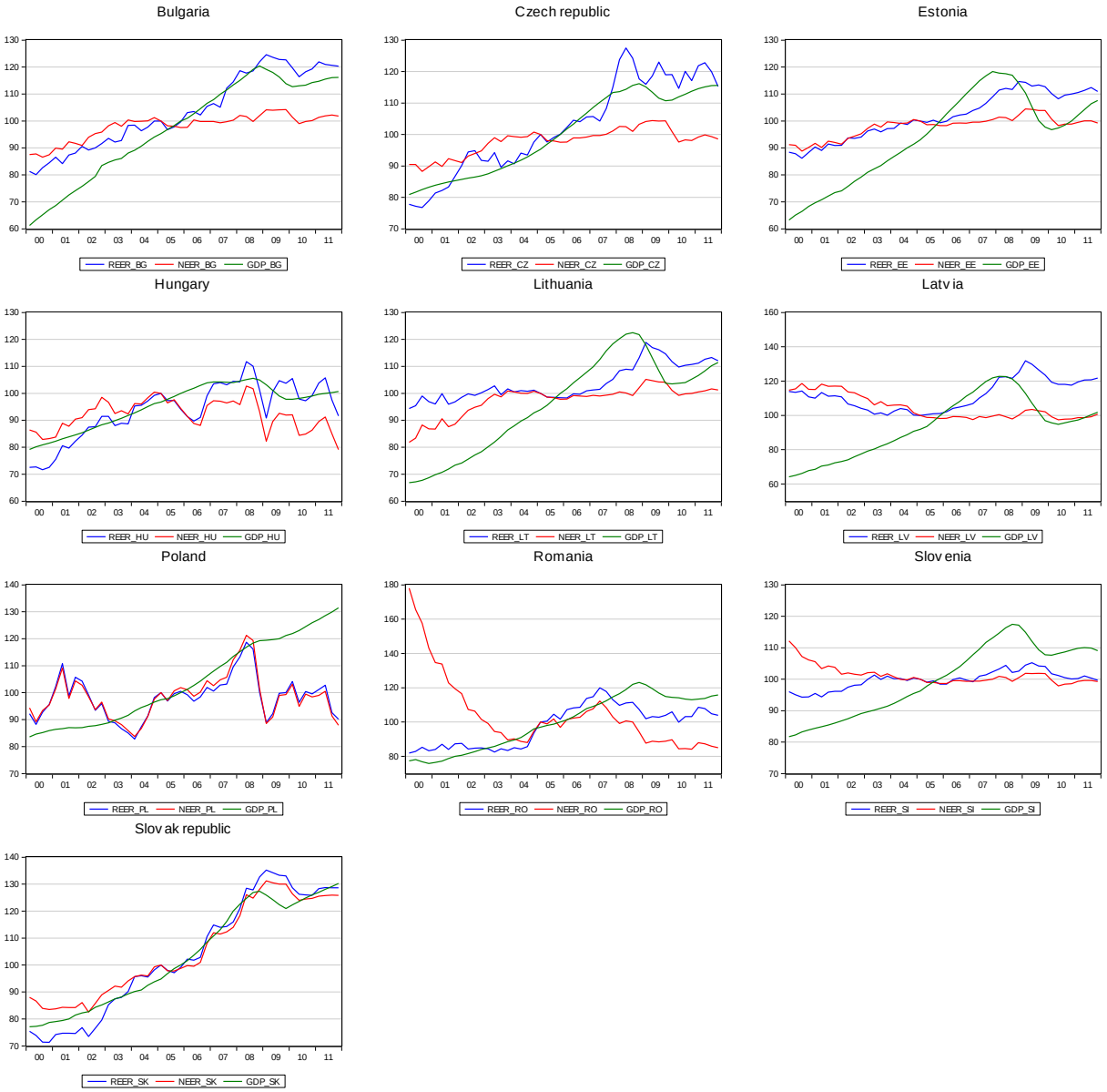


Figure 1. REER, NEER and GDP in the European Transition Economies

Note: Endogenous variables - real effective exchange rate (REER), nominal effective exchange rate (NEER) and gross domestic product (GDP) are expressed as indexes (2005 = 100).
Source*:* Compiled by author based on data taken from IMF - International Financial Statistics (August 2012).

In order to estimate our model consisting of three endogenous variables for ten European transition economies (Bulgaria, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovak Republic, Slovenia) we use the quarterly data ranging from 2000Q1 to 2011Q4 (48 observations) for the real effective exchange rates[9], nominal effective exchange rates[10] and real GDP

[9] Real effective exchange rates are the same weighted averages of bilateral exchange rates adjusted by relative consumer prices.

(Figure 1). Time series for the annual real GDP calculated on the quarter base are seasonally adjusted. Time series for all endogenous variables were drawn from IMF database (International Financial Statistics, August 2012).

To correctly identify exogenous shocks hitting the model as well as to compute variance decomposition and impulse-response functions it is necessary VAR model to be stationary. To check the model it is necessary to test the time series for unit roots and cointegration.

A. Unit Root Test

The augmented Dickey-Fuller (ADF), and the Phillips-Perron (PP) tests were computed to test the endogenous variables for the unit roots presence. Results of unit root tests are summarized in the table 1 (detailed results of unit root are not reported here to save space. Like any other results, they are available upon request from the author).

Table 1. Unit Root Tests

Country	model	Order of integration of endogenous variables					
		REER		NEER		GDP	
		ADF	PP	ADF	PP	ADF	PP
Bulgaria	A	I(1)	I(1)	I(1)	I(1)	I(1)	I(1)
	B	I(1)	I(1)	I(1)	I(1)	I(1)	I(1)
Czech republic	A	I(1)	I(1)	I(1)	I(1)	I(1)	I(1)
	B	I(1)	I(1)	I(1)	I(1)	I(1)	I(1)
Estonia	A	I(1)	I(1)	I(1)	I(1)	I(1)	I(1)
	B	I(1)	I(1)	I(1)	I(1)	I(1)	I(1)
Latvia	A	I(1)	I(1)	I(1)	I(1)	I(1)	I(1)
	B	I(1)	I(1)	I(1)	I(1)	I(1)	I(1)
Lithuania	A	I(1)	I(1)	I(1)	I(1)	I(1)	I(1)
	B	I(1)	I(1)	I(1)	I(1)	I(1)	I(1)
Hungary	A	I(1)	I(1)	I(1)	I(1)	I(1)	I(1)
	B	I(1)	I(1)	I(1)	I(1)	I(1)	I(1)
Poland	A	I(1)	I(1)	I(1)	I(1)	I(1)	I(1)
	B	I(1)	I(1)	I(1)	I(1)	I(1)	I(1)
Romania	A	I(1)	I(1)	I(1)	I(1)	I(1)	I(1)
	B	I(1)	I(1)	I(1)	I(1)	I(1)	I(1)
Slovak republic	A	I(1)	I(1)	I(1)	I(1)	I(1)	I(1)
	B	I(1)	I(1)	I(1)	I(1)	I(1)	I(1)
Slovenia	A	I(1)	I(1)	I(1)	I(1)	I(1)	I(1)
	B	I(1)	I(1)	I(1)	I(1)	I(1)	I(1)

Source: Author's calculations.

Both ADF and PP tests indicate that all variables are non-stationary on the values so that the null hypothesis of a unit root cannot be rejected for any of the series. Testing variables on the first differences indicates the time series are stationary so that we conclude that the variables are I(1).

B. Cointegration Test

Because endogenous variables have a unit root on the values it is necessary to the test the time series for cointegration using the Johansen, and Juselius cointegration test. The test for the cointegration was computed using two lags as recommended by the AIC (Akaike Information Criterion) and SIC (Schwarz Information Criterion). Results of cointegration tests are summarized in

[10] Nominal effective exchange rates are calculated as geometric weighted averages of bilateral exchange rates.

the table 2 (detailed results of cointegration tests are not reported here to save space. Like any other results, they are available upon request from the author).

The results of the Johansen cointegration tests confirmed the results of the unit root tests for both models (models A and B) in the Czech Republic, Lithuania and Hungary only. Trace statistics and maximum eigenvalue statistics (both at 0.05 level) in these two countries indicate that there is no cointegration among the endogenous variables of the model. One test statistics indicates that we cannot however denote the rejection of the null hypothesis about no cointegration among variables (indicating the existence of one cointegrating relationship) for model A (Bulgaria, Estonia, Poland, Romania and Slovak Republic) and model B (Bulgaria, Latvia, Romania, Slovak Republic and Slovenia). An increase in the length of the lag to three lags resulted in the loss of the cointegrating relationship among variables in all countries indicating that any linear combination of two variables is nonstationary process.

Table 2. Johansen, and Juselius Cointegration Tests

Country	Number of cointegrating equations			
	model A		model B	
	trace stat.	max eigvalue stat.	trace stat.	max eigvalue stat.
Bulgaria	1	0	1	0
Czech republic	0	0	0	0
Estonia	0	1	0	0
Latvia	0	0	1	0
Lithuania	0	0	0	0
Hungary	0	0	0	0
Poland	1	0	0	1
Romania	1	0	0	1
Slovak republic	1	0	1	0
Slovenia	0	0	0	1

Source: Author's calculations.

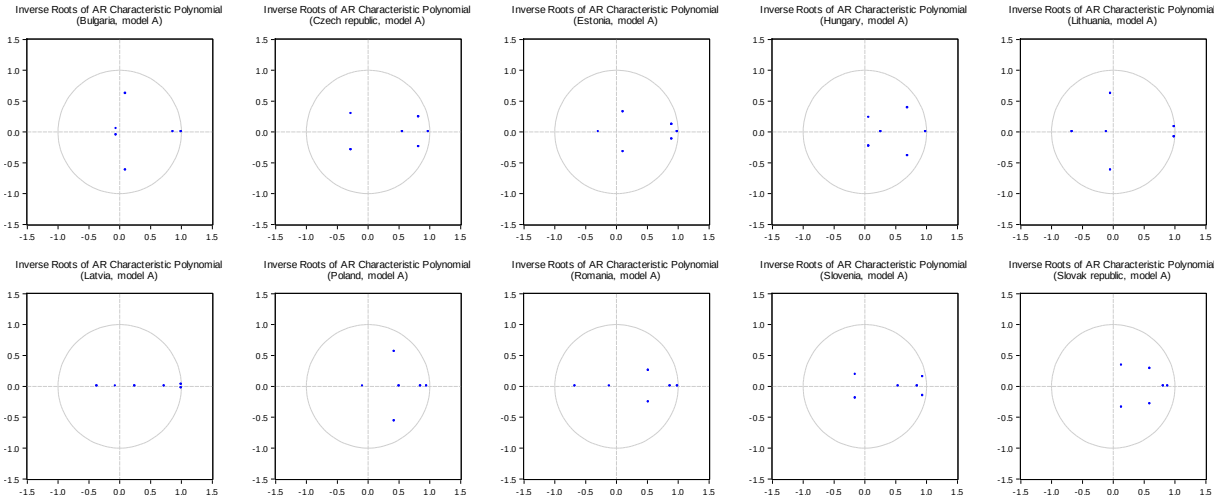
C. VAR Stability

To test the stability of the VAR model we also applied a number of diagnostic tests. We found no evidence of serial correlation, heteroskedasticity and autoregressive conditional heteroskedasticity effect in the disturbances. The model also passes the Jarque-Bera normality test, so that errors seem to be normally distributed. The VAR models seem to be stable also because the inverted roots of the model for each country lie inside the unit circle (Figure 2).

Following the results of the unit root and cointegration tests we estimated the model using the variables in the first differences so that we can calculate variance decompositions and impulse-response functions for all ten countries from the group of the European transition economies. In line with the main objective of the paper we focus on interpretation of the structural shocks contribution to the REER and NEER conditional variance. At the same time we analyse responses of REER and NEER on the positive one standard deviation nominal, demand and supply shocks. We also observe effects of economic crisis on the structural shocks determination potential in the European transition economies by comparing the results for models estimated using time series for two different periods - model A (2000:Q1-2007:Q4) and model B (2000:Q1-2011:Q4).

Changed ordering of the variables didn't seem to affect the results of the analysis. Considering variance decompositions and impulse-response functions are not very sensitive to the endogenous variables ordering we present the results of the models (model A1 and B1) with default ordering of the endogenous variables (detailed results for models A2, A3, B2, B3 are available upon request from the author).

Model A



Model B

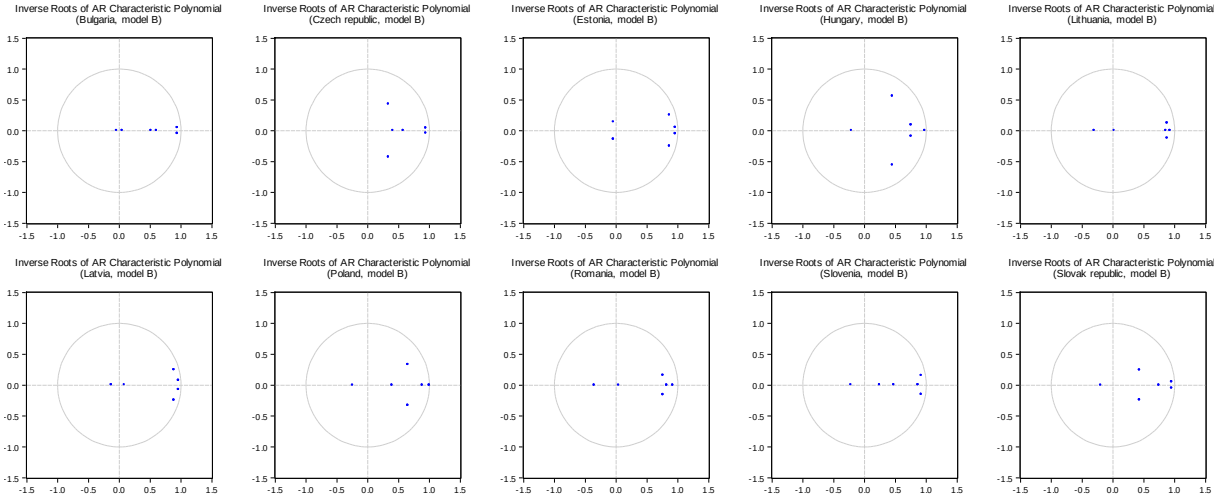


Figure 2. VAR Stability Condition Check

Source*:* Author's calculation.

D. Variance Decomposition

The figure 3 shows the estimated contribution of the structural shocks to the REER and NEER conditional variance in the European transition economies during the pre-crisis period. It seems to be clear that dominant part in immediate deterministic effect to the REER leading path during the pre-crisis period comes from *demand shock* in all ten countries. While in the Estonia, Hungary, Latvia, Romania, Slovenia and the Slovak republic the contribution of the shock remained relatively stable even in the medium term, its role slightly decreased in Bulgaria, the Czech Republic, Lithuania and Poland over time. At the same time the role of *nominal shock* seems to be quite stable and of a minor importance in determining REER path in all countries. While the contribution of the *supply shock* seems to be similarly low, its effect increases in Bulgaria, the Czech Republic, Lithuania, Latvia and Poland in medium term.

Slightly different picture indicate the variance decomposition of NEER. Percent short-run NEER variance due to *demand shock* seems to be similarly high in all countries but the Slovak republic. Reduced (in comparison to REER) but still significant seems to be contribution of demand shock to NEER variability in Bulgaria, the Czech Republic and Estonia. In Lithuania and Latvia the long-run role of demand shock to NEER leading path seems to be higher (in comparison to REER). The role of *nominal shock* in determining NEER variability seems to be stable while following slightly

decreasing trend over time in all countries but Bulgaria and the Czech Republic. Finally, contribution of *supply shock* to the NEER conditional variance seems to be negligible in the Czech Republic and Hungary, while its role slightly increases in the long period in Poland. In the Slovak Republic the supply seems to be quite important in determining NEER leading path even in the short period.

In the Figure 3 we summarize variance decomposition of REER and NEER for the model with pre-crisis time series (model A1) in the European transition economies.

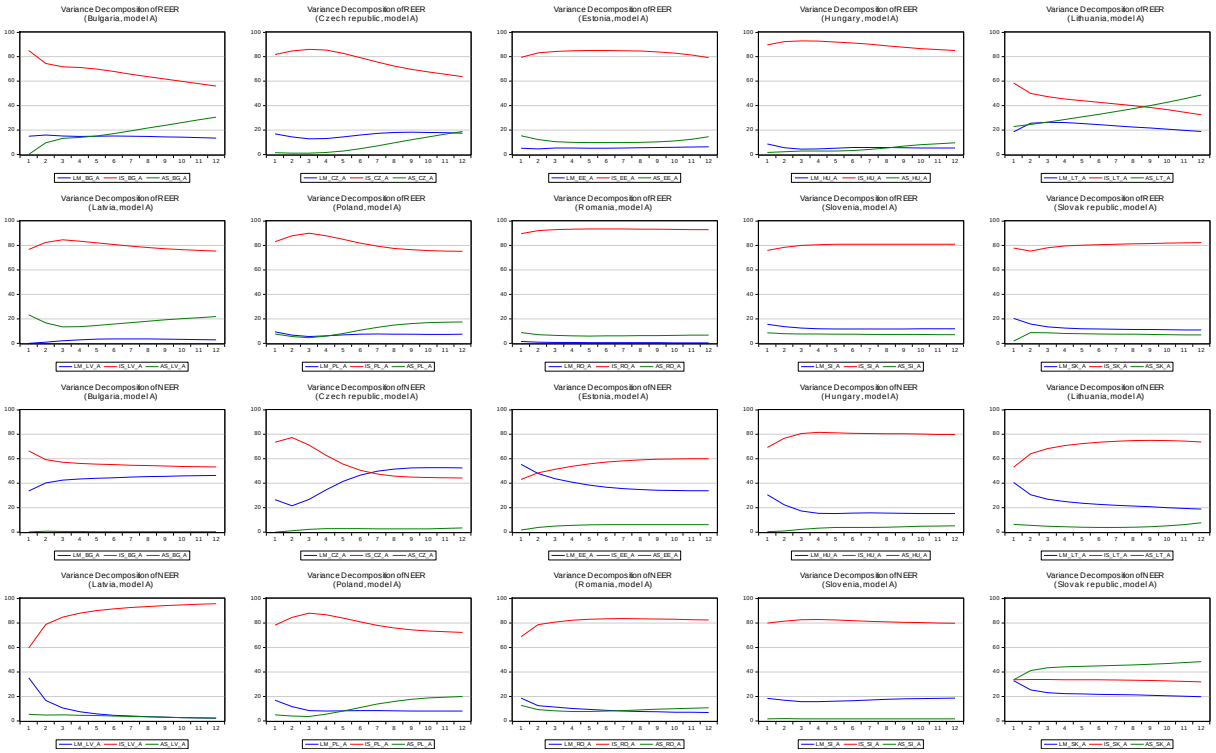


Figure 3. Variance Decomposition of REER and NEER (2000:Q1-2007:Q4)

Note: Curves represents relative contribution of structural shocks to the REER and NEER conditional variance in each individual country from the group of the European transition economies.

Source*:* Author's calculation.

The Figure 4 shows the estimated contribution of the structural shocks to the REER and NEER conditional variance in the European transition economies during the extended period. Immediate contribution of *nominal shock* to the REER and NEER conditional variability slightly decreased (but with significant exception in Slovenia and the Slovak republic when decomposing NEER variance). The role of the shock seems to be reduced even in the long run in all countries but Bulgaria (REER), Estonia (REER), Lithuania (REER) and Latvia (REER). Quite different effect of the crisis period we observed from the variance decomposition of REER and NEER due to *demand shock*. While the overall effect of the shock remained notably high even with increased lag since the shock in Hungary and Poland, its effect was significantly reduced in the long period in Bulgaria (REER), the Czech Republic (REER), Estonia (REER; in short period too), Lithuania (REER - though short-run contribution significantly increased, NEER), Latvia (REER - though short-run contribution slightly increased), Romania (REER, NEER), Slovenia (NEER) and the Slovak republic (REER). Reduction in the contribution of shock we also observed from decomposing variance of NEER in Poland. At the same time the contribution of *supply shock* to the REER variability markedly increased in the Czech Republic, Romania and the Slovak republic especially in the long run (the effect was also present from decomposing variance of NEER in Bulgaria, the Czech republic, Lithuania, Poland, Romania, Slovenia and the Slovak Republic) while it remained stable and low in Estonia, Hungary and Latvia.

In the Figures 4 we summarize variance decomposition of REER and NEER for the model with extended time series (model B1) in the European transition economies.

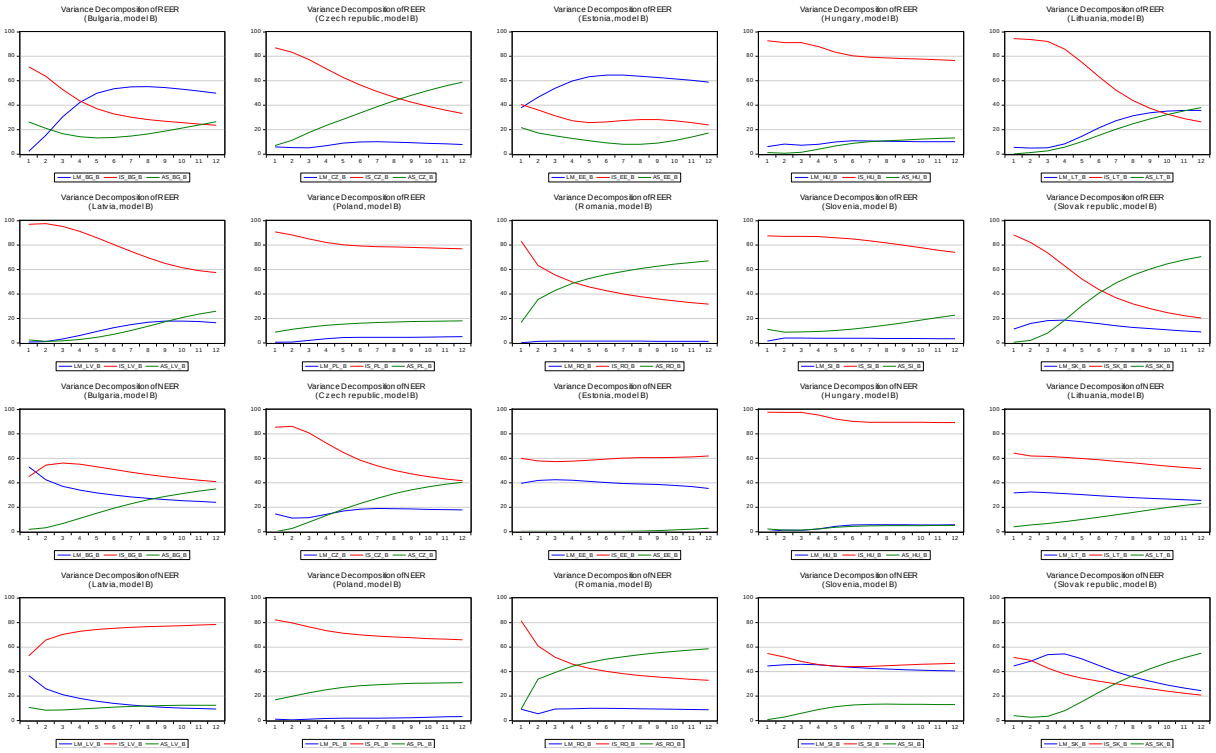


Figure 4 Variance Decomposition of REER and NEER (2000:Q1-2011:Q4)

Note: Curves represents relative contribution of structural shocks to the REER and NEER conditional variance in each individual country from the group of the European transition economies.
Source: Author's calculation.

E. Impulse-Response Function

The Figure 5 shows estimated responses of REER and NEER to positive structural one standard deviation nominal, demand and supply shocks in the European transition economies during the pre-crisis period. *Nominal shock* caused REER and NEER increase (appreciation). On the other hand it is clear that immediate REER and NEER appreciation seems to be just temporary in all ten countries. While durability and intensity of the positive effect of nominal shock notably differed among countries we also experienced its destabilizing effect in the Czech Republic (NEER), Hungary (REER, NEER) and Poland (REER, NEER). Nominal shock seems to be neutral in the long run in determining REER and NEER path as its effect died out in all ten countries in the long period. As we expected *demand shock* was followed by the immediate REER and NEER appreciation in all countries but Bulgaria (NEER) and the Czech Republic (NEER), both with slightly delayed appreciation. Positive influence of demand shock seems to be stronger and more durable in comparison with effect of nominal shock in all countries but Lithuania (REER), Bulgaria (NEER), the Czech republic (NEER), and Latvia (NEER) while its effect died out slightly later (effect of demand shock seems to be more durable in determining REER, NEER) in all countries but Bulgaria (NEER). Effect of the shock seems to be also neutral in the long period in relation to the REER and NEER path. *Supply shock* caused immediate exchange rate appreciation in the Czech republic (NEER), Estonia (REER, NEER), Lithuania (REER, NEER), Latvia (NEER),Romania (REER, NEER), Slovenia (REER, NEER) and the Slovak republic (REER, NEER) while in the remaining countries REER and NEER appreciated with short-term lag length up to four quarters (REER in Hungary) eventually six quarters (NEER in Hungary). Durability of the shock differed among countries. While the positive effect of the shock died out quite early in the Czech republic (NEER), Estonia (REER), Slovenia (REER) and the Slovak republic (REER), its effect in Bulgaria (NEER), Estonia (NEER), Hungary (REER, NEER), Lithuania (REER, NEER), Latvia (REER, NEER), and Poland (REER, NEER) disappeared in the long period while the permanent effect of the shock we experienced in Bulgaria (REER), the Czech republic (REER), Slovenia (NEER) and the Slovak republic (NEER).

In the Figure 5 we summarize impulse-response functions of REER and NEER for the model with pre-crisis time series (model A1) in the European transition economies.

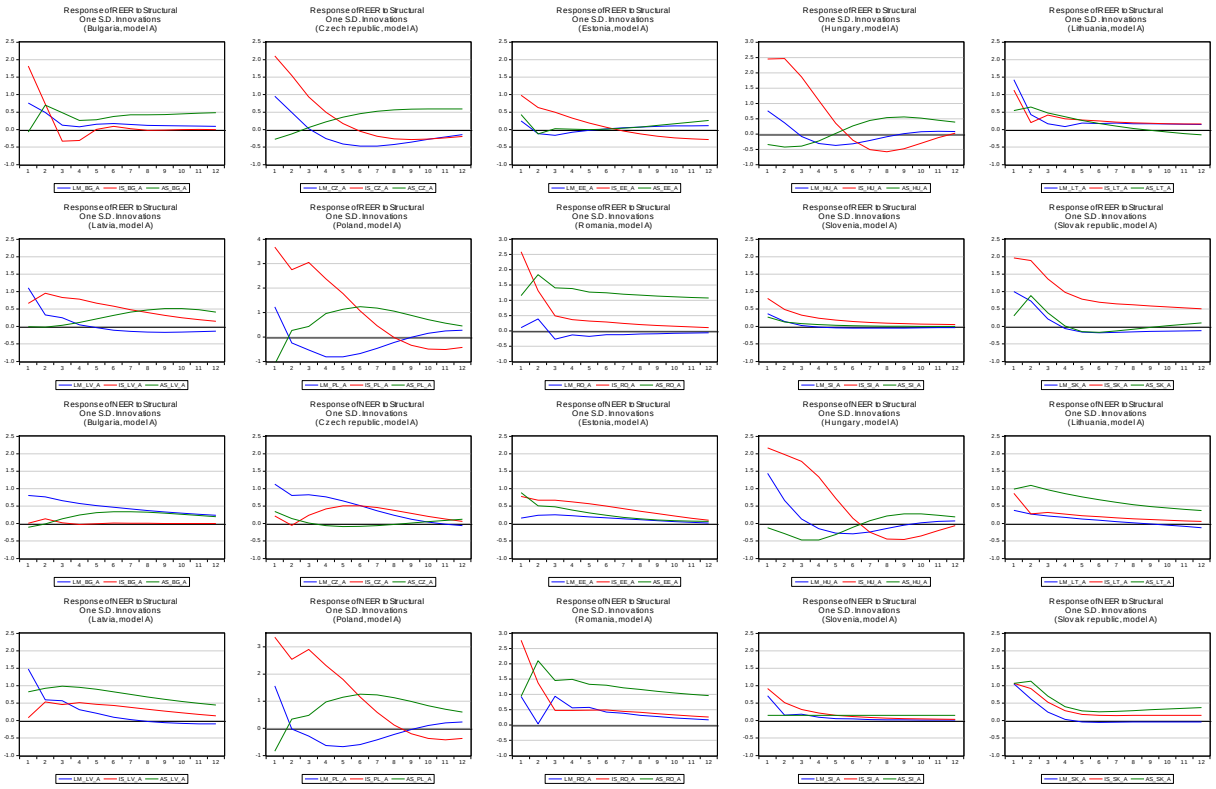


Figure 5. Responses of REER and NEER to Structural Shocks (2000:Q1-2007:Q4)

Note: Curves represents responses of REER and NEER to one standard deviation positive structural shocks in each individual country from the group of the European transition economies.
Source: Author's calculation.

The Figure 6 shows estimated responses of REER and NEER to positive structural one standard deviation nominal, demand and supply shocks in the European transition economies during the extended period. Crisis period affected responses of REER and NEER to nominal, demand and supply shocks. *Nominal shock* was followed by REER and NEER appreciation in all countries. Immediate REER and NEER responses to the shock are similar to pre-crisis period seem to be slightly reduced in Hungary (NEER) and Poland (REER, NEER) while in Bulgaria (REER), Estonia (REER), Hungary (REER), Lithuania (REER, NEER), Romania (NEER), Slovenia (REER) and the Slovak republic (NEER) the effect of the nominal shock seems to accelerated. Immediate exchange rate responses were followed by lagged exchange rate path to the equilibrium reflecting increased REER and NEER volatility on its way to pre-shock levels in all countries but the Czech Republic (NEER). After *demand shock* REER and NEER appreciated immediately in all countries though its effect seems to be just temporary and died out in about one year after the shock in all countries but Estonia (REER), Lithuania (REER), Latvia (REER), Romania (REER, NEER) and the Slovak republic (NEER). Both nominal and demand shocks seems to be neutral in determining REER and NEER leading path in the long period. Crisis period also affected response of REER and NEER to *supply shock*. Both exchange rates immediate responses to supply shock seem to differ from pre-crisis period in all countries but Slovenia. On the other hand we observed significant increase in the long-run effects of the shock on both REER and NEER. While in the Czech republic (NEER), Hungary (REER, NEER), Latvia (NEER), Poland (REER, NEER), Romania (REER, NEER) positive effect of the shock continuously died out over time with increased lag, in rest of the countries we observed long-run (permanent) effects on leading path of the exchange rates.

In the Figure 6 we summarize impulse-response functions of REER and NEER for the model with extended time series (model B1) in the European transition economies.

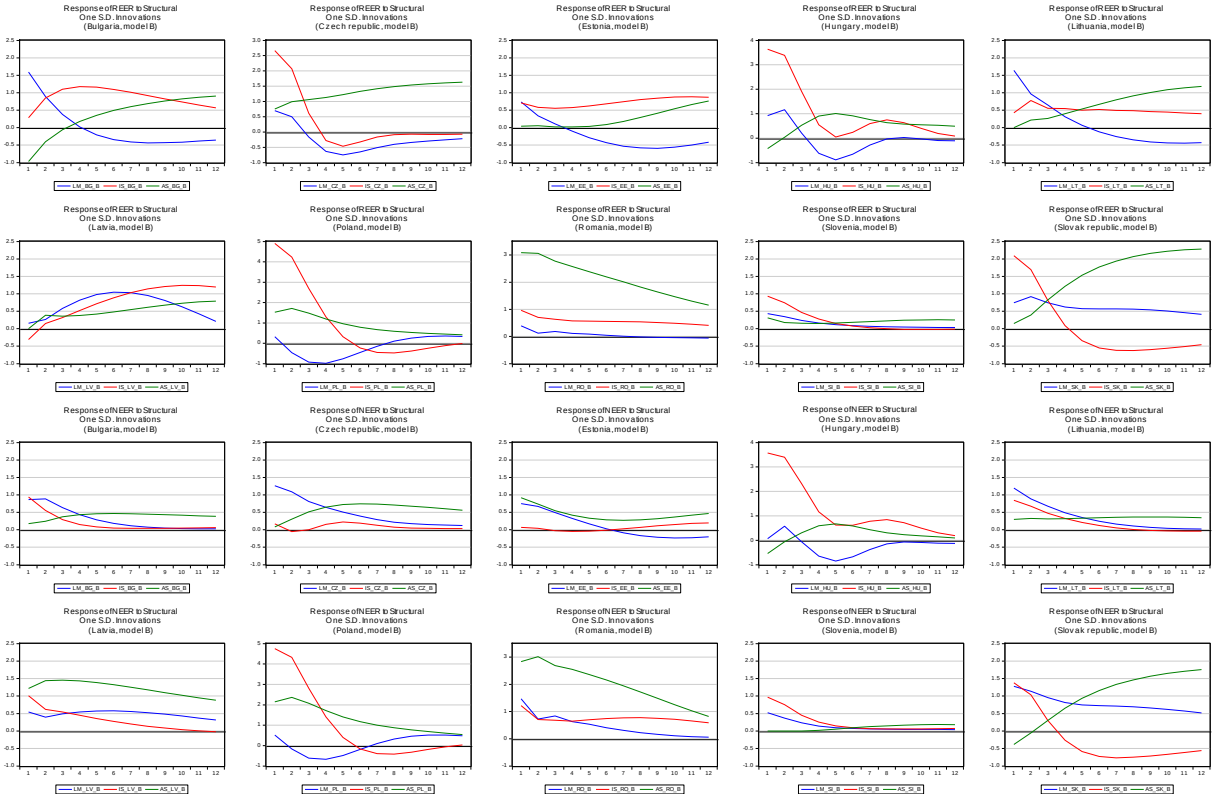


Figure 6. Responses of REER and NEER to Structural Shocks (2000:Q1-2011:Q4)

Note: Curves represents responses of REER and NEER to one standard deviation positive structural shocks in each individual country from the group of the European transition economies.
Source*:* Author's calculation.

Conclusion

Exogenous structural shocks determined exchange rates in the European transition economies in the line with the general empirical investigations though we observed some specific implications and related distorting effects of structural shocks during the crisis period leading to the unpredicted exchange rate shifts that may be a subject of a further academic discussion focusing on the specific causalities of the economic crisis. Variance decompositions and impulse-response functions computed from estimated VAR model revealed notable differences in the behaviour of real and nominal exchange rates after being hit by the one standard deviation positive nominal, demand and supply shocks as well as in their contribution to the real and nominal exchange rate conditional variability.

In general, our results mostly confirmed our expectations of the exogenous shocks determination potential related to the real and nominal exchange rate conditional variance in our sample of ten transition economies during the pre-crisis period. While the role of demand shock seems to be crucial in determining the real exchange rate path (not only in the short period) in all ten countries, its contribution to the variability of nominal exchange rate has decreased in general (Slovenia, the Slovak Republic) or with lag (the Czech Republic, Lithuania, Romania). The role of nominal shock and supply shocks in determining nominal and real exchange rate differed reasonably in many cases. While nominal shocks changed their contribution especially in the short period, the role of supply shocks increased mainly with rising lag.

Crisis period significantly affected the role of shocks in determining REER and NEER leading path in all countries but Hungary and partially in Poland (though minor differences are present in these countries too). We emphasize obvious reduction in contribution of demand shock to REER variance in Bulgaria, the Czech Republic, Romania and the Slovak Republic associated with increased role of supply shock in the Czech Republic, Romania and Slovak Republic and of nominal shock in Bulgaria. This trend is also present in NEER variance decomposition though with reduced intensity. We suggest the "swap-trigger effect" between two shocks (decreasing role of demand shocks versus increasing

role of supply shocks) may be considered as the most significant side effect of the crisis related causalities that should be the subject of the further rigorous investigation.

Following our expectations nominal and demand shocks caused immediate REER and NEER appreciation in most countries from the group of the European transition economies. Prevailing high short-run sensitivity of exchange rates to demand shock resulted in significant vulnerability of REER and NEER to sudden shifts caused by substantial aggregate demand components (especially in external demand) that seems to be a crucial subject of interest mainly in small opened economies (especially the Czech republic, Slovenia, the Slovak republic and Baltic countries). On the other hand increasing medium-term and long-term importance of supply shock in determining REER reflects increasing role of domestic sources of supply shocks including changes in relative competitiveness and productivity.

Responses of REER and NEER due to crisis effects reflected changed contribution of structural shocks to the exchange rate leading path during the crisis period in all ten European transition economies. We emphasize short-term destabilizing effects of nominal shocks to REER path in the Czech Republic, Hungary and Poland as well as permanent effects of supply shocks on REER path in Bulgaria and the Czech Republic as well as NEER path in Slovenia and the Slovak Republic. Although it may be difficult to understand and interpret early benefits of Eurozone membership due to common crisis effects we suggest our results may contribute to the discussion about short-term and long-term effects of sacrificing monetary sovereignty in small open transition economies while still leaving room for further empirical investigation.

Acknowledgement

This paper was written in connection with scientific project VEGA no. 1/0973/11. Financial support from this Ministry of Education's scheme is also gratefully acknowledged.

References

[1] Artis, M.J., Ehrman, M. 2000. The Exchange Rate - A Shock-absorber or Source of Shocks? A Study of Four Open Economies. Robert Schuman Centre for Advanced Studies, Working Paper No. 38/2000. San Domenico di Fiesole, European University Institute, 39 p.

[2] Borghijs, A., Kuijs, A. 2004. Exchange Rates in Central Europe. International Monetary Fund, Working Paper, No. 2/2004. Washington D.C., International Monetary Fund, 29 p.

[3] Bayoumi, T.A., Eichengreen, B. 1992. Shocking Aspects of European Monetary Unification. NBER Working Paper, no. 3949. Cambridge, National Bureau of Economic Research.

[4] Ben Arfa, N. 2009. Analysis of Shocks Affecting Europe: EMU and some Central and Eastern Acceding Countries. *Panoeconomicus*. 1(56): 21-38.

[5] Borghijs, A., Kuijs, L. 2004. Exchange rate in the Central Europe. IMF Working Paper, no. 04/02. Washington, International Monetary Fund.

[6] Calvo, G., Reinhart, C. 2002. Fear of Floating. *Quarterly Journal of Economics* 117(2): 379-408.

[7] Chowdhury, I.S. 2004. Sources of Exchange Rate Fluctuations: Empirical Evidence from Six Emerging Market Countries. *Applied Financial Economics*, 14(10): 697-705.

[8] Clarida, R., Gali, J. 1994. Sources of Real Exchange Rate Fluctuations: How Important Are Nominal Shocks? Carnegie-Rochester Conference Series on Public Policy 41, p. 1-56.

[9] Fidrmuc, J., Horváth, R. 2007. Volatility of Exchange Rates in Selected New EU Members: Evidence from Daily Data. CESifo, Working Paper No. 2107. Munich, CESifo, 31 p.

[10] Fidrmuc, J., Korhonen, I. 2001. Similarity of supply and demand shocks between the Euro area and the CEECs, BOFIT Discussion Papers 14/2001, Bank of Finland, Institute for Economies in Transition.

[11] Enders, W., Bong-Soo, L. 1997. Accounting for Real and Nominal Exchange Rate Movements in the post-Bretton Woods Period, *Journal of International Money & Finance*, 16(2): 233-254.

[12] Égert, B., Halpern, L., MacDonald, R. 2005. Equilibrium Real Exchange Rates in Transition

Economies. William Davidson Institute, Working Paper, No. 793. Michigan, William Davidson Institute, 50 p.

[13] Frait, J., Komárek , L. 2001. Real Exchange Rate Trends in Transitional Countries. University of Warwick, Economic Research Paper No. 596. Warwick, University of Warwick, 35 p.

[14] Hamori, S., Hamori, N. 2007. Sources of real and nominal exchange rate movements for the Euro. *Economics Bulletin*, 6(32): 1-10.

[15] Kollmann, R. 2001. The Exchange Rate in a Dynamic-Optimizing Business Cycle Model with Nominal Rigidities: A Quantitative Investigation. *Journal of International Economics*, 55(2): 243-262.

[16] Kutan, A.M., Dibooglu, S. 1998. Sources of real and nominal exchange rate fluctuations in transition economies. Federal Reserve Bank of St. Louis, Working Paper No. 22/1998. St. Louis, Federal Reserve Bank of St. Louis, 21p.

[17] Lastrapes, W.D. 1992. Sources of fluctuations in real and nominal exchange rates, *Review of Economics & Statistics*, 74(3): 530-539.

[18] Mirdala, R. 2008. *Exchange Rate and Output Vulnerability in Selected CEECs (SVAR Approach)*, Journal of Economics (Ekonomický časopis), 56(8): 745-763.

[19] Mirdala, R. 2012. Macroeconomic aspects of real exchange rate volatility in the Central European Countries. *Journal of Applied Economic Sciences*, 7(2):163-178.

[20] Stazka, A. 2006. Sources of real exchange rate fluctuation in Central and Eastern Europe. CESifo Working Paper, no. 1876. Munich, CESifo GmbH.

THE IMPACT OF GROWTH ON BIODIVERSITY: AN EMPIRICAL ASSESSMENT[11]

Roberta DE SANTIS
Istat and Luiss University, Rome, **Italy**
rdesantis@istat,rdesantis@luiss.it

Abstract

Several studies investigating environmental Kuznets curve (EKC) relationship for biodiversity, suffer from limitations and the empirical evidence is inconclusive. More specifically, with few exceptions, the previous EKC studies for biodiversity looked into the diversity of a particular species or a number of species rather than a broader measure of biodiversity. In addition, these studies do not control for some economic factors that could directly or indirectly affect the biodiversity stock such as trade and foreign direct investments. The innovative features of this paper are its attempts to estimate an ECK for biodiversity using an overall index of biodiversity and the inclusion in the traditional ECK equation of proxies for trade and FDI. We also tested the impact on biodiversity of the membership in agreements for biodiversity protection. According to our estimates the ECK is partially verified. Rising incomes are associated with increasing biodiversity then with decreasing biodiversity and eventually with increasing biodiversity again.

Keywords: Biodiversity risk, trade, FDI, environmental Kuznets curve.

JEL Classification: O40, Q50, C23, C52

1. Introduction

Since it first appeared as a formal concept in the early 1990s, the environmental Kuznets curve (EKC) hypothesis[12] has engendered significant debate within academic and policy literature.

Whether the Environmental Kutznets curve relationship holds for biodiversity loss or not is a particularly challenging issue to investigate. In fact, there may be some biodiversity losses that cannot be continuously substituted with better production technology and thus the ECK hypothesis would be rejected.

The empirical literature investigating the EKC relationship for biodiversity is not particularly recent, suffers from some limitations and it is inconclusive. With few exceptions, the previous EKC studies for biodiversity looked into the diversity of a particular species or a number of species rather than into a broader measure of biodiversity. In addition, these studies do not account for some economic factors that could directly or indirectly affect species diversity such as trade and foreign direct investments (FDI). International trade, in fact, could influence the biodiversity trough the effects on economic growth, on production specialization and on technological innovation diffusion. The presence or not of FDI in a country, on the other hand, could help in assessing the "pollution haven" stating that foreign investors from industrial countries are attracted to weak environmental regulations in other countries. This principle says that a company would want to locate in a country with the lowest environmental standards for using less environmental friendly production techniques. This hypothesis, if verified, has obvious negative feedbacks on biodiversity.

The innovative features of this paper are its attempts to estimate ECK for biodiversity using an overall index of biodiversity terrestrial and marine and the inclusion in the traditional ECK equation of proxies for trade and FDI for the main OECD countries in the time period 1990-2010. We also tested the impact on biodiversity of the membership in international agreements for biodiversity protection and in particular the Convention for Biological Diversity.

The paper is organized as follows. The first section conducts a critical survey of the most recent empirical literature, the second and the third sections describe the empirical strategy, the equation and the dataset and the estimation results. Conclusions follow.

[11] The views expressed in this paper are those of the author and do not necessarily represent the institutions with which the author is affiliated. Any error or mistake remains authors' sole responsibility.

[12] The hypothesis states that environmental degradation will increase with economic development up to a point, upon which additional development will lead to a decline in environmental degradation.

2. A survey of the literature

The EKC relationship has generated extensive debate and empirical investigation[13]. Various empirical EKC studies have employed different methods, and evaluated different environmental indicators resulting in a broad spectrum of findings. Based on a number of empirical findings supporting the EKC, some analysts argue that there exists a general inverted U-shape relationship between economic growth and the environment. On the contrary, others argue that there is no inverted U-shape relationship between income and overall environmental quality (e.g. Stern 1998; Stern, and Common 2001; Harbaugh *et al.* 2002)[14].

The idea behind the EKC hypothesis is based on the assumption that environmental stress or the loss of biodiversity, are involuntary and unplanned consequences, of consumption and production activities intended to improve human well-being. As the economy grows, the level of environmental degradation will also increase, unless: 1) the negative changes in environmental quality associated with specific activities decreases per unit of activity or 2) the mix of activities changes such that the share of activities associated with fewer negative changes increases, and 3) the degree to which these changes occurs is large enough to compensate for the overall increase in levels of activity. Furthermore, it has to be underlined that the ECK hypothesis is based on a important assumption that is the reversibility of degradation in environmental quality and the existence of knowledge on how to produce the reversal.

This debates on the monotonic or not monotonic relationship between growths and environmental quality is complicated further if we consider the fact that among the environmental losses, especially the loss of biodiversity, could not be continuously avoided with an environmental friendly production technology. Thus, whether the EKC relationship holds for biodiversity loss, remains an open issue.[15] As in the broader EKC literature, most authors estimate a regression model with some measure of biodiversity as the dependent variable and per capita income or a higher order polynomial as the independent variable, in addition to some additional covariates that might be relevant. The most frequent additional covariates are population density or some related measure such as fraction of urban population, economic aggregates such as measures of trade intensity or the share of agriculture, and measures of civil and political liberties and/or political institutions.

The empirical evidence is assessed in terms of the statistical significance of the estimated coefficients on the income terms and the location of the 'turning point,' that is, the level of income at which biodiversity-income relationship changes from decreasing (increasing) biodiversity with increases (decreases) in income to increasing (decreasing) biodiversity with increases (decreases) in income.

The studies investigating the EKC relationship for biodiversity, with few exceptions are subject to various limitations. First of all, different authors use heterogeneous measures of biodiversity[16]

[13] The empirical robustness of the inverted U-shape relationship remains a debatable issue. For an extensive survey see Jie He (2007).

[14] "*Originally based on empirical findings, the inverted-U curve predicted by this hypothesis concerning the relationship between pollution and per capita income has been interpreted in various ways. What optimists see in it is that environmental deterioration is an unavoidable stage in economic development, a mere temporary phenomenon before we become rich enough to implement seriously the necessary pollution abatement activities. In contrast, pessimists point that this hypothesis only has weak credibility given the instable estimation results yielded by over 100 studies based on the experience of various countries*. "Jie He (2007).

[15] Rothman, and Khanna (2008) summarizes the empirical literature on the EKC for biodiversity.

[16] Maozumder *et al.* (2006) investigate the EKC hypothesis for the overall risk of biodiversity loss by using the multivariate National Biodiversity Risk Assessment Index (NABRAI; Ryers *et al.* 1998, 1999) and several variants, which include genetic, species, and ecosystem diversity. McPherson, and Nieswiadomy (2000) examined the EKC relationship for threatened birds and mammals and found an N-shape relation for threatened birds; the implication is that biodiversity loss ultimately increases with higher level of income. They found no evidence of an EKC relationship for threatened mammals. Naidoo, and Adamowicz (2001) examined the EKC relationship for birds and mammals as well as for amphibians, reptiles, fishes, invertebrates and found a general U-shape relationship for amphibians, reptiles, fishes, and invertebrates. However, they find an inverted U-shape relationship for birds and mammals. Dietz, and Adger (2001) examined the EKC hypothesis using species area-relationship in a number of tropical countries. They found

making the comparison among the different empirical findings impossible. The measurement is, in fact, one of the main problems related to the biodiversity. The term 'biodiversity' is a simple contraction of 'biological diversity', and at first sight the concept is simple too: biodiversity is the sum total of all biotic variation from the level of genes to ecosystems. The challenge comes in measuring such a broad concept in ways that are useful. Turner *et al.* (1993) divide the notion of biodiversity into three different categories: (1) genetic diversity, (2) species diversity and (3) ecosystem diversity. The richness and diversity of genetic information stored in the genes of plants, animal and microorganisms is referred as genetic diversity. The richness and variety of different species is referred as species diversity, where species variety is most commonly used to proxy biodiversity. The richness and variety of ecological process is referred to as ecosystem diversity.

A related point is that biodiversity cannot be easily reduced to a single number, such as species richness. Perhaps it will be possible to go part way if the many indicators are inter-correlated, as some certainly are. The stronger the correlations, the more reasonable it will be to reduce multiple measures to a few principal components or even a single measure, to create dimensions of diversity.

For the specific purpose of this paper, a proper measure of biodiversity had to be able to account for other factors that directly affect species diversity. Land exposed to high disturbance levels, human population density, other endemic species, genetically invented new species etc. can be the examples of such factors. For this reason we use the biodiversity index proposed by UN that is the percentage of protected areas marine and terrestrial of country. This measure seems to be appropriate especially for developed countries where the correlation between the protected areas and the "variety of life on earth" is high. Furthermore, if biodiversity is measured in terms of the land area under conservation, it is possible to have both a decrease and an increase of biodiversity while if we measure biodiversity in terms of the number of animal or plant species, an increase may not be possible, at least not on a timescale of interest.

Given the importance of the measurement issue and as suggested by Rothman, and Khanna (2008), the related literature may be classified into two broad categories based on the indicators of biodiversity used. The first category includes those studies where the authors argue that their measures of biodiversity are such that the loss in biodiversity is irreversible and cannot be recovered so that the relationship between their measure of biodiversity and per capita income is expected to be monotonic. (Asafu-Adjaye (2003), and Dietz, and Adger (2003). Therefore, a primary concern, by ecologists and others, is that biodiversity losses may be irreversible after crossing critical thresholds (i.e. irreparable damage to ecosystem functioning, or complete extinction of collections of species), thus restricting the ability to mitigate or substitute.

The second group of studies allows for the possibility of a non-monotonic relationship between biodiversity and per capita income. All the other studies fall into this category and employ a measure of biodiversity that can be expected to decrease as well as increase within a reasonable timeframe. Despite the evidence regarding the existence of an EKC for biodiversity is inconclusive one key element derived from this literature is the important role of non-income variables in explaining biodiversity changes. Therefore, changes in biodiversity are associated with socio-economic and political factors such as the structure of the economy, population density and urbanization, and the degree of civil and political liberties. This finding is very much in line with the wider literature on the EKC hypothesis.

3 Empirical strategy, equation and dataset

The EKC literature have hypothesized that the relationship between economic growth and environmental quality is not monotonic and may change sign from positive to negative when a country reaches a certain level of income. The same phenomenon may be drawn on the supply side by changes in input and output mix when the latter are correlated with domestic per capita income. This implies an inverted-U shape relationship between environmental degradation and income. For this reason, the standard EKC curve could be represented by a polynomial approximation as follows:

$$ES_i=ai+a_1X_i+a_2X_i^2+a_3X_i^3+e_i \quad (1)$$

no EKC relationship between income and biodiversity loss, but did find that conservation effort increases with income.

where: ES is the environmental stress level, Xi the per capita income of country i and e_i is the error term.

Equation (1) allows testing hypotheses of ES - income relationships.

i)If a1 > 0 and a2= a3= 0 reveals a monotonically increasing relationship indicating that rising incomes are associated with rising level of ES;

ii) a1< 0 and a2=a3= 0 reveals a monotonically decreasing relationship indicating that rising incomes are associated with decreasing level of ES;

iii) a1> 0, a2< 0 and a3= 0 reveals a quadratic relationship representing an inverted U- shape EKC relationship. That is, rising incomes are associated initially with increasing ES and eventually with decreasing ES.

iv) a1 <, 0 a2 > 0 and a3= 0 also reveals a quadratic relationship representing a general U-shape relationship. That is, rising incomes are associated initially with decreasing ES and eventually with increasing ES.

v) a1> 0, a2< 0 and a3> 0 reveals a cubic relationship representing rising incomes are first associated with increasing ES then with decreasing ES and eventually with increasing ES again.

vi) a1< 0, a2 > 0 and a3 < 0 is another cubic relationship representing rising incomes are first associated with decreasing ES then with increasing ES and eventually with decreasing ES again. This relationship is a U-shape followed by an inverted U-shape relationship.

We intend to evaluate which of the above hypotheses best describes the income-biodiversity relationship. It is important to underline that, the biodiversity variable has to be interpreted in an opposite way with respect to the ES variable, since the increase (decrease) of the variable correspond to a reduction (increase) of a certain environmental stress.

In this analysis, we modify the equation to take into account biodiversity instead of environmental stress and we include in the equation some economic variables. We consider trade, as Rock (1996) found a positive relationship between trade openness and pollution intensities. Trade impacts operate through several vectors. Trade liberalization changes relative prices, which affect exploitation incentives. Trade can also have broader equilibrium effects, such as on factor markets and incomes, which may affect demand for resource-intensive products - or for ecosystem services. Trade interacts with and can influence the institutions governing the management of natural resources. Finally, trade can also be a direct vector for introducing threats to ecosystems in the form of invasive species.

Similarly, foreign direct investment variable is included to test for the pollution haven hypothesis (Suri, and Chapman 1998). The pollution haven hypothesis states that increasingly stringent environmental regulation will move polluting activities towards countries that have more relaxed environmental protection. The equation is estimated for the OECD 34 countries; the time span is 1990-2010[17]. The estimated equation form is the following:

$$Bio_i = a_i + a_{1ln}\text{Gdppc}_i + a_{2ln}\text{Gdppc}^2_i + a_{3ln}\text{Gdppc}^3_i + a_4 TRADE_i + a_5 URBAN_i + a_6 FDI_i + a_7 CBD_i \qquad (2)$$

Where: i) Bio_i is the percentage of protected areas marine and terrestrial of country with respect to the total country area i (*source*: UN);

ii) Gdppc_i is the per capita GDP (*source* OECD)

iii) TRADE is the sum of exports and imports as percentage of GDP (*source* OECD)

iv) URBAN is the percentage of urban population over the total population (*source*: FAO)

v) FDI is the stock of inward FDI as percentage of GDP (*source*: Unclad)

vi) CBD is a dummy variable representing the membership to the Convention on Biological Diversity[18] (*source*: Convention on Biological Diversity).

[17] Summary statistics for the data are provided in Table A2 in the appendix.

[18] The Convention on Biological Diversity (CBD), known informally as the Biodiversity Convention, is an international legally binding treaty. Its objective is to develop national strategies for the conservation and sustainable use of biological diversity. It is often seen as the key document regarding sustainable development. The Convention was opened for signature at the Earth Summit in Rio de Janeiro on 5 June 1992 and entered into force on 29 December 1993.

vii) ai is the intercept measuring country specific time invariant effects.

From this specification, the turning points incomes at which biodiversity is at its minimum (maximum) level is easily derived through the conventional rules for the study and resolution of cubic functions.

As for the empirical strategy, we use a panel data technique[19]. A major motivation for this choice is the possibility to control for the correlated time invariant heterogeneity. We perform a Hausman specification test to check the presence of correlation between explanatory variables and individual effects. Results are reported in table 1: the null hypothesis of zero correlation is accepted, showing that for our purposes the REM provides more efficient estimates than FE estimators[20].

4. Estimation results: is there an environmental Kuznets curve for the biodiversity?

According to our estimates, the ECK hypothesis (vi) is verified, indicating that rising incomes are first associated with increasing biodiversity (decreasing ES) then with decreasing biodiversity (increasing ES) and eventually with increasing biodiversity again (decreasing ES).

In terms of the control variables, trade has not a significant impact on biodiversity while FDI inflows (and the percentage of urban population) have a negative and significant impact on biodiversity supporting the pollution haven hypothesis. It seems thus that the foreign investors are attracted by the possibility to produce in countries with relatively more relaxed environmental protection and this determines a reduction of the biodiversity level calculated as percentage of protected areas.

We also find a positive and significant relationship between CBD membership and biodiversity level. Thus it seems that rather than passively relying on simple economic growth to protect biodiversity, taking direct policy actions at national and international level can have positive impacts (i.e., international treaties and protocols). However it might be that economic incentives play a crucial role in the design of such institutional agreements and actually achieving such environmental protection.

To sum up, the estimates indicates that rising incomes are first associated with increasing biodiversity (decreasing ES) then with decreasing biodiversity (increasing ES) and eventually with increasing biodiversity again (decreasing ES). The non-monotonic relationship could be explained by the fact that a certain level of income (production) there may be some biodiversity losses that cannot be continuously substituted with environmental-friendly production technology due to ecological threshold and the unique nature of the damage. The following new increase of biodiversity could be explained by the fact that at a certain level of income it is possible to restore/ increase biodiversity also using very expensive methodology (not accessible at a lower income level).

Table 1. The impact on biodiversity of growth, trade and FDI

N. of observations: 601 N. of bilat. relat. 34	Time sample : 1990-2010	
Bio	within	GLS
lnGdppc	0.30**	0.31***
lnGdppc2	-0.12***	-0.12***
lnGdppc3	0.01***	0.01***
Trade	0.01	0.01
FDI	-0.07*	-0.07*
URBAN	-013***	-0.12***
CBD	0.01***	0.1***

[19] The two most widely used panel data models are the random effect model (REM) and fixed effect model (FEM): both can control for heterogeneity. Their assumptions are different. REM models require that unobserved bilateral effects are ~ n.i.i. and orthogonal to the remaining part of the error term. regressors have to be uncorrelated to individual effects and error term for all cross sections and time periods. If the orthogonality conditions hold, the REM provides more efficient estimates than FE estimators. If explanatory variables are correlated with unobserved individual effects FEM is consistent.

[20] The test statistic of 4.61 is greater than the chi-squared critical value with 8 degrees of freedom therefore the null hypothesis that the REM is consistent is not rejected.

Trend	0.03***	0.03***
Costant	-0.02	-0.07
	F test (8,559) =71.42 Prob>F= 0.00	Wald $\chi^2(8)$=570.73 Prob> χ^2= 0.00

**** significant at 1% , ** significant at 5%, * significant at 10%.*

To investigate further the impact on biodiversity of CBD membership we included in our regression interaction terms between the environmental regulations dummy and the other regressors (Table 2). With the inclusion of these terms, the estimated coefficients indicate the difference in effects of the variable (FDI, URBAN, GDPpc) on the dependent variable (biodiversity) between countries that had signed the CBD and those that had not.

We found a positive and significant coefficient for GDPpc and for URBAN. This evidence seems to show that for OECD countries having signed the CBD increased the positive impact of the GDPpc and partly mitigated (by the amount of the estimated coefficient) the negative impact on biodiversity of the urban population pressure.

Table 2. Interaction effects

	Coeff.
Gdppc*CBD	0.01***
FDI* CBD	-0.09***
URBAN * CBD	-0.00***
Test: χ2 (3): 24.3***	

**** significant at 1% , ** significant at 5%, * significant at 10%.*

It is quite complicate to compare our results with prior EKC studies. Therefore, most of the empirical literature on ECK for biodiversity looked into the diversity of a particular species or a number of species rather than into a broader measure of biodiversity. Only the Mozumder *et al.* paper, as far as we could check, uses an overall index for biodiversity. Mozumder *et al*. fund no support for the EKC relationship for any of the three different biodiversity risk indices; however it has to be underlined that they did not use a panel data technique and the countries under consideration are different from those in this study[21].

According to our estimates the turning point GDP per capita at which biodiversity is at its maximum and minimum level is respectively 47.1 thousand dollars and 63.2 thousand dollars.

In 2010, GDP per capita for the average of the 34 OECD countries taken into consideration was 29.5 thousand dollars, therefore in 2010 on average the OECD countries were on the ascending part of the "biodiversity" ECK curve.

Conclusions

Whether the Environmental Kutznets curve relationship holds for biodiversity loss or not is a particularly challenging issue to investigate. In fact, there may be some biodiversity losses that cannot be continuously substituted with better production technology. The studies investigating the EKC relationship for biodiversity, with few exceptions are subject to various limitations. First of all, different authors use heterogeneous measures of biodiversity making the comparison among the different empirical findings impossible and therefore the empirical evidence is inconclusive.

In this paper we measure biodiversity in terms of percentage of terrestrial and marine area under conservation, to make possible for the indicator to both decrease and increase in order to test the ECK hypothesis. If we would have measured biodiversity in terms of the number of animal or plant species, an increase might not be possible, at least not on a timescale of interest. Furthermore, for the specific purpose of this paper, a proper measure of biodiversity had to be able to account for other factors that directly affect species diversity such as trade and FDI.

[21] In Table 1 in the appendix is available a summary of the empirical literature on the existence of a ECK for biodiversity.

According to our estimates for 34 OECD countries in the period 1990-2010 the ECK hypothesis is verified. Rising incomes are first associated with increasing biodiversity (decreasing ES) then with decreasing biodiversity (increasing ES) and eventually with increasing biodiversity again (decreasing ES).

The non-monotonic relationship could be explained by the fact that a certain level of income (production) there may be some biodiversity losses that cannot be continuously substituted with "economically accessible" environmental-friendly production technology due to ecological threshold and the unique nature of the damage. The following new increase of biodiversity could be explained by the fact that at a certain level of income it is possible to restore/ increase biodiversity also using very expensive environmental-friendly production technology.

We also find a positive and significant relationship between CBD membership and biodiversity level. Thus it seems that rather than passively relying on simple economic growth to protect biodiversity, taking direct policy actions at national and international level can have positive impacts (i.e., international treaties and protocols).

We included in our regression interaction terms between the environmental regulations dummy and the other regressors (table 2). With the inclusion of these terms, the estimated coefficients indicate the difference in effects of the variable on the dependent variable between countries that had signed the CBD and those that had not.

We found a positive and significant coefficient for per capita GDP and for the percentage of urban population. This evidence seems to show that for OECD countries having signed the CBD increased the positive impact of the per capita GDP and partly mitigated (by the amount of the estimated coefficient) the negative impact on biodiversity of the urban population pressure.

References

[1] Asafu-Adjaye, J. 2003. Biodiversity Loss and Economic Growth: A Cross-Country Analysis. *Contemporary Economic Policy* **21**:173-185.

[2] Dasgupta, P. 2000. *Valuing biodiversity, encyclopaedia of biodiversity'*, edited by Simon Levin, New York: Academic Press.

[3] Dasgupta, S., Laplante, B., Wang, H., and Wheeler, D. 2002. Confronting the environmental Kuznets curve. *Journal of Economic Perspectives*, Vol. 16, No. 1, pp. 147- 168.

[4] De Santis, R. 2012. Impact of environmental regulations on trade in the main EU countries: conflict or synergy? *The World Economy* vol. 35 issue 7.

[5] Dietz, S., and Adger, W.N. 2001. Economic growth, biodiversity loss and conservation effort. CSERGE Working Paper No. ECM 01-03, University of East Anglia, Norwich.

[6] Grossman, G, and Krueger, B. 1996. The Inverted-U: What Does IT Mean? *Environment and Development Economics*, Vol. 1, No. 2, pp. 119-122.

[7] Harbaugh, B., Levinson, A., and Wilson, D. 2002. Re-examining the empirical evidence for an Environmental Kuznets Curve. *Review of Economics and Statistics*, Vol. 84, No. 3, pp. 541-551.

[8] Jie He. 2007. Is the environmental Kuznets curve hypothesis valid for developing countries? A survey. Gredi WP, 07-03.

[9] Kuznets, S. 1955. Economic growth and income inequality. *American Economic Review*, Vol. 45, No.1, pp. 1-28.

[10] Mozumder, P., Berrens, R.P., and Bohara, A.K. 2006. Is There an Environmental Kuznets Curvefor the Risk of Biodiversity Loss? *The Journal of Developing Areas*, **39**: pp.175-190.

[11] McPherson, M., and Nieswiadomy, M.L. 2000. Environmental Kuznets curve study of threatened species. Paper Presented at 75th Annual Conference of the Western Economic Association International, Vancouver, British Columbia, Canada.

[12] Naidoo, R., and Adamowicz, W.L. 2001. Effects on economic prosperity on numbers of threatened species. *Conservation Biology*, Vol. 15, No. 4, pp. 1021-1029.

[13] Omer, A., Pascual, U., and Russell, N. 2003. Agricultural Intensification and Biodiversity Loss: Is There and Agri-EKC?, The School of Economics Discussion Paper No. 0317, The University of Manchester, Manchester, UK.

[14] Panayotou, T. 1993. Empirical tests and policy analysis of environmental degradation at different stages of economic development. World Employment Program Research Working Paper WEP2-22/WP 238.

[15] Rothman, D., and Khanna, N. 2008. Macro- and micro-perspectives on economic development and Biodiversity. Binghamton University Economics Department Working Paper 0801.

[16] Ryers, B., and James, A.N. 1999. An upgraded national biodiversity risk assessment index. *Biodiversity and Conservation*, Vol. 8, No. 11: 1555-1560.

[17] Ryers, B., Van Jaarsveld, A.S., McGeoch, M.A., James, A.N. 1998. National biodiversity risk assessment: A composite multivariate and index approach. *Biodiversity and Conservation*, Vol. 7, No. 7: 945-965.

[18] Rock, M. 1996. Pollution Intensity of GDP and Trade Policy: Can the World bank be Wrong?. *World Development*, Vol. 24, No. 3: 471-47.

[19] Rothman, D.S., and Khanna, N. 2008. Macro- and Micro- perspectives of economic development and biodiversity: Binghamton University Economics Department Working Paper 0801.

[20] Stern, D.I. 1998. Progress on the Environmental Kuznets Curve. Environment and *Development Economics*, Vol. 3, No. 2: 175-198.

[21] Stern, D.I., and Common, M.S. 2001. Is there an environmental Kuznets curve for Sulfur? *Journal of Environmental Economics and Management*, Vol. 41, No. 2: 162-178.

[22] Suri, V., and Chapman, D. 1998. Economic growth, trade and the energy: implications for the environmental Kuznets curve. *Ecological Economics* 25: 195 -208.

[23] Turner, R.K., Pearce, D., and Bateman, I. 1993. *Environmental Economics: An Elementary Introduction*. The John Hopkins University Press, Baltimore.

REVIEW ON ACCOUTING OF REVENUE RELATED TO NET TURNOVER OF THE SMEs

Silvia SIMIONESCU
Spiru Haret University, **Romania**
silviasimionescu@yahoo.com

Abstract:
The categories or types of income included in the turnover characterize the profile of the basic business and, naturally, have the largest share in the total income of the entity.
Analysing the layout of the profit and loss we see that the net turnover also includes the operating subsidies reflected through the 7411 "Income from subsidies related to turnover" account.
In our opinion proceeds from the sale of goods cannot be recognized in case of the internal operations within companies, such as: the transmission of products and goods for sale in own shops, the use of goods for the internal needs of the company etc.

Keywords: net turnover, profit and loss, income earned, revenue from services rendered, finished products, waste products, royalties, income from work, trade discounts offered.

JEL Classification: M12, M54, J53

1. Introduction

In the accounts related to revenues on sales of goods the entries are made in the moment of delivery of goods to customers, of deliveries based on invoice or in other conditions stipulated in the contract so that the transfer of ownership to the customer is confirmed.

The income from sales of goods is reflected in the books of accounts using synthetic accounts of first degree which constitute the group 70 "Net turnover" namely 701 "Sales of finished products", 702 "Sale of semi-finished products", 703 "Sales of residual products", 704 "Services rendered", 705 "Revenues from research studies", 706 "Rental and royalty income", 707 "Sale of goods purchased for resale", 708 "Revenues from sundry activities" and 709 "Trade discounts offered".

2. The income from sales of goods

Revenues, shown schematically in Figure 1, can be recognized only if certain express conditions are met, relating to:

- transfer to the buyer of the significant risks and rewards arising from the ownership of the goods;
- the sold goods are no longer managed or controlled by the selling entity;
- the income and expenses generated by the transaction should be measurable.

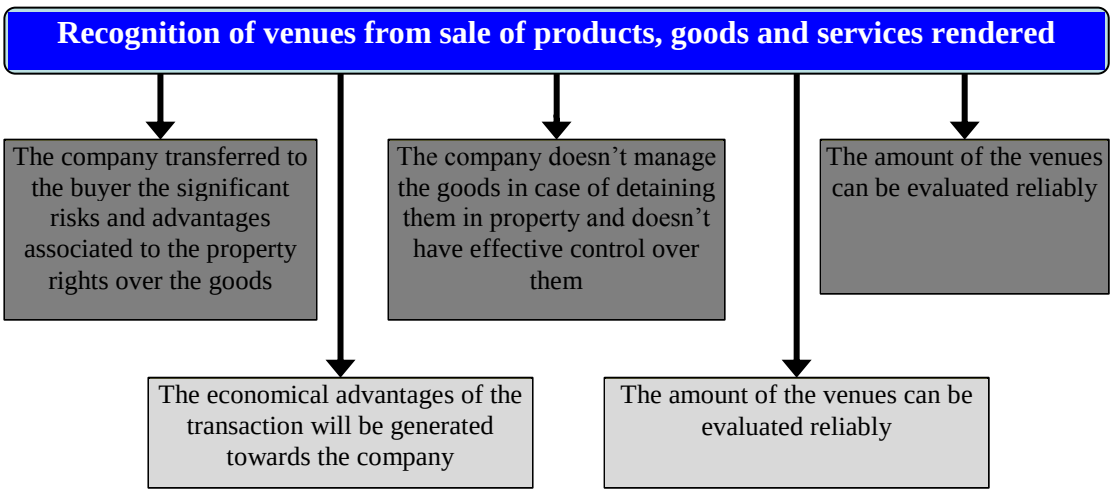
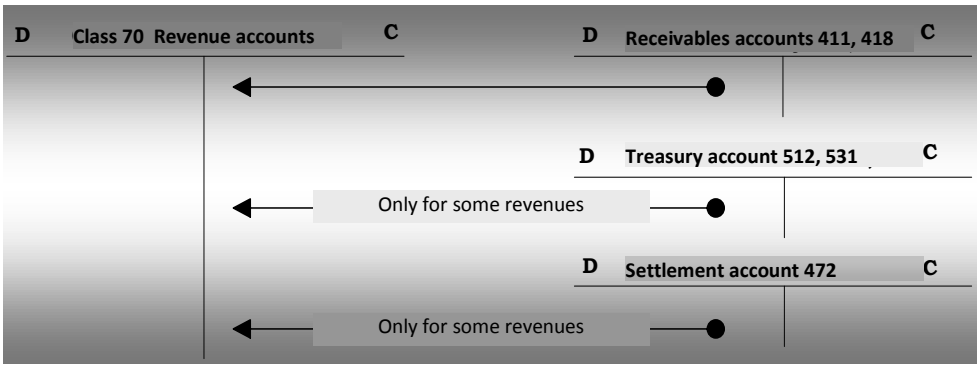


Figure 1. Recognizing revenue from sale of goods
Source: *IAS 18 "Revenue from current activities"*

Thus, some manufacturing enterprises record the transmission of the products in their stores, especially in those located in other cities, as sale of goods, which unjustifiably increases the total income and therefore distorts the indicators of financial reports. In their turn, revenues from services are recorded in the book of accounting as they are performed, otherwise they reflect as works and services in progress, on the account of income from production stored.

In case of royalty income, the recognition is based on accrual accounting, according to the contract.

Generally, the income in Group 70 "Net turnover" are reflected in the accountancy as illustrated below (except for the 709 account "Trade discounts granted"):

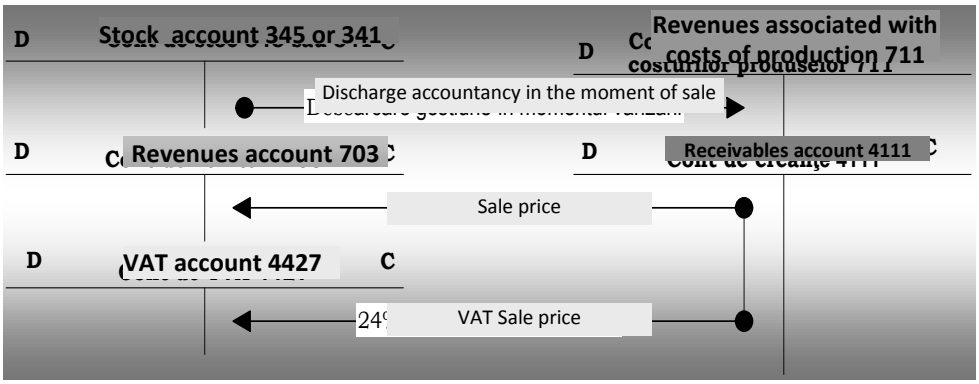


A. Sales of finished products

After obtaining the finished products, the manufacturer has three options depending on the market demand of the products and his need of liquidity for continuing the process of production:

- to store the products in view of selling;
- not to store the products, but to ship them directly to customers from which he has received firm orders;
- to transfer the products to own shops to be sold under retail (e.g., manufacturers of clothing, footwear, knitwear, furniture, etc.).

a) In the first two instances, regardless of the manufacturer's option or of the contractual stipulations, the products are reflected as such in the accounts at the cost of production, then the asset is discharged and the revenue from sale is recognized based on the invoice at the selling price of the delivered production and which is subject to VAT, as illustrated below:



b) In case of transfer of the finished products to own stores, the finished products become goods. As stated in O.M.P.F. 3055/2009, both the finished products and the goods belong to the same category of current assets, they differ only in the account in which they are recorded: the finished products in account 345 and the goods in account 371.

However, the two accounts are not mutually exclusive; they "collaborate" through the correspondence between the debit and credit of each account.

The sale of finished products through own retail stores is regulated by GO 99/2000 in the spirit that own shops of the manufacturers are defined as "factory store" or "factory warehouse". In these

sale structures which sell only goods obtained from own production, producers are obliged to comply with all the requirements imposed to any retailer engaged in retail trade. The particularity of own stores selling products from own production is that they can practice selling discounted products (except food).

Manufacturers can practice discounted sales in the spirit of GO 99/2000 art. 16 letter. c) of Chapter 5 "Commercial practices" for that part of their production which meets the following conditions about which consumers were informed:

- it has not previously been offered for sale due to manufacturing defects,
- it is not subject of returns from the commercial network;
- it represents the unsold stock of the production from the previous season.

In order to demonstrate the compliance with these conditions, producers are obliged to justify the origin and the manufacturing date of the products sold at reduced price. Included into the "Commercial practices" approved by law, selling at discounted price sometimes involves a sale at a loss.

To illustrate the particularity of the sale of products through their own retail stores, we considered the case of a company that manufactures, among other things, customizable automatic umbrellas**.** Moreover, given the principle of expenditures connected to income and the fact that we have not exemplified all expenditures (only the most significant ones) we consider it appropriate to present a complete cycle of expenditures and income generated by the production and sale of umbrellas. In this regard, we started from the following situation:

The company produced in January of year N, 1000 pieces umbrellas at a production cost of 28 lei/piece and 75% of production is sold based on firm orders while 25% is sold through its own retail store. The production costs involved in the production present the following structure:

- costs of raw materials (60%): 16,800 lei
- costs of auxiliary materials (20%): 5,600 lei
- labour costs (12%): 3,360 lei
- overhead (8%): 2,240 lei

Of the output, a quantity of 750 pieces with a value of 21,000 lei is delivered directly to customers on the basis of firm orders (negotiated price 32 lei/pcs.) and the amount of 250 pieces with a value of 7,000 lei is transferred into their own shop.

Following to the performed transfer and the reception of received goods, the store forms the retail price which includes VAT under settlement, as follows:

- delivery price: 28.00 lei/pcs
- mark-up (15.21%): 4.26 lei
- VAT under settlement (24%): 7.74 lei
- Total sales price

  Retail 40.00 lei/pcs

- Since 50 umbrellas remain unsold, in April of year N, there is a reduction of 10% of the retail price, the new price being 36 lei/piece, structured as follows:
- delivery price: 28,00 lei/pcs
- mark-up (3.71%): 1.04 lei
- VAT under settlement (24%): 6.96 lei
- Total sales price

  Retail 36.00 lei/piece

The presented context will generate the following account records:

Table 1. Accounting for revenues related to direct sales and sales through own retail store

Explanations	Accounting records in company		Comments
	Production activity	Own retail store	
1. Consumption of raw and auxiliary materials, energy and labour in the production process	601 = 301 16.800 602 = 302 5.600 % = 401 2.777,6		For calculating the salary related contributions, the following rates were considered: 20.8% CAS,

Explanations	Accounting records in company		Comments
	Production activity	Own retail store	
	605 2.240 4426 537,6 641 = 421 2.656 645 = 431 704		5.2% HID, 0.5% unemployment
2. Obtaining of the final products	345 = 711 28.000		Failure of bookkeeping lead to registration of finished products at production cost
3. Sale of finished products to customers under contracts and discharge of accountancy at registration price	411 = % 29.760 701 24.000 4427 5.760 711 = 345 21.000		Income: 750 pcs x 32 lei/pcs Cost: 750 pcs x 28 lei/pcs
4. Transfer of finished products into accountancy of own store		371 = % 10.000 345 7.000 378 1.065 4428 1.935	The collection of VAT is found delayed until the actual sale of the goods, when the VAT under settlement related to the goods in stock becomes VAT payable related to the goods discharged from stocks
5. Accounting regulation of 711 account	711 = 121 7.000		250 pcs x 28 lei/pcs
Opinion: we consider proper the switching of the credit balance of account 711into the profit and loss account, the amount related to the products sold through the store, because their value is recorded twice in operating expenses: - first, at the completion of the production process, by accounting records related to production cost (accounting formulas 601 = 301, 602 = 302, 641 = 421 and so on..); - the second time, at the sale of goods through the store, by accounting formula 607 = 371. If such a record would not be made, in accounting terms the company would record a loss from the production process.			
6. Sale of finished products from store		5311 = % 8.000 707 6.452 4427 1.548	Sale of 200 pcs x 40 lei/pcs
Note: As it can be seen, incomes are no longer recorded into the account 701 "Revenue from sale of finished products," but into the account 707 "Revenue from sale of goods".			
7. Discharge of goods from accountancy		% = 371 8.000 607 5.600 378 852 4428 1.548	Cost: 200 pcs x 28 lei/pcs Mark-up:200pcs x4.26 lei/pcs VAT under settlement: 200 pcs x 7.74 lei/pcs
8. Price reductions related to products in own shop		371 = % - 200 378 - 161 4428 - 39	Mark-up: (4.26 – 1.04) x 50 pcs VAT under settlement: (7.74 – 6.96) x 50 pcs
9. Selling discounted goods		5311 = % 1.800 707 1.452 4427 348	Proceeds: 50 pcs x 36 lei/pcs Income: 50 pcs x29.04 lei/pcs VAT: 50 pcs x 6,96 lei/pcs
10. Discharge of discounted goods from accountancy		% = 371 1.800 607 1.400 378 52 4428 348	Cost: 50 pcs x 28 lei/pcs Mark-up: 50 pcs x1.04 lei/pcs VAT under settlement: 50 pcs x 6.96 lei/pcs

Analysing the records, we see that, in the event that a manufacturer also has its retail store selling its own products obtained two categories of expenditure and also two categories of income are recognized in the profit and loss, namely:

- the expenditures and revenues accounts which reflect the result of the production;
- the expenditures and revenues accounts which reflect the result of the production;

B. Income from sale of waste products.

If management accounting distinguishes between waste and by-products obtained, in financial accounting that distinction does not appear, the delimitation of waste products being evasive.

In our opinion**,** a waste product means waste, scrap and by products with waste value, which, according to their usefulness, may be unusable or usable.

a) Unusable waste products, either because of their toxicity or because of their social uselessness, have no value.

These products are the inherent result of the manufacturing process, and in practical language, they are called waste.

Having no value, they are not recorded and they don't affect the calculation of the cost of the finished products from which they were obtained. However, if they imply costs with transport, handling, temporary storage, destruction, these costs are recognized in the period in which they were made, they are recorded in expenditure accounts according to their nature and they are embedded in the cost of finished products obtained.

b) Usable waste products take the form of either recoverable or reusable waste (iron, bronze or zinc filings, parings, spray iron, etc.), or of reshuffle scrap. Their recovery can be done either by reuse in the enterprise, or by sale (through specialized units).

When waste products are reused in the company (such as the splashing iron), they are valued at the price of raw materials from which they were obtained. Their value reduces the cost of the finished products from which they were obtained and increases the cost of the finished products in which they are reused.

In the context set, according to the Chart of Accounts such products generate only the management movement specific to the obtaining and discharging of waste products from the accountancy, an aspect unspecified by the accounting regulations in force.

Given the cost calculation principles according to which the value of the recoverable and reusable materials correct the value of the raw materials consumed, in our opinion, we believe that the waste products usable in the enterprise should be treated as commodity and therefore be reflected as a cost recovery at the moment they are obtained and to affect the expenditures with raw materials consumed at the moment they are used.

When waste products are sold, they are valued at the selling price of the market and are recognized as revenue from selling waste products by the account 703.

*c) The by-products with value of waste***,** known as secondary products, are specific for the food industry, enterprises to exploit cereal products, agriculture, pharmaceutical companies etc... and raises the question of their assessment.

The evaluation of by-products is done differently depending on the conditions of recovery.

Thus, if the products are sold in the stage they result, the value is given by the negotiated or the market price that can be realized. Where to sell the by-products additional operations are needed in order to improve their quality, the assessment is made at an inclusive price based on the selling price.

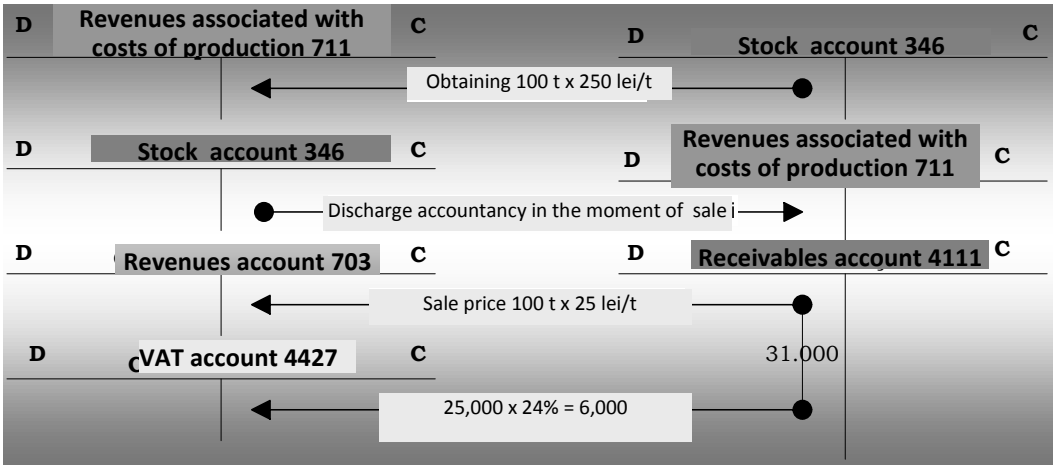
The inclusive price of by-products is formed as follows: the by-product market price is reduced by an estimated percentage of benefit and distribution expenses, the result is added to the cost of any additional treatments (technological improvements) for capitalization, consisting of certain material consumption, labor and overheads.

Given the peculiarity of the second situation, we moot the case of a company which acquires conditions and capitalizes cereal products**.** In case of conditioning the wheat, this operation leads to fresh wheat and a mixture of chaff, dirt and grains; if they are in a proportion of 50-70% of the total mixture, they are subject to a reconditioning operation with a resulting by-product, the wheat break, and a light mix. The market selling price for the wheat break is 250 Euro/tonne and the estimated cost is 200 Euro/tonne. The inclusive price, the price at which the residual by-product is recorded into accountancy, shall be determined according to Table 2.

Table 2. Calculation of the inclusive price

Explanations	Calculation	Value (lei)
Selling price wheat break	100 tonnes x 250 lei/tonne	25.000
Subtract 20% benefit and distribution expenses	2500 x 25%	- 6.250
Add additional treatment costs (consumption of utilities, labour, overheads)	- utilities 3,500 - workmanship 1,320 - overhead expenses 300	+ 5.120
Total cost by-product wheat break		23.870
Cost/tonne	23.870 : 100	238,70

Following the study at such company, we notice a simplification of the accounting manner for waste products in the sense that both their obtaining and selling reflect in the selling price, as illustrated below:



In the case of the two companies, the use of sales price as a waste products registration price is an adverse consequence of the lack of organization of management accounting which leads to a distortion of economic indicators of economic performance analysis. We express this point of view because restoring of agricultural products is a production process even if the basic profile of the company is of trading goods.

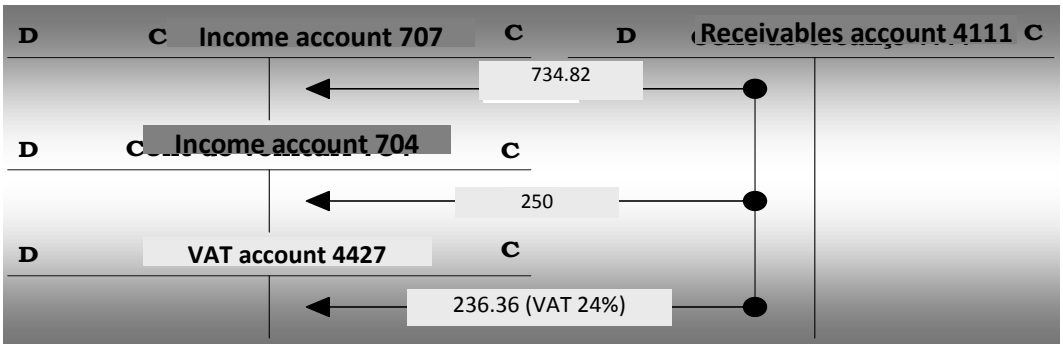
C. Revenues from combined transactions.

Combined sales are specific to those SMEs that supply goods that require assembly (AC systems, power plants, etc.)

In case of combined transactions, which include the sale of goods and services, revenue shall be recognized after the installation and control of goods received by the buyer. Revenue from these transactions consists of two main elements:

- proceeds from the sale of goods that must be evaluated at the fair value of the means of payment received or receivable,
- Revenues from services which can be determined based on the actual volume of services rendered; the percentage correlation of the actual volume of services rendered at a predetermined time to their total provided by contract or the percentage correlation of the expenditures incurred at a predetermined time to the total amount provided by contract.

Thus, we shall refer to a delivery invoice of an air conditioner (and implicitly of some materials necessary for the installation) whose value at delivery price is 734.82 lei, 250 lei installation labour, VAT 24%, invoice leading to Recognition as illustrated below:



*D. Income from sales with scheduled delivery***.**

Commercial transactions for goods with scheduled delivery appear in situations where special requirements for transport and storage, such as: sale of fuels and lubricants, chemicals, wine products in big games, cereal, etc.

Such commercial transactions, with contractual clause "ex-work", are covered by the Accounting Regulations[22], section 156, paragraph 2, letter c) and section 258, but depending on the nature of the goods delivered two situations may occur:

- if the transfer of the property risk is done at the date of issue of the first invoice under the contract in accordance with paragraph 156 of the Accounting Regulations "goods sold and not delivered yet, held ownership transfer", then the entire invoice will be the buyer's accounting coverage as current stock supply, and in the vendor's accounts to reflect income from sales. It is obvious that at the completion of deliveries differences may occur from the original invoice, situation in which a reversal or a supplementary invoice will be issued for the differences;
- In some situations, in practice, the transfer of risk is made when the delivered property is loaded into the recipient's truck. Thus, the transfer of risk and property is made when the means of transport exits the gate of the company. In this case, the issue of the original invoice has for the customer a character of advance invoice. Each loading of trucks accompanied by the shipping note leads to registration of the goods into the beneficiary's assets at the contractual price and the seller recognizes the revenues.

Although the accounting regulations in force do not have express stipulations concerning the managing regime of goods delivered in several instalments, in our opinion, it seems appropriate to use the off-balance sheet account 8039 "Other off-balance sheet values." In this way, goods sold (for which the ownership was transferred) and undelivered can register separately in terms of management and in accountancy they remain highlighted only in off balance.

*E. Income from delivery of goods on consignment***.**

Selling goods on consignment is under arrangements made between the parties under consignment contracts.

The Consignment Contract is a contract under which the consignor (consignment unit) undertakes to deliver goods to the consignee (depositor, individual or business) for the latter to find a buyer for these assets.

Specific for the operations of sale of goods on consignment is the delivery date. Thus, in case of goods delivered under a consignment contract it shall be deemed that the delivery of goods from consignor to consignee takes place at the date when the goods are delivered by the consignee to its customers. The consignee acts in his own name but on behalf of the consignor, when delivering goods to customers.

Regarding the Recognition of the operations of this kind of transactions, the consignment units proceed as follows:

- when receiving goods from depositors, they don't register in accountancy that entry into administration, as it is recorded with the extra-account 8033 "Assets held in custody";

- upon receipt, it must draw the "Delivery receipt on consignment". This document is drawn up in two copies, one of which shall be handed to the depositor, and the other remains at unit. If the depositor is VAT payer, goods deposited on consignment are accompanied by the shipment slip of the goods (cargo), which will contain the words "for sale on consignment"
- the charging in accountancy of the goods received from depositors is carried out when the property was sold;
- in accountancy, on sale, the effects are reflected in the profit and loss on income and expenses, the depositor is paid and the consignment fee charged is retained.

For illustration, we brought up the case of a consignment unit which does the following:

- receives from depositors individuals (according to the Delivery receipt on consignment), the following items:
  - a collection of icons on wood and glass worth 5,000 lei charged with a commission of 16%;
  - traditional crafts equipment worth 3,000 lei charged with a commission of 12%
- receives from a trader, VAT payer (according to the Delivery note), a piece of old furniture worth 2,000 lei, VAT 24%, commission charged 15%.

The accounting method for the two situations is shown in Table 3.

Table 3. Regime of income from selling goods on consignment

Explanations	**Consignment Store**	
	by purchase from individuals or legal entities non-included in the scope of VAT	by purchase from individuals or legal entities included in the scope of VAT
Retail price calculation at the consignment store	**a)** Value of goods (5,000) + Commission 16% (800) = Value of goods (5,800) + VAT related to commission (192) = Retail price (5.992**)** **b)** Value of goods (3,000) + Commission 16% (260) = Value of goods (3,260) + VAT commission 62.4 = Retail price (3.322.4)	**a)** bills depositor VAT payer 2,480 **b)** Retail price establishing: Value of goods 2,000 + Commission 15% 300 = Value of goods 2,300 + VAT 24% = Value of goods 552 = Retail price 2.882
Reception of goods at reception and establishing of retail price	D 8033 8.000	D 8033 2.480
Sale of goods at retail price according to the cash receipt issued	5311 = % 9.314,4 707 9.060 4427 254,4	5311 = % 2.882 707 2.300 4427 552
Registration of goods on the invoice issued	371 = % 9.314,4 462 8.000 378 1.060 4428 254,4	% = 401 2.480 371 2.000 4426 480 371 = % 882 378 300 4428 552
Discharge of goods from accountancy	% = 371 9.314,4 607 8.000 378 1.060 4428 254,4 C 8033 8.000	% = 371 2.882 607 2.000 378 300 4428 552 C 8033 2.000
Payment to depositors	462 = 5311 8.000	401 = 5311 2.000

F. Accounting treatment of performance guarantees.

The performance guarantee given by the contractor or other person involved in making an investment, according to which the contractor undertakes to complete the investment in due term in compliance with technical, quality and functional parameters according to the cooperation agreement[23], according to the Accounting regulations in force, falls into the category of financial assets and represents amounts retained by the beneficiary of the value of work performed by the supplier.

Any perceived warranties in order to ensure proper performance of a contract or of other nature do not represent operations in the scope of VAT, not being deliveries of goods or services in the spirit of art. 126 paragraph (1) of Fiscal Code. Therefore, people who perceive guarantees are not required to charge these amounts, according to art. 155 (1) of the Fiscal Code.

Providers are required to mention in invoices the value of construction and assembly, as shown in work situations and to collect VAT for this value, without this amount to be influenced by the performance bond.

In our opinion, we believe that in the relations between legal persons the warranty granted can proceed as follows:

- issuing of invoice with two lines: first line in black concerning the works performed according to the works situation, the second line in red, to reduce the performance bond by rate of X%; simultaneously, the production corresponding to the percentage of X% will be stored as it is not invoiced;
- at the end of the warranty period the percentage of X% will be billed too and simultaneously with the discharge of the production corresponding to the warranty coverage.

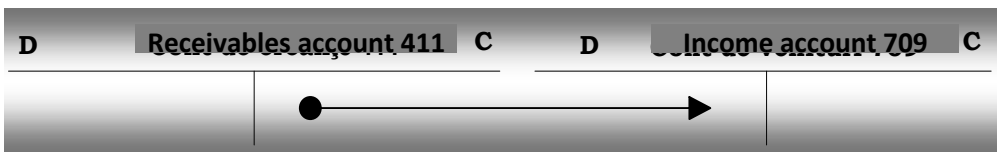
In this way, a proper matching of revenues and expenses is done, as shown in Table 4.

Table 4. Accounting performance guarantees

Explanations	Records according to the accounting regulations		Records according to personal opinion	
Value of construction and assembly according to provisional statement of work, performance guarantee 5%	4111 = % 704 4427 2678 = 4111 5121 = 4111	248.000 200.000 48.000 10.000 238.000	4111 = % 704 4427 345 = 711 5121 = 4111	238.000 190.000 48.000 10.000 238.000
Comments: According to our opinion, the bill includes two lines, the first line shows the invoice value according to provisional statement of works for which VAT is calculated according to the Fiscal Code in force; on the second line the performance guarantee in proportion of 5% is written in red, but for which no VAT is calculated.				
Final acceptance of the work shall regulate the amount of the performance bond	5121 = 2678	10.000	4111 = 704 5121 = 4111	10.000 10.000
Note: The manufacturer, based on its experience may constitute provisions for granting warranties and which will be resumed at the final acceptance of the work by the record: 1512 = 7812 10.000				

*G. Commercial discounts granted***.**

Reverse of trade discounts received as described in before, trade discounts granted are reflected by account 709 "Trade discounts granted" that functions as illustrated below:



Commercial discounts granted by suppliers can have various forms in practice, such as:

- direct reductions granted under promotions;
- payment of goods or services received through periodic discounts granted;
- discounts granted on the basis of coupons collected from various publications;
- reductions granted under a buy-back system.

From the perspective of the supplier, the following situations may arise during the registration of granted discounts to its customers:

- discounts are given on the invoice;
- reductions are granted after invoicing.

For illustration, we bring up all categories of discounts that may be granted, as follows:

– sale of finished products at retail price of 10,000 lei;
– 24% VAT on goods sold;
– 2% discount,
– draw 5% for large volume of products purchased by the customer;
– 5% rebates;
– 2% discount for payment before maturity by 15 days;
– cost of products sold 8,000 lei.

The accounting method for the two situations is shown in Table 5.

Table 5. Comparative aspects of accounting for trade discounts granted

Explanations	Provider's accounting records		Comments
	Reduction is granted in the initial invoice	Reduction is granted after invoicing	
Calculation of trade discounts	Discount: 10,000 x 2% = 200 lei Draw: (10,000 - 200) x 5% = 490 lei Discount: (10,000 - 200 - 490) x 2% = 186.2 lei Rebates: (10,000 – 200 – 490 – 186.2) x 5% = 456,19)0 – 456,19) = 8.853,81		Trade discounts calculation is the same regardless of when it is granted, as it is to notice, it is determines in cascade. Discounting is a financial reduction and does not affect the value of the invoice
Delivery of finished products	4111 = % 10.536,03 701 8.853,81 4427 1.682,22	4111 = % 12.400 701 10.000 4427 2.400	If cuts are included in invoice, the discounts granted are reflected in reduced sales revenue
Discharge of accountancy	711 = 345 8.000	711 = 345 8.000	
Ulterior grant of reductions	-	709 = 4111 1.146,19	Account 709 plays an amending role with the recorded venues. Within the account 121 it is deducted from venues that compose the turnover, hence the phrase "Net turnover '
Collection of invoice less the discount given	% = 4111 10.536,03 5121 10.349,83 667 186,20	% = 4111 10.536,03 5121 10.349,83 667 186,20	

Even if the amounts recorded in account 709 "Trade discounts granted" correct revenue recorded in account 121 "Profit and loss" as its role is to correct the turnover, in our opinion, the amounts granted as trade discounts should be reflected as an expense. In other words, the two accounts 609 should be reversed with the account 709, as we have previously expressed our opinion, with the necessary arguments.

Conclusion

The analysis of the abovementioned criteria allows us to consider that the proceeds from the sale of goods cannot be recognized in case of the internal operations within companies, such as: the transmission of products and goods for sale in own shops, the use of goods for the internal needs of the company etc. However this rule is not always respected in practice.

Analysing the operation of the two accounts, according to the specifications made by the Chart of accounts, we notice that the category of goods include also the finished products obtained from own production subsequently transferred to own stores to be sold directly to consumers, both businesses and individuals.

In principle, the accounting of revenue from combined transactions is not a complicated operation; important is the separation of incomes by their nature.

References

[1] Iacob, C., Ionescu, I., Goagără, D. 2007. *Contabilitate de gestiune conformă cu practica internaţională.* Editura Universitaria, Craiova, p. 84, in *Romanian.*

*** GO nr. 99/August 29, 2000 on the marketing of products and market services, republished in the Official Gazette nr. 603/31 august 2007, approved by Law 650/December 7, 2002 published in the Official Gazette nr. 914/December 16, 2002, amended by Law 211/2008.

*** EXW – Ex Works is the most convenient delivery condition for the seller as it provides minimum requirements for it; the buyer has to bear all risks and costs involved in taking over the goods at the agreed place.

*** OMPF 1826 for approving the Specifications regarding some measures for the organization and of management of accounting management, Official Gazette 23/2004

*** OMPF 3055/2009 for the approval of the Accounting regulations in compliance to the European Directives, Official Gazette, Part I, nr.766 of November 10, 2009

*** http://www.contabilizat.ro/dictionar_economic_si_financiar~termengarantie_de_terminare.html

A SIMPLIFIED MODEL OF AN INTERACTION DYNAMICS IN WORK GROUPS

Petr SNAPKA
VSB-Technical University of Ostrava, **Czech Republic**
petr.snapka@vsb.cz
Josef KASIK
VSB-Technical University of Ostrava, **Czech Republic**
josef.kasik@vsb.cz

Abstract:
The aim of the paper is to draw up a simplified model of an interaction dynamics in work groups. A work group in this model is considered to be a system whose behaviour can be expressed through four variables which are functions of time; to be specific, by means of: the interaction intensity among the work group members, level of friendly relations among the work group members, level of activity and initiative of the work group members and the level of external pressure of the workgroup's surroundings exerted on the group members. Further, the proposed system of interaction in work groups is investigated from the view of the general theory of system regulation. A regulated system is considered to be a group of workers and the regulated quantity is the level of friendly relations among the group members and/or the level of activity and initiative among the group members. A regulating system consists of a system of conditions present in the group in a certain period of time which affect achieving the equilibrium state of the system. Some dependences resulting from the proposed model are also interpreted.

Keywords: model, interaction, work group, information exchange, negative feedback system, work relations

JEL Classification: M12, M54, J53

1. Introduction

Theorists have been puzzling over human group and its dynamics for centuries (Homans 1951; Jardillier 1980; Shaw 1980; Wheelan, and Todd 2003; Hogg, and Vaughan 2008; Engleberg, and Wynn 2009). In spite of their endeavour they are not of one mind even when it comes to defining the word group (Forsyth 2009). There have been many researches that explore patterns of work group interaction since 1960 (Likert 1961; Tuckman 1965; Townsend *et al.* 1968; Gersick 1988; Perlow *et al.* 2004). The purpose of our paper is to describe a simplified model of an interaction dynamics in work groups that will help us to understand more clearly what we are observing in organizations.

2. A Simplified model for interaction in work groups

Mutual reactions among group members (interactions) occur during information exchange among the individual group members. The level of interaction intensity can be measured by means of information exchange duration among individual group members within a certain period of time.

The information exchange among individual group members is conditioned by:

a. work relations among group members in a workplace, while considering that the exchange of some important common information among workers in relation to their tasks in production process occurs,
b. friendly relations among individuals in the group who communicate information about various situations of their daily lives and help to sort out problems which have arisen in the workplace or outside it,
c. relations among workers during the activities and initiative of the group members, which the workers show during the solution and fulfilling of the group's tasks in order to achieve positive working behaviour of the group members; that is, in order to fulfil the goals of the production-economic system and in order to satisfy the expected needs of the work group members.

If the group members have been activated to change their working activities by external pressure, then the pressure acts as another factor which changes the level of interaction, therewith, changes in the group members' activities occur. (For instance, the term "external pressure" means information communicated by group leaders to the other group members in order to achieve

uniformity of their opinions on a certain problem in the group). For the purpose of further investigation, it will be assumed that the interaction level among the group members during exchange of necessary common information among the group members is unchangeable due to their tasks in the working process.

In view of this aspect, the work group will be taken as a system whose behaviour can be expressed through the dependence of the following four variables, which are time functions:

I(t) - interaction intensity among group members,
P(t) - level of friendly relations among group members,
A(t) - level of activity and initiative of group members,
E(t) - external pressure intensity exerted by the group members' surroundings on group members.

Level of the system variables can be quantified by the duration time of the information exchange among the group members within a certain time (e.g. within a work shift) within the variables of I(t); P(t); A(t); E(t).

The size of each variable will be considered as an average of the duration time of the information exchange among individual group members for the specific variable within a certain time.

For instance, the size of interaction intensity among group members, considered as an average value, is expressed as a ratio of the duration time of all information exchanges within a certain time to the number of group members.

The intensity of external pressure exerted by the working group's surrounding on the group members can be expressed as a ratio of the time duration of the information exchange induced by this pressure among the individual members of the group within a certain time to the total number of group members.

Similarly, the level of friendly relations among the group members can be also defined as a ratio of the time duration of the information exchange within the frame of the friendly relations among the group members within a certain period of time to the number of group members, etc.

Based on the results of the research into the behaviour of small work groups, causal relations among system variables can be expressed as follows (Cartwright, and Zander 1953; Engleberg, and Wynn 2009):

1. Interaction intensity increases simultaneously with the degree of friendly relations and the level of activity and initiative present in the group. In doing so, the activity level also rises with the increasing external pressure of the group's surroundings exerted on the group members.
2. The level of friendly relations will increase in time against the existing level of the relations in the specified time t if the interaction intensity among the group members has risen within the time t to a certain level. It means that in the group where there is a low level of friendly relations together with an increase in the time duration of the information exchanges among the group members resulting from relations other than the friendly ones, there is a tendency of increase in friendly relations among the group members in the time with respect to its existing level. On the contrary, if the interaction intensity in the group with a high level of friendly relations drops, these friendly relations are weakened.
3. The level of activity and initiative of the group members will increase in time in relation to its present level in the specified time t, if the level of friendly relations among group members has risen and if the level of the external pressure affecting the group has increased.

These three dependencies among the system variables can be expressed using the following equations:

$$I(t) = P(t) + A(t) \tag{2.1}$$

$$\frac{dP(t)}{dt} = a \cdot \left[I(t) - \alpha \cdot P(t) \right] \tag{2.2}$$

$$\frac{dA(t)}{dt} = b \cdot \left[P(t) - \beta \cdot A(t) \right] + c \cdot \left[E(t) - A(t) \right] \tag{2.3}$$

It is assumed that all the constants in these equations are positive and that the values of the dependent variables quickly reflect the changes of the independent variables.

Equation 2.1 characterizes the causal relation ad 1, equation 2.2 characterizes the relation ad 2, and equation 2.3 characterizes the relation ad 3. Equation 2.2 shows that the increase in the level of friendly relations among the group members in the time is higher, the higher the interaction intensity among group members in the time t is, and the lower the level of friendly relations among group members in the time t is, which is in line with the fact expressed by the causal relation ad 2.

The coefficient α is then a coefficient of the proportion of the interaction level to the level of friendly relations among the group members (hereafter referred to as a proportion coefficient).

The product α . P(t) equals the interaction rate reflecting the level of friendly relations among the group members in the time t.

It follows from equation 2.3 that the increase in the level of activity and initiative of the group members within the time is higher, the higher the level of friendly relations among group members is, and the lower the level of activity and initiative of group members in the time t is, and further, the higher the difference between the level of external pressure exerted by the group's surroundings and the level of activity and initiative among group members in the time t is, which is in line the causal relation ad 3.

The coefficient β gives the rate of the level of friendly relations among group members arising per unit of the level of activity and initiative exerted within the group without exertion of external pressure.

The reciprocal value of this coefficient, i.e. *1/β,* then measures the size of the level of activity and initiative exerted per unit of the level of friendly relations among the group members without the presence of external pressure. In a way, the coefficient *1/β* thus represents "spontaneity" of the exertion of activity and initiative by the group members acting as a result of friendly relations among the group members; therefore, it will be called a "spontaneity coefficient". The product β. A(t) equals the level of friendly relations among the group members reflecting the size A(t), i.e. the level of friendly relations among the group members in the time t without the presence of external pressure.

The coefficients a, b and c represent possible velocity, at which the system achieves the equilibrium state if it has deviated from the equilibrium state at the certain time t.

In conclusion, it can be noted as to the mathematical interaction model among the group members that the expressions of the found facts related to the interaction through linear relations, is simplified. Despite these facts, it is necessary to note that the model under consideration includes several important relations among the four mentioned variables, as it was found on the basis of research into the work groups' activities (Hogg, and Vaughan 2008).

3. A System of interaction in work groups as a negative feedback system (regulation circuit)

In the following part of the paper, the system of interaction in work groups as a regulation circuit will be examined. This depiction of the system makes it possible to determine the regulated and regulating system of the circuit, its transfer properties and the transfer properties of the whole circuit.

Based on this knowledge (transfer means an input/output ratio of individual circuit systems or of the whole system), dynamic properties of circuit systems or of the whole system can be investigated, i.e. how the transformation of input information into output information of the circuit will be performed. The information is represented by the variables of the circuit.

The knowledge of these properties makes it possible to investigate the conditions for the equilibrium state and the stability of the circuit and to predict circuit behaviour, while the circuit is in the equilibrium state or in a state close to the equilibrium state, and the conditions, under which the circuit remains in the equilibrium state or close to the state of equilibrium in time.

The regulated system means a group of workers, in which, for the purpose of the investigation, the regulated quantity will be the level of friendly relations among the group members or the level of activity and initiative among the group members.

The regulating system consists of a system of conditions present at a certain time in the group and the conditions affect the achievement of the equilibrium state of the group's behaviour and its stability. The conditions thus determine the achieving of the specific level of coefficients considered within the framework of the model as elements of the regulating system. Above all, these are the coefficients α and β.

Such a condition can be, for instance, the level of confidence among the group members and confidence in the leaders of the group, motivation of the group members to persist in the main values of the group and to achieve the aims of the group, the atmosphere, in which the interaction takes place, and the activity of the group related to handling the problems and making decisions in the group, the time of existence of the group, so that the mutual relations among group members can be established, the level of the group members' willingness to help every individual in the group to make the best of their abilities and to develop them, etc.

The research into the transfer properties of the circuit and its creation will be carried out by means of the Laplace-Wagner (LW) transformation.

For this purpose, the transformation of equations of the model from the original area to the transform area through the LW transformation will be carried out. This transformation will be performed with equations (2.1) and (2.2) and we will find the transfer properties of the circuit, whose input (regulating quantity) will be variable A(t) – the level of activity and initiative of the group members, and the output (regulated quantity) P(t) – the level of friendly relations among the group members.

After transforming equations (1) and (2) by means of LW, the following will be obtained:

$$I(p) = P(p) + A(p) \quad (3.1)$$

$$p \cdot P(p) = a \cdot I(p) - a \cdot \alpha \cdot P(p) \quad (3.2)$$

where p is an operator for LW transformation.

The transfer of the regulation circuit F(p) as a ratio of the output to the input of the circuit representing regulation links in the interaction system in view of the changes in P(t) and the change in A(t) will be:

$$F(p) = \frac{P(p)}{A(p)} \quad (3.3)$$

Using equations (4) and (5), the operator transfer F(p) will have the following form:

$$p \cdot P(p) = a. P(p) + a. A(p) - a \cdot \alpha \cdot P(p) \quad (3.4)$$

$$P(p) \cdot (p - a + \alpha \cdot a) = a \cdot A(p) \quad (3.5)$$

$$F(p) = \frac{P(p)}{A(p)} = \frac{a}{p - a + \alpha \cdot a} \quad (3.6)$$

The flow diagram in fig. 1 represents the calculated transfer.

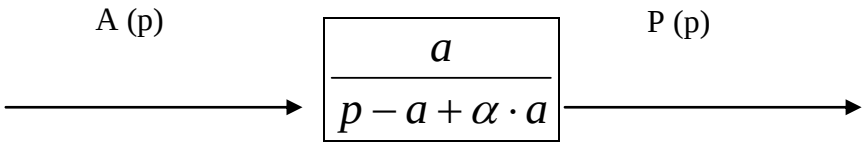


Figure 1. *Flow diagram for regulation circuit transfer F(p) as a ratio of output to input of the circuit.*

If this transfer is compared to the transfer of a general regulation circuit, which is in the following form:

$$\frac{y}{x} = \frac{S}{1 + R \cdot S}, \quad (3.7)$$

where

y = regulation circuit output,

x = regulation circuit input,

S = regulated system transfer,
R = transfer of the regulating system,
the following is obtained

$$\frac{P(p)}{A(p)} = \frac{\frac{a}{p}}{1+(\alpha-1)\cdot\frac{a}{p}} \qquad (3.8)$$

$$S = \frac{a}{p}$$

The transfer of regulated system and the transfer of regulating system R = α – 1. The product sign of the transfer of the regulating and regulated systems shows that it is negative feedback of the regulation circuit.

The flow chart of the regulation circuit, if the transfer of the regulating and regulated systems is known, is in fig 2.

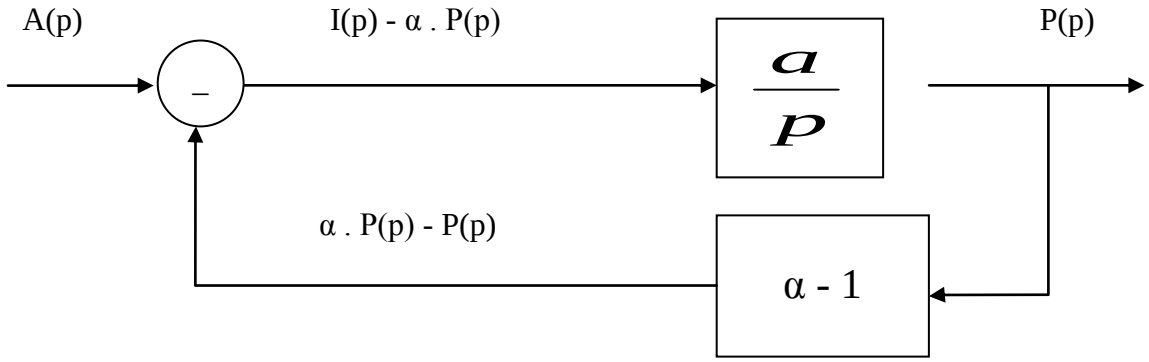


Figure 2. Flow chart of the regulating circuit, provided that the transfer of the regulating and regulated systems is known

The dynamic properties of this regulation circuit, which express how the output of the circuit will respond to the input change, are described by means of the above-mentioned circuit transfer. By virtue of the knowledge of both the regulating and regulated systems transfer, the dynamic properties of each system of the circuit are known.

The transfer of the regulating system or its "amplification" (α-1) actually determines the level of activity and initiative present in the group on a unit of the level of friendly relations among the group members.

The value of the regulating system output α . P(p) - P(t) equals the level of activity and initiative inside the group, which is in line with the value P(t). If the size of this value at the specific time t equals the initial value of activity and initiative among members of the group, whose existence induced the regulation process, at the time t_0, and the increase in the level of friendly relations among group members according to relation (2.2) occurs, then A(p) – α . P(p) + P(p) = 0. The regulation process stops, because the initial positive effect of the group members' activity and initiative ceases to influence the increase in friendly relations among group members. In other words, there was increase in the level of friendly relations to such a value that I(p) = α . P(p) and the circuit reached the equilibrium state.

In order to investigate the conditions of the equilibrium state and stability of the regulation circuit, the well-known rules for investigation into these states from the general theory of system regulation will be used.

At first, the transfer of the regulation circuit in the equilibrium state will be found by virtue of the theorem on limit, since the theoretical equilibrium state of the circuit for the specific regulated quantity turns up no sooner than at the time $t \to \infty$. At this time the value of the regulated quantity stabilizes at a certain level. The limit of function for $t \to t \to \infty$ is in this instance a certain real number.

The regulated quantity is P(t), which is the level of friendly relations among group members at the time t.

Transfer of the equilibrium circuit

Based on the general regulation theory, the following applies:

$$\lim_{t\to\infty} P(p) = \lim_{p\to 0} P(p) \tag{3.9}$$

Using relation (3.8), the following will be obtained:

$$\lim_{p\to 0} P(p) = \lim_{p\to 0} \frac{\frac{a}{p}}{1+(\alpha-1).\frac{a}{p}}.A(p) \tag{3.10}$$

For p→0 the variable P(p) will always be the certain value P_0, corresponding to the value of the equilibrium state of the circuit for the level of friendly relations among the group members, and the variable A(p) will be the value A_0 corresponding to the value of the equilibrium state of the circuit for the level of activity and initiative among the group members.

The limit of circuit transfer

$$F(p) = \frac{\frac{a}{p}}{1+(\alpha-1).\frac{a}{p}}$$

for p→0, assuming continuous functions, will be calculated by virtue of the substitution p=0 in the transfer.

Then

$$\lim_{p\to 0} \frac{\frac{a}{p}}{1+(\alpha-1).\frac{a}{p}} = \frac{1}{\alpha-1} \tag{3.11}$$

and the transfer of the circuit will be

$$F_r = \frac{P_0}{A_0} = \frac{1}{\alpha-1} \tag{3.12}$$

The transfer F_r means that, if there is the equilibrium state, the level of friendly relations among the group members A_0 equalling the following value will develop:

$$P_0 = \frac{1}{\alpha-1}.A_0 \tag{3.13}$$

Circuit Stability

In order to investigate the circuit stability, the rules applicable in the general regulation theory for investigation into the system stability will be used again. The regulation circuit will be stable, if the roots of the characteristic transfer equation of the circuit have negative real parts. The characteristic circuit equation will be created by putting the circuit transfer denominator equal to zero.

In this instance, the circuit transfer is in the following form:

$$\frac{P(p)}{A(p)} = \frac{\frac{a}{p}}{1+(\alpha-1).\frac{a}{p}} \tag{3.14}$$

and the characteristic equation:

$$1+(\alpha-1).\frac{a}{p} = 0 \tag{3.15}$$

In solving equation (3.15), its root p will be obtained, whereas

$$p = a.(1 - \alpha) \tag{3.16}$$

From the stability condition it must be valid that p < 0, therefore
$a.(1 - \alpha)$ must be lower than 0.

The condition will only be fulfilled if α > 1 and a > 0, which is expected for the constant. If α > 1, the circuit will be stable and interference of the equilibrium state eliminates itself.

Should $\alpha = \frac{P(t) + A(t)}{P(t)}$ while α is a constant value, then α is higher than 1, which is required by the circuit stability condition only when there is a certain level of information exchange among the members of the group, resulting from a certain level of activity and initiative of the members of the group which induces the increase in the level of friendly relations among the group members within the time.

In this instance, the interfered equilibrium of the circuit eliminates itself. The occurrence of disequilibrium is caused by the fact that the level of friendly relations among the group members at the time t is not adequate to the intensity of interaction among the group members at this time. The interaction has increased owing to a rise in the level of activity and initiative of the group members. The level of friendly relations among the group members (provided that I(t) has risen in the specific time), rises in time up to the size P_0, which equals to the equilibrium state of the circuit. It means that

$$\frac{dP(t)}{dt} = \mathbf{0}$$

If the value was, for instance, one, i.e. if no information exchanges existed due to the activity and initiative of the group members, then the intensity of the interaction in time would be determined only by the level of friendly relations among the group members. Should this be the case, each state of the circuit would be the equilibrium state and the following condition would be fulfilled:

$$\frac{dP(t)}{dt} = \mathbf{0}$$

In view of the regulation circuit in this instance, the transfer of the regulating system R=0 (the regulating system does not perform any regulating interventions) and α. P(p)- P(p) = 0. At the time t, no activity or initiative among the group members arising from the regulation process have emerged and the interaction intensity is determined only by virtue of the level of friendly relations among the group members.

The existence of information exchange among the group members induced by their activity and initiative has, therefore, a positive influence on the creation of friendly relations among the group members. An increased frequency of information exchange among the group members as a result of an increase in the activity and initiative of the group members in order to fulfil the group's goals and thus the goals of the individuals in the group is a condition for the increase in friendly relations among the group members.

Further, the transfer of the equilibrium state for the regulation circuit, whose output (the regulated value) will be A(t) – the level of activity and initiative of the group members, and input (the regulating value)will be E(t) – the external pressure exerted by the group's surroundings on the group, as well as the transfer of the equilibrium for the regulation circuit, whose output will be P(t) – the level of friendly relations among the group members and input will be E(t) – the external pressure exerted by the group's surroundings on the group, will be found.

In order to find the transfer of the equilibrium state of the regulation circuit with a regulated quantity A(t) and the regulation quantity E(t), equation (3) and the condition that

$\frac{dA(t)}{dt}$ must be 0 if the system is in the equilibrium state, will be used.

In the case of the equilibrium state of the circuit, the variables A(t), E(t) and P(t) obtain the specific values A_0, E_0 and P_0, corresponding to the equilibrium state of the circuit. Equation (3) is in the form:

$$\frac{dA(t)}{dt} = b.[P(t) - \beta.A(t)] + c.[E(t) - A(t)]$$

This equation, if there is circuit equilibrium, provided that the following applies $\frac{dA(t)}{dt} = 0$ and $A(t) = A_0$, $P(t) = P_0$ a $E(t) = E_0$ will be in the following form:

$$0 = b \,.\, (P_0 - \beta \,.\, A_0) + c \,.\, (E_0 - A_0) \tag{3.17}$$

The transfer of the circuit in the equilibrium state will be determined from equation (3.17) after substituting the value for P_0 as a ratio of a circuit output to a circuit input and then

$$A_0.\left[c - b.\left(\frac{1}{\alpha - 1}\right) - \beta\right] = c.E_0 \tag{3.18}$$

and the transfer circuit in the equilibrium state is in the following form:

$$F_{1r} = \frac{A_0}{E_0} = \frac{c.(\alpha - 1)}{(c + b.\beta).(\alpha - 1) - b} \tag{3.19}$$

The transfer F_{1r} means that if there is the equilibrium state of the circuit, the level of external pressure exerted by the group's surroundings on the group E_0 induces the activity and initiative of the group members corresponding to the value

$$A_0 = \frac{c.(\alpha - 1)}{(c + b.\beta).(\alpha - 1) - b}.E_0 \tag{3.20}$$

In order to find out the transfer of the equilibrium state of the regulation circuit with the regulated quantity P(t) and regulating quantity E(t), relation (3.19) will be used, while relation (3.12) will be substituted for A_0.

Then the transfer $\frac{P_0}{E_0}$ will be as follows:

$$F_{2r} = \frac{P_0}{E_0} = \frac{c}{(c + b.\beta).(\alpha - 1) - b} \tag{3.21}$$

The transfer F_{2r} then means that if there is the equilibrium state of the circuit defined in the previous paragraph, the level of the external pressure exerted by the group's surroundings E_0 will induce the level of friendly relations among the group members equalling to the following value:

$$P_0 = \frac{c}{(c + b.\beta).(\alpha - 1) - b}.E_0 \tag{3.22}$$

The condition of the equilibrium stability of the regulation circuit with the transfer $F_{1r} = \frac{A_0}{E_0}$ will be determined from relation (3.19), by the adapting of the transfer F_{1r} to the transfer of the general regulation circuit.

The transfer F_{1r} will then be in the following form:

$$F_{1r} = \frac{A_0}{E_0} = \frac{1}{1 - \frac{b.[1 - \beta.(\alpha - 1)]}{c.(\alpha - 1)}} \tag{3.23}$$

Relation (15) can be considered as the sum of an infinite geometric series with the following ratio:

$$q = \frac{b.[1 - \beta.(\alpha - 1)]}{c.(\alpha - 1)}$$

for which it apples that if $|q| < 1$, the series is convergent and in the interpretation for the regulation circuit, it means that this circuit is stable.

Due to this fact, in the case that the regulation circuit, whose transfer in the equilibrium state is F_{1r} is to be stable, the following must apply:

$$\left|\frac{b.[1-\beta.(\alpha-1)]}{c.(\alpha-1)}\right| < 1 \qquad (3.24)$$

If condition (3.24) applies, which means that the equilibrium state of the regulation circuit determined by the transfer F_1r is stable, then, with respect to relation (3.23), it must apply that $A_0 > E_0$, otherwise $A_0 \leq E_0$.

About the group fulfilling condition (3.24), we will say that it has a positive relation to external pressure, because the specific value of the external pressure exerted by the group's surroundings on the group will induce an increase in the activity and initiative of the group members. In this context it can be, for instance, the positive work morale of the group members, given that these members respect, for example, the orders of their superiors and increase their activity and initiative, so that the tasks which have been assigned to them are fulfilled with adequate responsibility.

If the group fails to fulfil the condition, it can be noted that the group shows a negative attitude towards the present external pressure of the group's surrounding exerted on the group.

With respect to condition (3.24) for the stability of the equilibrium state of the regulation circuit, it is evident, that the product c . (α - 1) should be relatively high compared to the product b [1 — β.(α —1)]. This means that the product β.*(α* - 1), which is obtained by low β and (α - 1), should be low.

If low β is required for the stability of the equilibrium state of the regulation circuit, i.e. a high value of the spontaneity coefficient *1/β*, it means that if the group fulfils the condition of stability (3.24), a great deal of the activity and initiative of the group members per unit of the level of friendly relations among the group members will be created in addition to the level required by the group's surroundings.

The requirement for a low difference of α - 1 has the effect that, in the case of the equilibrium state of the circuit, a higher level of friendly relations P_0 arises, while the activity and initiative of the group members amounting to the value A_0 is exerted compared to the state when the difference of α – 1 is large.

Further, with respect to condition (3.24) for the stability of the circuit, it is required that c > b. This means that in the group, a change in the level of activity and initiative of the group members is influenced more by the external requirements (external pressure) of the group's surroundings laid on the group than by the level of friendly relations among the group members.

All these relations prove the fact that there is mutual conditionality of the increase in the level of friendly relations among the group members and the increase in activity and initiative of the group members, with a simultaneous rise in the intensity of interaction among the group members affected by the external pressure exerted by the group's surrounding on the group, which applies for groups meeting the conditions for stability of the system of "interaction among group members".

In order to achieve the values of the coefficient influencing the desirable state of the system equilibrium and stability – "interaction in work groups" – adequate conditions must be created in the group. For instance, existence of a low value of the spontaneity coefficient (1/β) which does not contribute to the stability and harmony of the behaviour of the group members within the group, can be caused, among others, by insignificant mutual relations among the individual group members. Even though there are friendly relations among group members, they do not create such an amount of activity and initiative as they would create if there was a high binding of the tasks of the individual group members. Mutual relations among the group members' tasks are thus one of the conditions supporting the stability of interaction in the group and harmonic behaviour of the group members.

Conclusion

Conclusions drawn from the investigation into the equilibrium state and stability of the system of "interaction in work groups" are also in line with empirical knowledge obtained from research relating properties of highly effective work groups, i.e. groups characterized by harmonic behaviour.

Based on the research (Cartwright, and Zander 1953; Likert 1961; Perlow *et al*. 2004; Tuckman 1965; Wheelan, and Todd 2003) it was found that it is typical of an effective group, for example, that it exists for a sufficient period of time, which results in the fact that the workers in this group could create an adequate level of interaction among the group members. In view of the presented model, time is one of the factors influencing the achievement of the value of both individual variable models

and the coefficients α, β, a, and b, as well as the coefficient c in such a value that the system is stable and the group behaves harmonically.

Further, there is a high degree of confidence among the members of highly effective groups and their leadership. This fact is again reflected by the model in the way that the equilibrium state of the investigated system is dependent upon the positive relations of group members to external pressure, because here $A_0 > E_0$ and the system equilibrium is stable.

A highly effective group is also characterized by the fact that the values and goals of the group are sufficient integration and reflection of their members' mutual values and needs. The group members are highly motivated to persist in main values and the achieving of significant goals of the group. In the group, there is a lot of activity and initiative exerted by the group members in order to fulfil the group's goals and thus the goals of the individuals in the group. As a result, a high value of the spontaneity coefficient 1/β is achieved, which is desirable for the stability of the system equilibrium. This could be an interpretation of other dependences found on the basis of the behavioural analysis of the created regulation circuits and then the individual causes, which result in making the values of the basic parameters characterizing the group, either as a group able to achieve the equilibrium state and stability in their behaviour, i.e. a group with effective harmonic behaviour, or as a low effective group, can be synthesized.

We are also aware of the fact that the model of the system – "interaction in work groups" – is simplified compared to the complexity of relations in interaction among members of a work group. Despite this fact, the model helps to clarify the concept of investigation into independence or dependence of the factors affecting this process in the group and it also helps to derive new statements, which can, having been verified in practice, support comprehension of the behaviour of work groups. This procedure of research into the interaction process in the group also shows the possibilities of utilization the general theory of system regulation for investigation into dependences in human behaviour.

References

[1] Cartwright, D., and Zander, A.1953. *Group dynamics research and theory*. Tavistock Publications Limited.

[2] Engleberg, I.N., and Wynn, D.R. 2009. *Working in groups.* 5th Ed, Allyn & Bacon.

[3] Forsyth, D.R. 2009. *Group dynamics.* 5th Ed, Wadsworth Publishing.

[4] Gersick, C.J.G. 1988. Time and Transition in Work Teams: Toward a New Model of Group Development. *The Academy of Management Journal.* Vol. 31, No. 1, pp. 9-41.

[5] Hogg, M.A., and Vaughan, G. 2008. *The social psychology.* 5th Ed, Pearson Education Limited.

[6] Homans, G.C. 1951. *The human group.* Routledge.

[7] Jardillier, P. 1980. *L'Organisation humaine du travail.* Presses Universitaires de France.

[8] Likert, R. 1961. *New Patterns of management.* McGraw Hill.

[9] Perlow, A.L., Gittell, J.H., and Katz, N. 2004. Contextualizing patterns of work group interaction: toward a nested theory of structuration. *Organization Science*, Vol. 15, No. 5, pp. 520-536.

[10] Shaw, M.E. 1980. *Group dynamics: The Psychology of Small Group Behaviour.* McGraw Hill.

[11] Townsend, M.A. *et al*. 1968. Virtual teams: technology and the workplace of the future. *Academy of Management Executive*, Vol. 12, No. 3, pp. 17-29.

[12] Tuckman, B.W. 1965. Developmental sequence in small groups. *Psychological Bulletin*, Vol. 63, No. 6, pp. 384-399.

[13] Wheelan, S.A., and Todd, W. 2003. Mapping dynamic interaction patterns in work groups. *Small Group Research*, Vol. 34, No. 4, pp. 443-467.

DO M&A ENHANCE VALUES? MIXED METHODS AND EVIDENCE

Amporn SOONGSWANG
School of Management, *Shinawatra* University, **Thailand**
amporn@siu.ac.th

Abstract

This study features the impact of takeovers on the event firms traded on the Stock Exchange of Thailand (SET). The study investigates a long-window abnormal return, or during a period of twelve months before and after the announcements using several metrics. The traditional models and the latest research method were employed for the abnormal return estimation for the bid period. These are the market and market-adjusted models and the matched reference portfolio of firms. The cumulative abnormal return (CAR), buy-and-hold abnormal return (BHAR) and monthly average abnormal return methods were used for the measurement of the returns of the two sets of firms. Both parametric and non-parametric test statistics were also used. The results suggest that target firm's shareholders gain substantial and positive abnormal returns; meanwhile bidding firm's shareholders realize positive rather than negative abnormal returns. The total gains are positive at 37.63% explaining takeovers create values.

Keywords: M&A, takeover, total gain, shareholder wealth, event study, Thailand.

JEL Classification: G14, G34

1. Introduction

Forms of the event study methodology has been the predominant method used to measure stock price responses to merger or takeover announcements, and most studies suggest that target firm shareholder returns are on average significantly positive; meanwhile, the evidence on bidding firms is far less conclusive (e.g., Campa, and Hernando 2004; Eckbo 2009). Consequently, even though a number of studies report positive total abnormal returns, or total gains; some argue that takeovers have negative effects (e.g., Jensen 2006; Martynova, and Renneboog 2011; part of results reported by Akbulunt, and Matsusaka 2010).

Thus, this research was undertaken to explore this issue in a Thai context: whether or not takeovers result in positive or negative effects on target and bidding firms' shareholders and subsequently their total gains. The study primarily based on a sample of successful tender offers. The analysis emphasized abnormal performance measurement by using monthly stock price data. Several more metrics were used. In addition to the market and market-adjusted models, the matched reference portfolio method, which is the latest research method, was employed for the abnormal return estimation for the long-term (bid period). The cumulative abnormal return (CAR), buy-and-hold abnormal return (BHAR) and monthly average abnormal return methods were also used for the measurement of the returns to the target and bidding firms. This study provides evidence that the takeovers, occurring in the Thai stock market result in substantially positive total gains to the event firms. This study enriches the financial literature on emerging markets in terms of greatly enhancing variety results and provides a further comparison with developed stock markets.

2. Review of Prior Studies

Prior studies show that the stock prices of target firm significantly increase at and around the announcement of a takeover. These studies include studies that examine the takeover activities occurring prior to 1980 and during the 1980s and 1990s (e.g., Mandelker 1974; Ellert 1976; Eckbo 1983; Bradley, Desai, and Kim 1988; Frank, Harris, and Titman 1991; Schwert 1996; and more recent studies (e.g., Bhagat, Dong, Hirshleifer, and Noah 2005; Martijn, Vinay, and Kose 2009). Similar evidence is suggested by surveys, such as Datta, Pinches, and Narayanan 1992; Jarrell, Brickley, and Netter 1988; and Jensen, and Ruback 1983; and more recent surveys, such as Bruner 2002; Burkart, and Panunzi 2006; Campa, and Hernando 2004; and Martynova, and Renneboog 2008a.

Work on non-USA and European stock markets gives further support; see, for example, King (2009), in a Canadian study; Da Silva Rosa, Izan, Steinbeck, and Walter (2000), in an Australian study; Firth (1997), in a New Zealand study; Kang, Shivdasani, and Yamada (2000), in a Japanese study, all report that the target firm shareholders benefit significantly from takeover announcements.

Meanwhile, the evidence on bidding firm's shareholder returns is inconclusive. Datta, Pinches, and Narayanan (1992) cite some contrary evidence to that reported in Jensen, and Ruback (1983) and Jarrell, Brickley, and Netter (1988). In particular, they find that the bidding firm's shareholders do not gain at all; whether successful or not.

Bruner (2002) summarizes the findings of 44 studies and 13 of 20 studies report significantly negative returns varying between -1 and -3%. Similarly, Campa, and Hernando (2004) summarize the findings of 17 studies, 10 of these studies report negative abnormal returns which vary between less than 1% and -5%, and in most cases are significantly different from zero. Seven more studies report zero or positive abnormal returns ranging from zero to 7%. Additional support, but different views, from some other studies; see, for example, Brown, and Da Silva Rosa (1998) report that acquisitions increase bidding firm shareholders' equity value, which are similar results reported in studies (e.g., Beitel, Schiereck, and Wahrenburg 2002; Eckbo, and Thorburn 2000; Floreani, and Rigamonti 2001; Fields, Fraser, and Kolari 2007; Goergen, and Renneboog 2004; Ghosh 2001; Ghosh 2004; Herman, and Lowenstein 1988; Parrino, and Harris 1999).

Even though there is more consensus about the net shareholder wealth effect of takeovers, some other studies report different results. Most studies report positive combined returns, but relatively small ranging from less than 1 to 5 %; e.g., Campa, and Hernando 2004; Fan, and Goyal 2006; Goergen, and Renneboog 2002; Holmen, and Knopf 2004; Houston, James, and Ryngaert 2001; Kuipers, Miller, and Patel 2002; Moeller, Schlingemann, and Stulz 2005; Mulherin, and Boone 2000; except for studies by Bradley, Desai, and Kim (1988); Healy, Palepu, and Ruback (1992); Lang, Stulz, and Walkling (1989); and Smith, and Kim (1994) report positive combined returns, ranging from 7.43% to 11.30%. Meanwhile; see, for example, Varaiya (1985) finds negative combined returns of -3.90%; Aktas, Bodt, and Declerck (2002) report both positive and negative combined returns, varying from -0.61% to +5.89%, which are similar to those reported by Akbulut, and Matsusaka (2010).

Whilst most of the previous studies have focussed on US and European events, only a small number of merger studies have examined developing or emerging stock markets; e.g., Estrada, Kritzman, and Page 2006; Fernandes 2005. Moreover, there have been a very small number of studies investigating Thai mergers. Lins, and Servaes (2002) assess the value of corporate diversification in seven emerging markets, including the Thai stock market, and find that diversified firms experience a discount of approximately 7% when compared with single-segment firms. Claessens, Djankov, Fan, and Lang (1998) suggest that whilst firms in more developed stock markets are successful in vertical diversification; in less developed stock markets, firms in Indonesia, Korea, Taiwan and Thailand appear to suffer significantly negative effects from vertical integration, but gain significantly benefits from complementary expansion. Fauver, Houston, and Naranjo (2003) report that in high-income countries, there is a significant diversification discount, but in lower-income and segmented countries, there is either no diversification discount or diversification premium. Khanna, and Palepu (2000) suggest that diversification is more valuable in emerging markets than in more developed economies. The evidence is therefore inconclusive.

Obviously, most studies have focused on stock returns over short time-periods (a few days or a few months) around the takeover announcements, including Thai merger studies. In addition, they have been predominantly analyzing a target or bidding firm's performance rather than examining total takeover effects, or total gains of the event firms. These Thai studies used daily stock price data, examined short-window abnormal returns and applied only the market model plus a limited range of statistical tests. We know that event study results are sensitive to the metrics used. Thus, a more comprehensive study of merger and acquisition performance on the Thai stock market is timely and justified.

Unlike prior Thai studies, I examine the both firms and use monthly stock price data to investigate long-time period effects around the takeover announcements, or during a period (-12,+12) months before and after the takeovers. Specifically, in addition to including more sample data by covering a longer period from year 1992 to 2002, this study investigates target and bidding firms and their total gains using several more research methodologies including the latest research methods. For example, I apply the matched reference portfolio method and bootstrapped skewness-adjusted t-statistic tests. This contributes to the understanding more of Thai takeover effects on the event firms, and enriches financial literature in terms of greatly enhancing the existing literature given the limited number of prior studies involved and the variety of their results.

A majority motivation for this study is to examine whether or not different samples, markets and methodologies result in different outcomes. This is the first comprehensive study of Thai mergers, focusing both target and bidding firms. This study extends the literature and permits an international comparison of merger and acquisition effects on the Thai stock market.

3. Data

This study uses stock price data rather than accounting data for the takeover performance measurement. There are four significant sources of data set out as follows:

(1) The list of total companies listed on the SET at any point of time during the period 1991-2003, the list of delisted companies and the list of companies traded under the rehabilitation sector or "REHABCO" were obtained from the SET.

(2) All tender-offer statistics between August 1992 and October 2002 were obtained from the Securities and Exchange Commission, Thailand (SEC).

(3) The Thomson Primark Datastream database was used to provide stock prices, market values (MV) or market capitalizations, and book values (BV) or net tangible assets (NTA) for the sample firms.

(4) Brooker Group Public Co., Limited, based in Bangkok, Thailand, was used as a minor source of data for cross-checking the book values obtained from the Datastream.

4. Research methodology

Past studies show evidence that market reaction to news is not always completed over short-time periods, such as Loughran, and Vijh 1997; and Rosen 2006. Similarly, several more studies document abnormal returns spread over the long-term post-event period of time, for example, studies by Baker, and Limmack 2001; Fama 1998; Hou, Olsson, and Robinson 2000; Kothari 2001; Kothari, and Warner 1997; Schwert 2002.

However, there have been studies concentrate on merger and acquisition activities on developed stock markets, for example, Brown, and Warner (1980 and 1985), Campbell, and Wasley (1993), Dumontier, and Petitt (2002); Dyckman, Philbrick, Stephan, and Ricks (1984), Fields *et al*. (2007); and Goergen, and Renneboog (2002), among others. Most of them have examined abnormal returns measured on a particular day or cumulated over some months. There are an increased number of recent studies that have focused more on long-term performance examination, but they have emphasized more on target firms rather than bidding firms, and very less on total gains of the event firms. Even though Martynova, and Renneboog (2008a) suggest that to determine the success of a takeover, one can take several perspectives, such as evaluating M&As from the perspective of the target's or bidder's shareholders, or calculating the combined shareholder wealth effects, Cybo-Ottone, and Murgia (2000) argue that looking only at the target and bidder separately would give a distorted interpretation of the market reaction to the announcement.

Thus, I evaluate the target and bidder's total gains resulted from the takeover announcements over the bid-period by using the simple average method, which is similar to that used in Jensen, and Ruback (1983). Nevertheless, by comparison, with a limitation number of studies examining takeover effects either on developing markets or the Thai market, nearly all of them have given priority to short-term performance investigation, used daily stock price data and applied the limited ranges of research methods and statistical tests.

An interest of this research is examining long-term bid-period abnormal return behaviour of target and bidding firms. This consequently results in total gains of the event firms responded to takeover announcements on the SET. This study uses monthly stock price data to investigate the effects around the takeover announcements, or during a period (-12, +12) months before and after the takeovers. Specifically, in addition to including sample data by covering a longer period from 1992 to 2002, this study investigates target and bidding firms and their total gains using more research methodologies. For example, I apply two traditional models: market and market-adjusted models and three significance statistic tests: standardized-residual test, standardized cross-sectional test and conventional t-tests. Moreover, the more advance research methods are also used; see, for example, the matched reference portfolio of firms and the bootstrapped skewness-adjusted t-statistics.

This study is largely based on a sample of successful tender offers. The analysis emphasizes abnormal performance measurement by using monthly stock price data. The firm's stock price

reaction to the takeover announcement was estimated as the rate of abnormal return to the shareholders of the target and bidding firms. The abnormal return was defined as the difference between the realized return observed from the market and the benchmark return over the period around the takeover announcements. Also, it was defined "at the announcement of takeovers" or "around the takeover announcements" as the event-window of the examination.

The event period was the bid period or (-12, 0, +12) months, month '0' was defined as the event month, and the event month was defined as the submission month of the tender offer by the bidder to the SEC, or the month that the proposal was filed at the SEC. The analysis is based on the tender offer statistics obtained from the SEC between 1992 and 2002. The sample firms were classified according to whether they were involved as a target or bidder.

In the time selected, the takeovers on the SET involved 151 tender offers (151 targets and 74 bidders). From this database, a sample was set up according to the following criteria:

(1) A tender offer was classified as being successful if the bidder increased its holding of the target shares or purchased at least some24 of the outstanding target shares that were tendered for. Thai security legislation defines a proportion above 25% of the target shares' holdings as a 'strategic shareholder' and the bidder is required to tender an offer for the total remaining outstanding shares of the target.

(2) Any tender offer was excluded from the sample when it occurred with the purpose of a de-listing[25]. Some cases were also deleted when the tender offer was cancelled later or the target firm was in the process of delisting.

(3) The survivorship period of time required in this study is the period over (-48, +16) months, due to the limitation of available stock price data.

These selection criteria reduced the initial sample from 151 tender offers to 52 tender offers (52 target firms) and 28 tender offers (42 bidding firms).

4.1 Measurement of abnormal returns

4.1.1 The market model

To examine the effect of the event on each stock, *i*, control is made for the normal relation between the return on stock *i* during month *t*, and the return on the market index R_m.

$$R_{it} = \alpha_i + \beta_i R_{mt} + \varepsilon_{it} \quad (1)$$

where R_{it} is the return of stocks, R_{mt} is the return of market index, α_i is the intercept term, β_i is the systematic risk of stocks and ε_{it} is the error term.

The market model was selected as an expected return model and the OLS (ordinary least squares) regression was used in regression of the stock return over three years of the estimation period against the return on the valued weighted SET index for the corresponding calendar months. Month 13 (or 0) was determined as the event month and calculated 25 abnormal returns on each stock over the period around the takeover announcements, from month 1 (-12) through to month 25 (+12). This interval is the event window for the bid period investigation of this study. The impact of the event on stock returns was examined through a number of stocks that were affected by the takeover announcements at the event time. The abnormal returns (ARs) were averaged as

$$AAR_t = 1/n \sum_{i=1}^{n} \varepsilon_{it} \quad (2)$$

where *n* is the number of stocks.

[24] The control of a firm can increase continuously from none for those who own no shares to complete for those who own 100% of the target's shares or voting rights operations (see more in Bradley, Desai, and Kim 1988, p. 5; also see Dodd, and Ruback 1977, p.352). In this study, the bidders hold the target shares approximately 28.19% before they tender an offer and/or offers, then the purchased target shares of about 28.99% finally result in their target share holding of 57.18%, on average.

The accumulated effect of the event was examined using the cumulative abnormal return (CAR) measure. The values of the AARs were continuously cumulated for every month from T_1 (month1 or -12) to T_2 (month 25 or +12) as

$$\text{CAAR} = \sum_{t=T1}^{T2} \text{AAR}_t \tag{3}$$

The buy-and-hold abnormal return (BHAR) approach was also used. A stock's BHAR was defined as the product of one plus each month's abnormal return, minus one. To obtain a holding-period buy-and-hold abnormal return (BHAR_{iT}), the abnormal returns were calculated as

$$\text{AR}_{it} = R_{it} - \alpha_i - \beta_i R_{mt} \tag{4}$$

$$\text{BHAR}_{iT} = \prod_{t=0}^{T-1} [1+\text{AR}_{it}] - 1 \tag{5}$$

where t=0 is the event month or the beginning period and T-1 is the period of investment (in months).

Abnormal performance (BHAR_{pT}) was defined as the cross-sectional average of the buy-and-hold abnormal return of the number of stocks (n). That is the abnormal return (BHAR_{iT}) was averaged as

$$\text{BHAR}_{pT} = 1/n \sum_{i=1}^{n} \text{BHAR}_{iT} \tag{6}$$

4.1.2 The market-adjusted model

The market-adjusted model was another expected return model used for this study as

$$R_{it} = \beta_i R_{mt} + \varepsilon_{it} \tag{7}$$

where R_{it} is the return of stocks, R_{mt} is the return of market index, β_i is the systematic risk of stocks and ε_{it} is the error term.

4.1.3 A matched reference portfolio method

In developing a test to detect long-term abnormal stock returns, it is significant to control for firm size and book-to-market ratios. The size of the Thai stock market is small, with a total number of listed companies varying between 320 and 454 firms during 1992-2003. Sorting by another factor, such as beta, would further reduce the number of firms available for any control group and lead to small numbers in the control groups. This number could be less than twenty firms and serve to undermine the benefits of using a matched reference portfolio method. Thus, this research used a two-factor benchmark.

I used the matched reference portfolio of firms that matched the event firm on the basis of size and book-to-market ratio as the benchmark for the calculation of abnormal returns. There are studies that apply this method, for example, see Baker, and Limmack 2001; Bouwman, Fuller, and Nain 2003; Brown, and da Silva Rosa 1998; Gregory, and McCorriston 2002; Rosen 2006. These studies examine takeover effects on developed stock markets; however most of them used the matched reference portfolio as a benchmark for bidding firm long-term post-bid period abnormal return measurement. In my study, the matched reference portfolio method was used for long-term bid period investigation, and was applied for both the target and bidding firms' performance measurement.

The benchmark group was the firms listed on the SET and then deleted the firms that are related to takeover activities and under the 'Rehabilitation' sector. I excluded the firms that reported negative book value of common equities and those with non-available book values. The returns were calculated and it was assumed that the sample firms' returns would have changed in the same way as those of the benchmark group. The effects of the takeovers were examined by comparing the performance of the event firms with that of a reference portfolio of non-event firms.

The reference portfolio was formed by using a control group of firms matched on the basis of size and book-to-market ratio rankings. For target investigations, the number of firms in a control group varies between 302 and 420 firms and the number of firms in a portfolio varies between 57 and 97 firms. For bidder investigations, those numbers vary between 302 and 420, and between 56 and 95 firms respectively. The matched reference portfolios were built up by following a set of determining criteria. This results in 125 reference portfolios for 50 targets and 72 reference portfolios for 32 bidders. The number of firms in each portfolio varies between 19 and 32 firms and between 18 and 32 firms, consecutively

Both the CAR and BHAR methods were applied to calculate abnormal returns relative to the benchmark.

The long-term cumulative abnormal return (CAR) was calculated as

$$CAR = \sum_{t=1}^{T} [R_{it} - E(R_{it})] \quad (8)$$

where R_{it} is the monthly return of a sample firm (firm i) and $E(R_{it})$ is the return on a matched reference portfolio.

$$CAR = \sum_{t=s}^{s+T} [R_{it} - 1/n_t^s \sum_{j=1}^{n_t^s} R_{jt}] \quad (9)$$

where R_{jt} is the monthly return for the $j = 1, \ldots, n_t^s$ firms that are in the same size/book-to-market reference portfolio as firm i, which are also publicly traded in both period s and t.

The long-term buy-and-hold abnormal return (BHAR) of firm i, denoted as AR_i, was computed as:

$$AR_i = R_i - BR_i \quad (10)$$

where R_i is the long-term buy-and-hold return of firm i and BR_i is the long-term return for a particular benchmark of firm i.

The long-term buy-and-hold return of firm i over T months post-events was obtained by compounding monthly returns, that is:

$$R_i = \prod_{t=0}^{T-1} (1 + r_{it}) - 1 \quad (11)$$

where r_{it} is the return on firm i in month t, $t = 0$ is the event month or the beginning period and T-1 is the period of investment (in months).

The long-term benchmark return of firm i (BR_i) was calculated as:

$$BR_i(R_{bh}) = 1 / n \sum_{i=1}^{n} \prod_{t=0}^{T-1} (1 + r_{it}) - 1 \quad (12)$$

where R_{bh} is the long-run benchmark buy-and-hold return and n is the number of firms in a reference portfolio.

$$BR_i(R_{rb}) = \prod_{t=0}^{T-1} (1 + 1 / n \sum_{i=1}^{n} r_{it}) - 1 \quad (13)$$

where R_{rb} is the long-term benchmark rebalanced return.

Another alternative, the average compounded or holding-period abnormal return (AHPAR) (see Cowan, and Sergeant 2001) was calculated as:

$$\text{AHPAR} = 1 / n \sum_{i=1}^{n} (\text{HPR}_i - \text{HPR}_{\text{benchmark}i}) \quad (14)$$

where HPR_{i0} is the long-term buy-and-hold return of stock *i* (firm *i*) and $\text{HPR}_{\text{benchmark}i}$ is the long-term return for a particular benchmark of stock *i* (firm *i*).

The monthly long-term abnormal returns were estimated by means of the matched reference portfolio method. This results in 1,082 and 604 monthly average abnormal returns to the target and bidding firms in the samples, respectively.

Finally, total gains of the target and bidding firms or the event firms were calculated using the simple average method.

4.2 Significance tests of abnormal returns

To test the null hypothesis that the mean cumulative or BHAR is equal to zero for a sample of n firms, I employed both parametric and non-parametric test statistics.

4.2.1 Standardized-residual test

$$t = \sum_{i=1}^{N} \text{SR}_{iE} \Big/ \sqrt{\sum_{i=1}^{N} (T_i\text{-}2) / (T_i\text{-}4)} \quad (15)$$

or

$$t = \sum_{i=1}^{N} \text{SR}_{iE} \Big/ \sqrt{N} \quad (16)$$

where SR_{iE} is the standardized residual, T_i is the number of days (months) in security *i*'s estimation period and *N* is the number of firms in the sample.

4.2.2 Standardized cross-sectional test

$$t = 1/N \sum_{i=1}^{N} \text{SR}_{iE} \Big/ \sqrt{1/N(N\text{-}1) \sum_{i=1}^{N} (\text{SR}_{iE} - \sum_{i=1}^{N} \text{SR}_{iE}/N)^2} \quad (17)$$

4.2.3 Conventional *t*-tests

$$t_{\text{CAR}} = \overline{\text{CAR}}_{iT} / (\sigma(\text{CAR}_{iT}) / \sqrt{n}) \quad (18)$$

$$t_{\text{BHAR}} = \overline{\text{BHAR}}_{iT} / (\sigma(\text{BHAR}_{iT}) / \sqrt{n}) \quad (19)$$

where $\overline{\text{CAR}}_{iT}$ and $\overline{\text{BHAR}}_{iT}$ are the sample averages and $\sigma(\text{CAR}_{iT})$ and $\sigma(\text{BHAR}_{iT})$ are the cross-sectional sample standard deviations of abnormal returns for the sample of *n* firms.

4.2.4 Bootstrapped skewness-adjusted *t*-statistics

I adopted this *t*-statistic method by applying for the significance tests of both cumulative average abnormal returns (CAARs) and average buy-and-hold abnormal returns (ABHARs). The bootstrapping involves drawing *b* re-samples of size *m* with replacement from the original sample. *b* = 1,000 times of re-samplings are implemented in the procedures. *m* is 1 and 5, even though it seems arbitrary, 5 is approximately a quarter of the number of firms in typical reference portfolios in this study. The skewness-adjusted *t*-statistic was calculated as the formula below. To test the null hypothesis of zero mean at the significance level of α, the critical values for the skewness-adjusted *t*-statistic are based on the tabulated distribution of *t*-statistics.

$$t_{sa} = \sqrt{n}\,(S + 1/3\,\hat{\gamma}\,S^2 + 1/6n\,\hat{\gamma}\,) \quad (20)$$

$$S = \overline{AR}_T / \sigma\,(AR_T) \quad (21)$$

$$\hat{\gamma} = \sum_{i=1}^{n} (AR_{iT} - \overline{AR}_T)^3 / n\sigma\,(AR_T)^3 \quad (22)$$

where t_{sa} is the skewness-adjusted *t*-statistic, $\sqrt{n}\,S$ is the conventional *t*-statistic of $t = \overline{AR}_T / \sigma\,(AR_T) / \sqrt{n}$ and $\hat{\gamma}$ is an estimate of the coefficient of skewness.

5. Results

The market and market-adjusted models as well as the matched reference portfolio method were used for the estimation of abnormal returns for the target and bidding firms' shareholders. The CAR, BHAR and monthly average abnormal return methods were applied for the return measurements. The results are presented and explained in the following section in terms of the performances of the average abnormal returns of the event firms and their total gains. The main issues are the size and signs of these abnormal returns and whether or not they are significantly different from zero. The details of the results are shown in Tables 1 and 2.

5.1 Target and bidding firms' abnormal returns

The takeover effects during the announcement month were investigated and the results show that the CAARs over the period (-12,0), starting twelve months prior to and including the event month, of the target firms are significant and positive at 30.80% and 31.10%, when estimated from the market and market-adjusted models respectively. The total standardized residuals (TSRs) and the average event-period standardized residuals (ASRs) are significant and positive at 79.63 and 1.53; and 67.88 and 1.31, consecutively. The percentage of stocks with positive CAARs is 67.31% and 71.15% which are higher than the average of 58.46 % and 58.77%

Table 1. Summary of Results Estimated from the Market and Market-Adjusted Models for Target and Bidding Firms (Bid Period) Investigations

	Market Model (-12,+12)					Market-Adjusted Model (-12,+12)				
Sample	CAARs (-12,0)	CAARs	ABHARs	ATSRs	AASRs	CAARs	CAARs	ABHARs	ATSRs	AASRs
Target firms (52 firms)	0.308	0.407	1.466[a]	10.558	0.203	0.311	0.470	0.382	7.316	0.141
	(NA)	(2.14)*	(1.43)	(1.42)	(0.64)	(NA)	(3.69)**	(1.94)	(0.98)	(0.36)
Bidding firms (42 firms)	-0.009	-0.288	-0.032	7.229	0.172	0.264	0.183	0.156	9.422	0.224
	(NA)	(-1.66)	(-0.22)	(1.08)	(-0.42)	(NA)	(1.65)	(0.00)	(1.41)	(0.06)

***Note*:** CAARs=cumulative average abnormal returns; ABHARs=average buy-and-hold abnormal returns; ATSRs=the means of total or the sum of standardized residuals; AASRs=the means of the average event-period standardized residuals. The test statistics are provided in the parentheses below the values of the abnormal returns. According to the conventional *t* test, the results of the significance tests are the tests for the CAARs and ABHARs over the period (-12,+12) for the bid period investigation.

[a] When excluded *Q*: UOXT which has the remarkable substantial stock price returns in the sample, the ABHARs are significant positive at 47.13% (*t*=2.12).

*Significant at 5% level **Significant at 1% level.

Table 2. Abnormal returns estimated from the matched reference portfolio method for target and bidding firms (Bid Period) investigations

	Matched reference portfolio method (-12,+12)						
Sample	CAARs[a] Abnormal Returns	CAARs[b]	ABHARs11	ABHARs12[a]	ABHARs12[b]	ABHARs13	Monthly Average
Target firms (50 firms)	0.162	0.174	-0.048	0.126	0.108	0.161	0.018
% of positive			36.00%			66.00%	74.00%
Skewness-adjusted *t*-statistics	(3.94)**	(11.43)**	(-23.48)**	(2.52)*	(5.90)**	(12.47)**	(-8.23)**
% of positive Skewness-adjusted *t*-statistics			36.00%			66.00%	30.00%
% of positive difference between BHARs[1]				53.97%			
% of positive difference between CARs[1]	59.52%						
Bidding firms (32 firms)	0.102	0.118	-0.046	0.142	0.129	0.125	0.008
% of positive			31.25%			68.75%	68.75%
Skewness-adjusted *t*-statistics	(2.14)*	(8.79)**	(-18.97)**	(2.48)*	(7.84)**	(6.94)**	(-0.90)
% of positive Skewness-adjusted *t*-statistics			31.25%			68.75%	65.63%
% of positive difference between BHARs[1]				56.94%			
% of positive difference between CARs[1]	54.17%						

Note: CAARs=cumulative average abnormal returns; ABHARs=average buy-and-hold abnormal returns. To test the null hypothesis of zero means at a significance level of α, the critical values for the skewness-adjusted *t*-statistics are based on the tabulated distribution of *t*-statistics. Significant means at 1% and 5% levels that are shown by ** and * respectively.

[a] Method 1is the simple average method. [b] Method 2 is the bootstrap approach.

[1] The difference between BHARs of the target/bidding firm - BHARs of a set of portfolios which are actually averaged by the number of the sub-sets.

Meanwhile, the CAARs over the same period for the bidding firms are negative at -0.90% and positive at 26.40%. The TSRs and ASRs are insignificantly negative at -11.71 and -0.28 consecutively. The percentage of stocks with negative CAARs and positive are 54.76% and 71.43%

For the purposes of measuring the full effect of the takeover and to strengthen the results, the CAARs prior to and post the announcement months were estimated, and in addition to using the CAR approach for calculating the return measurements, the BHAR approach was also used. Therefore, in this section these results were evaluated and explained relative to the two firms.

The CAARs over the period (-12, -1) for the target firms are significantly positive at 17% and 18.30%. The CAARs and ABHARs over the period (-12, +12) are significantly positive at 40.70% and 47%; and 146.60% and 38.20%, respectively.

Those over the period (-12,-1) for the bidding firms are positive at 1% and substantially positive at 27%; while the CAARs and ABHARs over the period (-12,+12) are negative at -28.80% and positive at 18.30%; and negative at -3.20% and positive at 15.60%, consecutively.

The matched reference portfolio method was also used for the estimation of long-term abnormal returns for the target and bidding firms. The results present that for the bid period or the period (-12,+12), the average buy-and-hold abnormal returns (ABHARs) estimated from the BHARs(13), or ABHARs(13), and the BHARs(14), or ABHARs (14), for the target firm's shareholders are significant and positive at 12.60% (method 1) and 10.80% (method 2); and 16.10% respectively. Accordingly, the monthly average abnormal returns are significantly positive at 1.80%. These results are confirmed by the percentages of the proportion of positive abnormal returns of 53.97%, 66% and 74% respectively. Therefore, the results are mostly consistent with each other in terms of both the direction and magnitude, except for the different magnitude of the monthly average abnormal returns. At the same time, there is evidence that the CAARs are positive at 16.20% (method 1) and 17.40% (method 2), both are significant with *t* statistics of 3.94 and 11.43 respectively. Also, it is supported by the percentage of the positive CAARs of about 59.52%. The results are consistent with the positive ABHARs(13), ABHARs(14), and monthly average abnormal returns, even though of different magnitude. However, the average buy-and-hold abnormal returns estimated from the BHARs(12), or ABHARs(12), are significantly negative at -4.80% (*t*=-23.48). It is also supported by the percentage of the negative ABHARs(12) of approximately 64%.

Each earlier result is supported by the percentages of the positive and negative skewness-adjusted *t*-statistics for the abnormal returns. The percentage of the positive skewness-adjusted *t*-statistics for the ABHARs(14) is 66%, and the percentage of the negative skewness-adjusted *t*-statistics for the ABHARs(12) is 64%; meanwhile the percentage of the positive skewness-adjusted *t*-statistics for the monthly average abnormal returns is only 30%.

The results also present that the ABHARs(13) and ABHARs(14) for the bidding firms are significantly positive at 14.20% (method 1) and 12.90% (method 2); and 12.50% respectively. Consistently, the monthly average abnormal returns are positive at 0.80%. These results are strongly supported by the percentages of positive abnormal returns of 56.94%, 68.75% and 68.75% consecutively. Therefore, the findings are completely consistent with each other in terms of both the return direction and magnitude between the ABHARs(13) and ABHARs(14), but of different magnitude to the monthly average abnormal returns. Accordingly, the cumulative average abnormal returns (CAARs) are positive at 10.20% (method 1) and 11.80% (method 2), both are significant with *t*-statistics of 2.14 and 8.79 respectively. Also, it is supported by the percentage of positive CAARs of approximately 54.17%. This is entirely consistent with the ABHARs(13), ABHARs(14), and the monthly average abnormal returns. However, the ABHARs(12) are significantly negative at -4.60% (*t*=-18.97). It is also confirmed by the percentage of negative ABHARs(12) of about 68.75%.

The results deviate from each other to a degree; however each of the suggested results is supported by the percentages of the positive and negative skewness-adjusted *t*-statistics for the abnormal returns. The percentage of positive skewness-adjusted *t*-statistics for the ABHARs(14) is 68.75%, and the same percentage of 68.75% represents the negative skewness-adjusted *t*-statistics for the ABHARs(12). Meanwhile, the percentage of positive skewness-adjusted *t*-statistics for the monthly average abnormal returns is up to 65.63%.

5.2 Total gains

To measure the total gains of the target and bidding firms, this study uses the simple average method, which is similar to that used in Jensen, and Ruback (1983). Consequently, the total gains for the event firms are positive at 29.90% and 57.50%, when estimated from the market and market-adjusted models respectively; and positive at 27.80%, 17.43% and 2.60%, as estimated from the matched reference portfolio method using the CAR, BHAR and Monthly average abnormal return methods consecutively, or are approximately 37.63% on average. The total gains indicate that takeovers create values. The results corroborate with those of most prior studies including Akbulut, and Matsusaka (2010), even when using different methods: simple average and weighted average.

Conclusion

This study gives light to many results which are robust. The findings are consistent with each other, particularly in terms of the return direction, when comparisons are made amongst the market, market-adjusted models and the matched reference portfolio method; between the CAR and BHAR methods and also with the monthly average abnormal return method. The results are thus internally consistent when compared within this study itself, and also with most of the findings of previous studies of the developed stock markets and the limited existing studies of emerging stock markets, with respect to the different samples, methods and time periods of the investigations.

This research contributes to the understanding more of the impact of takeover effects on the target and bidding firms traded on the SET. The main findings suggest that a Thai takeover announcement results in substantial abnormal returns to the event firms. The average total gains are considerable and positive at 37.63% indicating takeovers create values. The results add to the literature on emerging markets in terms of enhancing the existing literature, given the limited number of prior studies involved and limited ways of applying research methodologies, and international comparisons of takeover effects on the Thai stock market.

References

[1] Akbulut, M.E., and Matsusaka, J.G. 2010. Fifty years of diversification announcements. *Financial Review* 45(2): 231-262.

[2] Aktas, N., de Bodt, E., and Declerck, F. 2002. Is there information leakage around business combinations on the French market. SSRN Working Paper.

[3] Baker, R.D., and Limmack, R.J. 2001. UK takeovers and acquiring company wealth changes: The impact of survivorship and other potential selection biases on post-outcome performance. Working Paper. University of Stirling.

[4] Beitel, P., Schiereck, B., and Wahrenburg, M. 2002. Explaining the M&A - success in European bank mergers and acquisitions. Working Paper. Institute for Mergers and Acquisitions. University of Witten/Herdecke.

[5] Bhagat, S., Dong, M., Hirshleifer, D., and Noah, R. 2005. Do tender offers create value? New methods and evidence. *Journal of Financial Economics* 76(1): 3-60.

[6] Bouwman, C., Fuller, K., and Nain, A. 2003. The performance of stock-price driven acquisitions. Working paper. University of Michigan.

[7] Bradley, M., Desai, A., and Kim, E.H. 1988. Synergistic gains from corporate acquisitions and their division between the stockholders of target and acquiring firms. *Journal of Financial Economics* 21: 3-40.

[8] Brown, P., and da Silva Rosa, R. 1998.Research method and the long-run performance of acquiring firms. *Australian Journal of Management* 23(1): 23-38.

[9] Brown, S.J., and Warner, J.B. 1980. Measuring security price performance. *Journal of Financial Economics* 8: 67-120.

[10] Brown, S.J., and Warner, J.B. 1985. Using daily stock returns: The case of event studies. *Journal of Financial Economics* 14: 3-31.

[11] Bruner, R.F. 2002. Does M&A pay? A survey of evidence for the decision-maker. *Journal of Applied Finance* 12: 48-68.

[12] Burkart, M., and Panunzi, F. 2006. Takeovers. ECGI-Finance Working Paper. No. 118/2006.

[13] Campbell, C.J., and Wasley, C.E. 1993. Measuring security price performance using daily NASDAQ returns. *Journal of Financial Economics* 33: 73-92.

[14] Campa, J.M., and Hernando, I. 2004. Shareholder value creation in European M&As, *European Financial Management* 10(1): 47-81.

[15] Claessens, S., Djankov, S., Fan, J.P.H., and Lang, L.H.P. 1998. Diversification and efficiency of investment by East Asian corporations. World Bank Working Paper.

[16] Cowan, A.R., and Sergeant, A.M.A. 2001. Interacting biases, non-normal return distributions and the performance of tests for long-horizon event studies. *Journal of Banking and Finance* 25: 741-765.

[17] Cybo-Ottone, A., and Murgia, M. 2000. Mergers and shareholder wealth in European banking. *Journal of Banking and Finance* 24: 831-859.

[18] Da Silva Rosa, R., Izan, H.Y., Steinbeck, A., and Walter, T. 2000. The method of payment decision in Australian takeovers: An investigation of causes and effects. *Australian Journal of Management* 25(1): 67-94.

[19] Datta, D.K., Pinches, G.E., and Narayanan, V.K. 1992. Factors influencing wealth creation from mergers and acquisitions: A meta-analysis. *Strategic Management Journal* 13: 67-84.

[20] Dodd, P., and Ruback, R. 1977. Tender offers and stockholder returns. *Journal of Financial Economics* 5: 351-373.

[21] Dumontier, P., and Petitt, B.S.P. 2002. Determinants of returns of acquiring firms around tender offer announcements: Evidence from French control-oriented and parent-subsidiary offers. Working Paper. ESA Universite de Grenoble.

[22] Dyckman, T., Philbrick, D., Stephan, J., and Ricks, W.E. 1984. A comparison of event study methodologies using daily stock returns: A simulation approach. *Journal of Accounting Research* 22: 1-33.

[23] Eckbo, B.E. 1983. Horizontal mergers, collusion, and stockholder wealth. *Journal of Financial Economics* 11: 241-273.

[24] Eckbo, B.E. 2009. Bidding strategies and takeover premiums: A review. *Journal of Corporate Finance* 15: 149-178.

[25] Eckbo, B.E., and Thorburn, K. 2000. Gains to bidder firms revisited: Domestic and foreign acquisitions in Canada. *Journal of Financial and Quantitative Analysis* 35(1): 1-25.

[26] Ellert, J.C. 1976. Merger antitrust law enforcement, and stockholder returns. *Journal of Finance* 31: 715-732.

[27] Estrada, J., Kritzman, M., and Page, S. 2006. Countries versus industries in emerging markets: A normative portfolio approach. *Journal of Investing* 15(4): 19-28.

[28] Fama, E.F. 1998. Market efficiency, long-term returns, and behavioural finance. *Journal of Financial Economics* 49: 283-306.

[29] Fan, J.P.H., and Goyal, V.K. 2006. On the patterns and wealth effects of vertical mergers. *Journal of business* 79(2): 877-902.

[30] Fauver, L., Houston, J., and Naranjo, A. 2003. Capital market development, integration, legal systems, and the value of corporate diversification: A cross-country analysis. *Journal of Financial and Quantitative Analysis* 38 (1) (March): 135-157.

[31] Fernandes, N. 2005. What level of portfolio disaggregation in emerging market investments?

Journal of Portfolio Management 31: 41-49.

[32] Fields, L.P., Fraser, D.R., and Kolari, J.W. 2007. Bidder returns in bank assurance mergers: Is there evidence of synergy? *Journal of Banking & Finance* 31: 3646-3662.

[33] Firth, M. 1997. Takeovers in New Zealand: Motives, stockholder returns, and executive share ownership. *Pacific-Basin Finance Journal* 5: 419-440.

[34] Floreani, A., and Rigamonti, S. 2001. Mergers and shareholders wealth in the insurance industry. Working Paper. Universita Cattolica del S. Cuore.

[35] Franks, J., Harris, R., and Titman, S. 1991. The post-merger share-price performance of acquiring firms. *Journal of Financial Economics* 29: 81-96.

[36] Ghosh, A. 2001. Does operating performance really improve following corporate acquisitions? *Journal of Corporate Finance* 7: 151-178.

[37] Ghosh, A. 2004. Increasing market share as a rational for corporate acquisitions. *Journal of Business Finance & Accounting* 31(1-2): 209-247.

[38] Goergen, M., and Renneboog, L. 2002. Shareholder wealth effects in large European takeover bids. Working Paper. University of Manchester Institute of Science and Technology.

[39] Goergen, M., and Renneboog, L. 2004. Shareholder wealth effects of European domestic and cross-border takeover bids. *European Financial Management Journal* 10(1): 9-45.

[40] Gregory, A., and McCorriston, S. 2002. Foreign acquisitions by UK limited companies: Long-run performance in the US, continental Europe and the rest of the world. Working paper. Financial Markets Research Centre. University of Exeter.

[41] Healy, P.M., Palepu, K.G., and Ruback, R.S. 1992. Does corporate performance improve after mergers? *Journal of Financial Economics* 31: 135-175.

[42] Herman, E., and Lowenstein, L. 1988. The efficiency effects of hostile takeovers. In John Coffee, Jr., Louis Lowenstein, & Susan Rose-Ackerman (Eds.). Knight, Raiders and Targets. Oxford: Oxford University Press.

[43] Holmen, M., and Knopf, J. 2004. Minority shareholder protections and the private benefits of control for Swedish mergers. *Journal of Financial and Quantitative Analysis* 39(1): 167-91.

[44] Hou, K., Olsson, P., and Robinson, D. 2000. Does takeover increase stockholder value? Working paper. University of Chicago.

[45] Houston, J.F., James, C.M., and Ryngaert, M.D. 2001. Where do merger gains come from? Bank mergers from the perspective of insiders and outsiders. *Journal of Financial Economics* 60: 285-331.

[46] Jarrell, G.A., Brickley, J.A., and Netter, J.M. 1988. The market for corporate control: The empirical evidence since 1980. *Journal of Economic Perspectives* 2(1): 49-68.

[47] Jensen, M.C. 2006. Takeovers: The controversy and the evidence. SSRN Working Paper.

[48] Jensen, M.C., and Ruback, R.S. 1983. The market for corporate control. *Journal of Financial Economics* 11: 593-638.

[49] Kang, J.K, Shivdasani, A., and Yamada, T. 2000. The effect of bank relations on investment decisions: An investigation of Japanese takeovers bids. *Journal of Finance* 55: 2197-2218.

[50] Khanna, T., and Palepu, K. 2000. Is group affiliation profitable in emerging markets? An analysis of diversified Indian business groups. *Journal of Finance* 55: 867-891.

[51] King, M.R. 2009. Pre-bid run-ups ahead of Canadian takeovers: How big is the problem? *Financial Management* 38(4): 699-726.

[52] Kothari, S.P. 2001. Capital markets research in accounting. *Journal of Accounting and Economics* 31(March): 105-231.

[53] Kothari, S.P., and Warner, J.B. 1997. Measuring long-horizon security price performance. *Journal of Financial Economics* 43: 301-339.

[54] Kuipers, D., Miller, D., and Patel, A. 2002. Shareholder wealth effects in the cross-border market for corporate control. Mimeo. Indiana University.

[55] Lang, L.H.P., Stulz, R.M., and Walkling, R.A. 1989. Managerial performance, Tobin's q, and the gains from successful tender offers. *Journal of Financial Economics* 24: 137-154.

[56] Lins, K., and Servaes, H. 2002. Is corporate diversification beneficial in emerging markets? *Financial Management* Summer: 5-31.

[57] Loughran, T., and Vijh, A.M. 1997. Do long-term shareholders benefit from corporate acquisitions? *Journal of Finance* 52: 1765-1790.

[58] Mandelker, G. 1974. Risk and return: the case of merging firms. *Journal of Financial Economics* 1: 303-335.

[59] Martijn, C., Vinay, B., and Kose, J. 2009. Takeovers and the cross-section of returns. *The Review of Financial Studies* 22(4): 1409-1445.

[60] Martynova, M., and Renneboog, L. 2008a. A century of corporate takeovers: What have we learned and where do we stand? *Journal of Banking & Finance* 32(10): 2148-2177.

[61] Martynova, M., and Renneboog, L. 2011. The performance of the European market for corporate control: Evidence from the 5th takeover wave. *European Financial Management* 17(2): 208-259.

[62] Moeller, S.B., Schlingemann, F.P., and Stulz, R.M. 2005. Wealth destruction on a massive scale? A study of acquiring-firm return in the recent merger wave. *Journal of Finance* 60(2): 757-782.

[63] Mulherin, J.H., and Boone, A.L. 2000. Comparing acquisitions and divestitures. *Journal of Corporate Finance* 6(2): 117-139.

[64] Parrino, J.D., and Harris, R.S. 1999. Takeovers, management replacement, and post-acquisition operating performance: Some evidence from the 1980s. *Journal of Applied Corporate Finance* 11(4): 88-97.

[65] Rosen, R.J. 2006. Merger momentum and investor sentiment: The stock market reaction to merger announcements. *Journal of Business* 79(2): 987-1017.

[66] Schwert, G.W. 1996. Mark-up pricing in mergers and acquisitions. *Journal of Financial Economics* 41: 153-192.

[67] Schwert, G.W. 2002. Anomalies and market efficiency. Working Paper. No. FR 02-13. University of Pennsylvania.

[68] Smith, R., and Kim, J. 1994. The combined effects of free cash flow and financial slack on bidder and target stock returns. *Journal of Business* 67(2): 281-310.

[69] Varaiya, N.P. 1985. A test of Roll's hubris hypothesis of corporate takeovers. Working Paper. Southern Methodist University.

AGENT-BASED DESIGN OF BUSINESS INTELLIGENCE SYSTEM ARCHITECTURE

Roman ŠPERKA
Silesian University in Opava, School of Business Administration in Karvina
Department of informatics, **Czech Republic**
sperka@opf.slu.cz

Abstract:
Business intelligence is a business management term used to describe applications and technologies which are used to gather, provide access to, and analyse data and information about the organization, to help make better business decisions. The multi-agent approach provides a feasible solution for construction of the business intelligence system. This paper firstly briefly introduces the traditional business intelligence architecting principles and multi-agent approach. Secondly, a design of business intelligence system architecture is proposed, which is composed of the system framework, agent description and system workflow. This design allows to reduce effectively the construction costs of business intelligence systems and to extend the applied scope of business intelligence by minimizing the amount of data transfer and data storage. Using the predictive functionality of the system can bring a significant competitive advantage of business units. The paper presents a new approach for business intelligence architecture modelling, representing an extension over existing systems.

Keywords: multi-agent, business intelligence, software agent, architecture, MAS.

JEL Classification: C63; C88; Y80; M29

1. Introduction

Business intelligence (BI) is a business management term used to describe the applications and technologies used to gather, provide access to, and analyse data and information about an enterprise, in order to help them to gain more competitiveness. (Nicholls 2006)

BI technologies include traditional data warehousing technologies such as the reporting, ad-hoc querying, and online analytical processing (OLAP). More advanced BI tools also include data-mining, predictive analysis using simulations, web services and advanced visualization capabilities. Traditionally, BI systems have been architected with the focus on the back-end, which is usually powered by data warehousing technologies. Lately, architectures for BI have evolved towards distributed multi-tier analytic applications. (Wu, Barash, and Bartolini 2011)

In this paper we describe the architecture of BI system based on the multi-agent approach (Spišák, and Šperka 2011). The existing approaches to construction of the BI system seriously hampered the popularization and development of BI because of the high construction costs. This work introduces multi-agent technology into the design of BI system to provide the prediction possibilities and to effectively reduce the construction costs of BI system.

This paper is structured as follows. Section 2 briefly introduces the traditional BI architecting principles and the BI framework is explained in more detail. In section 3 the multi-agent approach is presented. In order to explain the use of mobile agents in our proposal the advantages of this type of agents are declared. Section 4 presents the design of the BI architecture based on the multi-agent approach in detail.

2. Business intelligence architecting principles

As Figure 1 shows, BI is a process that involves two primary activities: getting data in and getting data out. According to (Watson, and Wixom 2007) getting data in, traditionally referred to as data warehousing, includes moving data from a set of source systems (e.g. legacy systems, CRM, ERP and OLTP applications) into an integrated data warehouse. The source systems typically represent heterogeneous technical platforms and data structures. Sources can reside within the organization, be supplied by an external provider, or come from a business partner.

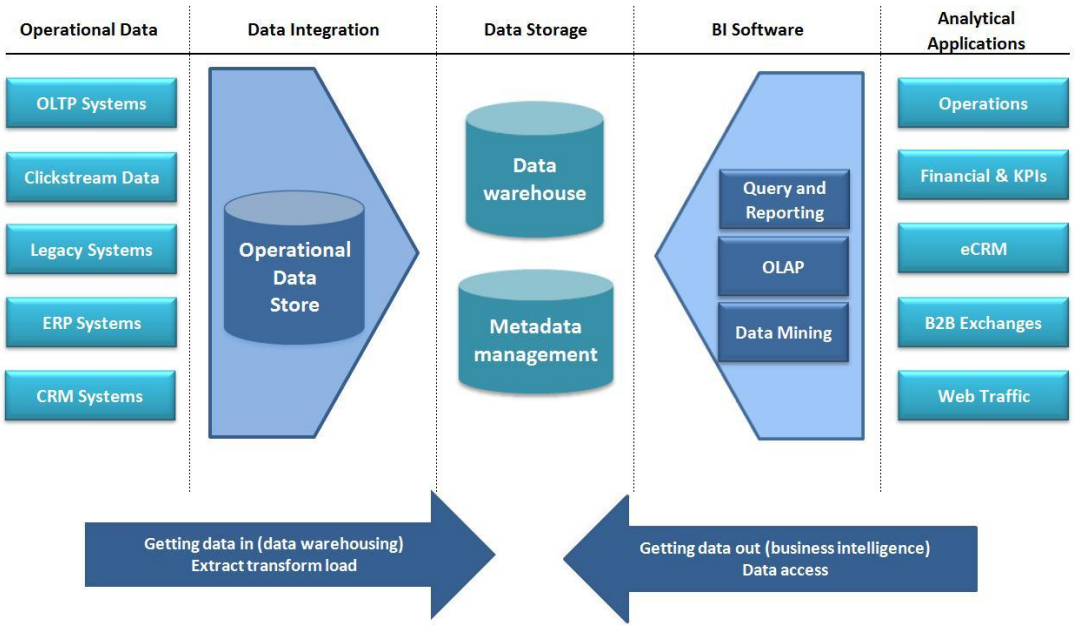


Figure 1. Business intelligence framework.

Source: own

A data warehouse team extracts data from the source systems and transforms it so that it is meaningful for decision support. For example records from several systems can be matched and consolidated based on a customer identification number, or all currency fields can be converted into Euros. Sometimes the warehouse team creates new fields during data transformation, such as time period totals or customer value scores.

Getting data in is the most challenging aspect of BI, requiring about 80% of the time and effort and generating more than 50% of the unexpected project costs. The challenge stems from multiple causes, such as poor data quality in the source systems, politics around data ownership, and legacy technology.

The data warehouse team places the transformed data into a data store that is subject-oriented, integrated, time-variant, and non-volatile (Inmon 2000). Depending on the architecture, the data warehouse may feed dependent data marts, which have a more narrow scope than a warehouse; marts focus on a particular functional area, geographic region, application, or organization division. Maintaining decision support data in a warehouse or marts that source their data from the warehouse ensures "a single version of the truth". Virtual representation of the data mart is multidimensional (OLAP) cube that allows easier visualization and reporting. OLAP cubes structure data hierarchically – the way managers think of their departments - but also allows users to rotate that data, changing the relationships to get more detailed insight into performance. This feature also provides advanced capabilities for complex calculations, trend analysis, and sophisticated data modelling. Once a user has the data in the order and format they desire, they can easily present their data graphically through charting on the fly, or export the data to excel to share with others. Advanced users can also perform statistical analysis with longitudinal (year over year) studies.

Metadata plays a key role in data warehousing because of the complexity of the data migration process. Data warehouse teams and business users must understand many characteristics of the data to manipulate and use it effectively. Metadata is technical and business in nature; it describes field values, sizes, ranges, field definitions, data owners, latency, and transformation processes. Metadata provides transparency as data moves from sources to the warehouse to end users.

Getting data in delivers limited value to an enterprise; only when users and applications access the data and use it to make decisions does the organization realize the full value from its data warehouse. Thus, getting data out receives more attention from organizations. This second activity, which is commonly referred to as BI, consists of business users and applications accessing data from the data warehouse to perform enterprise reporting, OLAP, querying, and predictive analytics.

The principal objectives of BI can be summed as follows:

- To provide a "single version of the truth" across an entire organization.
- To provide a simplified system implementation, deployment and administration.
- To deliver strategic, tactical and operational knowledge and actionable insight.

Because of the focus on information in BI applications, the privileged point of view of the supporting architecture has to be the information view (Putman, and Boehm 2000). From this point of view, the most popular paradigms (Bussler 2003), (Ariyachandra, and Watson 2005), (Ariyachandra, and Watson 2006) are:

- The hub-and-spoke architecture with centralized data warehouse and dependant data marts.
- The data-mart bus architecture with linked conformed dimensional data marts.
- Independent non-integrated data marts.

Figure 2 represents a typical layered vertical view of architecture for BI. In today's heterogeneous environments where many disparate systems and domains hold different parts of the necessary data, the most difficult challenges in achieving the above mentioned objectives are effective information delivery and technology integration.

Initially, BI reduces IT infrastructure costs by eliminating redundant data extraction processes and duplicate data housed in independent data marts across the enterprise. BI also saves time for data suppliers and users because of more efficient data delivery. As business users mature to performing analysis and prediction, the level of benefits become more global in scope and difficult to quantify.

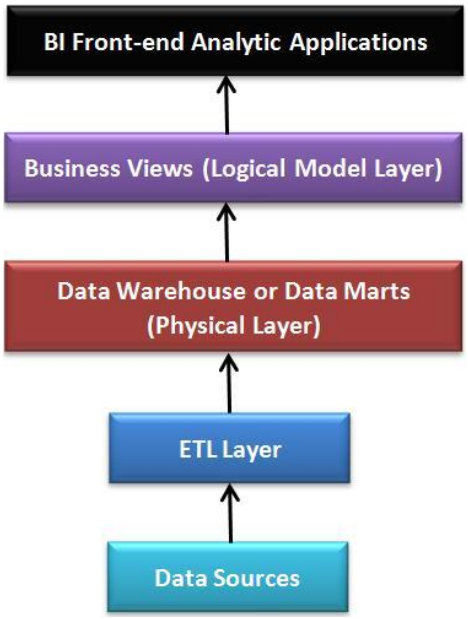


Figure 2. Conceptual architecture for business intelligence.
Source: adapted from (Wu, Barash, and Bartolini 2011)

We bring the advantages of multi-agent approach to above mentioned architecting principles to give a BI design which can reduce the construction costs of BI system and extend the applied scope of BI by minimizing the amount of data transfer and data storage. In next section, our understanding of the multi-agent approach principles will be explained.

3. Multi-agent approach

Multi-agent system (MAS) is a dynamic system, composed of a number of mutually interacting active and autonomous components, called agents. The term agent is very widespread. It may indicate (Burian 2010) the community, body or physical system (e.g. robot), which exists in the real world. In the context of multi-agent systems, however, the term generally refers to any relatively autonomous software application or only to a small part of it.

There are many sources, indicating the various definitions of an intelligent agent. For the purposes of this paper the definition of (Kubík 2004) appears to be optimal saying that the agent is an entity designed for the purpose to fulfil its objectives in an adequate environment. The functions of an agent are based on perception through sensors and actuators. Agent influences the conditions in the

environment to achieve the objectives. Some sources (e.g. Wooldridge 2009) depict the agent as a real or virtual object, placed in an environment, where it can act and perceive the environment. Agent is able to communicate with other agents. It has an autonomous behaviour, which is based on its observations, knowledge and interactions with other agents.

Within this definition some of the principles of an agent are listed:

- **Location** – the agent must be located in some environment. Its specific behaviour always depends on the environment. Behaviour of other agents also depends on what each of them is performing in an environment.
- **Carnality** – the agents must be able to perceive and to affect their environment, including other agents. It must have something that creates its decisions.
- **Intelligence** – intelligence of an agent is the result of each conflict with the environment and appropriate responses.
- **Synergy** – an agent affects other agents and reacts to their behaviour. This principle is an explicit expression of one of the characteristics, of the location.
- **Autonomy** – an agent performs actions at its own discretion. This principle is an explicit expression of one of the characteristics, of carnality.
- **Emergence** – a prerequisite for the emergence of this principle are all characteristics, listed above. The emergency concerns the whole system. In coordination of the agents are emerging new system properties, which are not properties of individual agents. These properties, however, are based on the experience with similar systems and can be expected or even planned.

An important characteristic of an agent is the ability. The ability means the characteristic of an agent to perform a task. Agent may have the ability to answer questions, to provide information about its condition, to solve differential equations, to transfer goods with certain size and weight, to look for metal objects and to avoid obstacles etc. For the purposes of this article we abstract from one of the agents principle, from the physicality. We consider an intelligent agent in the form of interactive software component. Agent underlies the whole system.

The interaction between agents is controlled by the rules set out in an interaction protocol. In this instance agents must be able to reach compromise, resolve conflicts, and allocate resources by agreement (Fasli 2006). A negotiation situation is generally characterized by three elements. Firstly, a negotiation set is provided which can be used as a collection of possible offers that an agent can make. Secondly, the specific protocol that is used controls the agent's interaction and finally, the strategies that have been defined for the agent to use. These are private and may take other agent strategies into account. A negotiation protocol is separated into admission rules, interaction rules, validity rules, outcome determination, withdrawal rules, termination, and commitment rules. Finally the chosen protocol is dependent on agent system itself; this includes the number of attributes that an agent is to have, and the number of agents present. (Alshammri 2009)

Agent architectures can be based on logic, reaction, belief-desire-intention, or hybrid. Logic-based agents utilize mathematical equations to model the surrounding environment and the rules for the decision inference. A disadvantage of logic-based agents is the difficulty with the modelling of the surrounding environment. It is difficult to find a form that is suitable to allow the agent to perform the necessary reasoning, planning and action in time. Reactive architectures utilize a direct link to the environment by building the representation into the sensory capabilities of the agent. An advantage of reactive agent architectures is that complexity is reduced due to the removal of an internal representation of the surrounding environment. However, the planning capability of the agent is reduced as it requires large amounts of information to determine the current state. (Fazlollahi 2010)

BDI stands for (B)eliefs, (D)esires and (I)ntentions, which are mental components. In short, belief represents the agent's knowledge, desire represents the agent's goals and intention lends deliberation to the agent. The beliefs of an agent represent the agent's knowledge. The content of the knowledge can be anything, for example knowledge about the agent's environment or about its history. The desires of an agent are a set of long-time goals. A goal is typically a description of a desired state of the environment. The desires provide the agent with motivations to act. The goals in the desires may be contradictory, so the system has to have some way to choose which goal to attempt to fulfil first, this is what the intentions are for. This last mental component is the most widely varied from application to application. Some view the intentions as a subset of the desires, while others consider

the intentions as a set of plans for achieving the goals in the desires. In the first case the intentions contain some of the goals from the desires. These goals should not contradict each other. The intentions are viewed as something the agent has dedicated itself to trying to fulfil. This lends stability to the system since it means that the agent will not try to attain contradictory goals.

We know more types of intelligent agents (e.g. Wooldridge 2009). Two basic groups are called stationary and mobile agents. Stationary agents exist as a single process on one host computer; mobile agents can pick up and move their code to a new host where they resume executing. Mobile agents are able to change platforms and environments; stationary agents are not. From a conceptual standpoint, such mobile agents can also be regarded as itinerant, dynamic, nomadic, wandering, roaming, or migrant. The rationale for mobility is the improved performance that can be achieved by moving the agent closer to the services available on the new host.

Some authors describe the attributes of stationary and mobile agents as follows (Odell 2010). When a stationary agent requires processing on a different platform, it must employ the services of another agent. Here, a communication (or request) conveys the intention to invoke a specific operation (via an RPC – Remote Procedure Call). The operation is then executed and the results (or reply) are returned to the requesting agent. Using stationary agents, then, has the following advantages:

- Reduces the complexity required for mobility.
- Encourages specialization within platforms.
- Employs well-established protocols.
- Supports closed-environment philosophy.

Disadvantages:

- Results in performance problems in those situations requiring high volume or frequency.
- Results in processing inefficiencies because having many specialized agents create more work than having a single mobile agent.
- Reduces effectiveness when a connection is lost.

In contrast, mobile agents use the network to exchange information primarily by changing platforms and environments using the remote programming (RP) technique. When a mobile agent requires processing on a different platform, it physically relocates to the desired server. This requires that all structural and behavioural properties of the agent must be transferred during migration and that any environmental differences be changed or accommodated. The big issues here are how much time is required to prepare for migration, how much data is actually transferred, and the performance of the transfer communication. The advantages of mobile agents are that they:

- Reduce network load;
- Reduce network-related delay;
- Reduce resource usage of clients;
- Enable distributed problem solving;
- Support asynchronous, autonomous processing;
- Promote reconfigurable or customized services;
- Make active behaviour scenarios conceivable;
- Enhance decentralization options.

Disadvantages:

- Involve a number of security issues such as the identification and authentication of agents, protection from destructive agents, as well as the assurance of the agent's willingness and ability to pay.
- Require transport/migration mechanisms be added to software environments - thus increasing their complexity.
- Have no industry standards for agent environments, migration approaches, or for measuring and billing resource consumption.
- Have not yet been used in an environment containing a large number of mobile agents.

We design BI system architecture adopting the principles of MAS. Main tasks of BI process could be solved on the local using collaboration between intelligent agents at all stages of BI (e.g. data integration, OLAP, data mining and prediction). This approach avoids a lot of data movement and storage.

4. Business intelligence architecture and operation mechanism based on agents

In this section we propose BI system architecture based on the multi-agent technology. We based our research on the architecture presented in (Yong *et al*. 2010). We used the declared description of BI framework, core functions and operations and we extended this architecture with prediction possibilities.

Many tasks, for example metadata extraction, data query, analysis, mining, prediction etc., could be completed by agents as to reduce the cost of data movement and storage. The design consists of three elements, namely framework, agent descriptions and workflow of the system.

4.1 Agent descriptions

In our design, there are eight agents, namely user agent, user management agent, task agent, OLAP agent, data mining agent, prediction agent, data management agent and data source agent.

- *User agent.* This agent is located in the user layer, created by user management agent when user logs and destroyed when user exits. The main function of user agent is to aid users to acquire BI services better. That includes: sending request to the request list, clarifying service request by interaction with user and displaying the results in the form of user's preference.
- *User management agent.* This agent is located in the agent layer and mainly achieves the following function: managing the user agent, offering the query of sharing results, managing user profile base and sharing knowledge base, finishing certain tasks instead of user according to analysing user's historical behaviour record and carrying out some intelligent services (e.g. collaborative recommendation).
- *Task agent.* The main function of this agent is to assign the tasks based on the matchmaking between requests and services. That includes: assigning request to the corresponding service unit based on matchmaking between user's requests and service items and managing request list and service list.
- *OLAP agent.* The main functions of this agent include: aggregating the relevant data in the form of multidimensional cube according to the user's request, and providing the multidimensional data analysis function, such as slice, dice, rotation, drill-down, drill-up etc.
- *Data mining agent.* This agent mainly achieves the function of data mining. There are many types of data mining algorithms e.g. classification algorithms, clustering, regression, rule discovery algorithms etc. It executes the data mining tasks according to different strategies. It cooperates indirectly with the prediction agent through data bus. In accordance with the prediction agent (on the user's request) it runs different algorithms. The result of the analysis uses prediction agent as a service provided to the user agent. The workflow of data mining tasks is as follows: Firstly, the data mining agent reads metadata from the metadata base to clarify the location of data resources. Then, it decomposes the mining request based on the metadata until each decomposed data mining sub-task can be completed at local data sources. Finally, the data mining algorithms which could finish the corresponding sub-tasks are executed and the results are returned to the data mining agent. Data mining algorithms are used so that only identification numbers of algorithms are sent to the data source agent and the data source agent calls the native code of corresponding algorithm. This can reduce the data flow on the network.
- *Prediction agent.* This agent is located in the agent layer. It provides functionality to predict the business results to the user through the data bus in the agent layer. It cooperates indirectly with the data mining agent. The results of the data mining analysis are used to simulate the business behaviour of the data resources owner. It uses many methods e.g. wavelet network, neural network, Box-Jenkins method, Mackey-glass time series etc.(Tamura *et al.* 2008). The prediction agent represents the proposed extended approach to BI and, in our opinion, can bring a significant BI extension resulting in a significant competitive advantage.
- *Data management agent.* Main functions of this agent are routine maintenance and implementation of the tasks. Routine maintenance achieves the monitoring of various data sources, integrating the metadata through the ontology mapping, summarizing the local metadata of various data sources, establishing the global metadata stored in the metadata

base which provides the call for other service units and maintaining and updating the metadata base. Implementation of tasks receives assigned task about the data query, sends the task to the corresponding data source agent and integrates the results.

- *Data source agent.* This agent manages the various types of data resources. That includes structured, semi-structured data and unstructured data. It provides services to upper layers. The main functions of this agent are receiving the calls of the data query, to provide the data sets for query and analysis, the extraction and the mining to complete the corresponding task. It also establishes and maintains local metadata, and sends the local metadata to the data management agent.

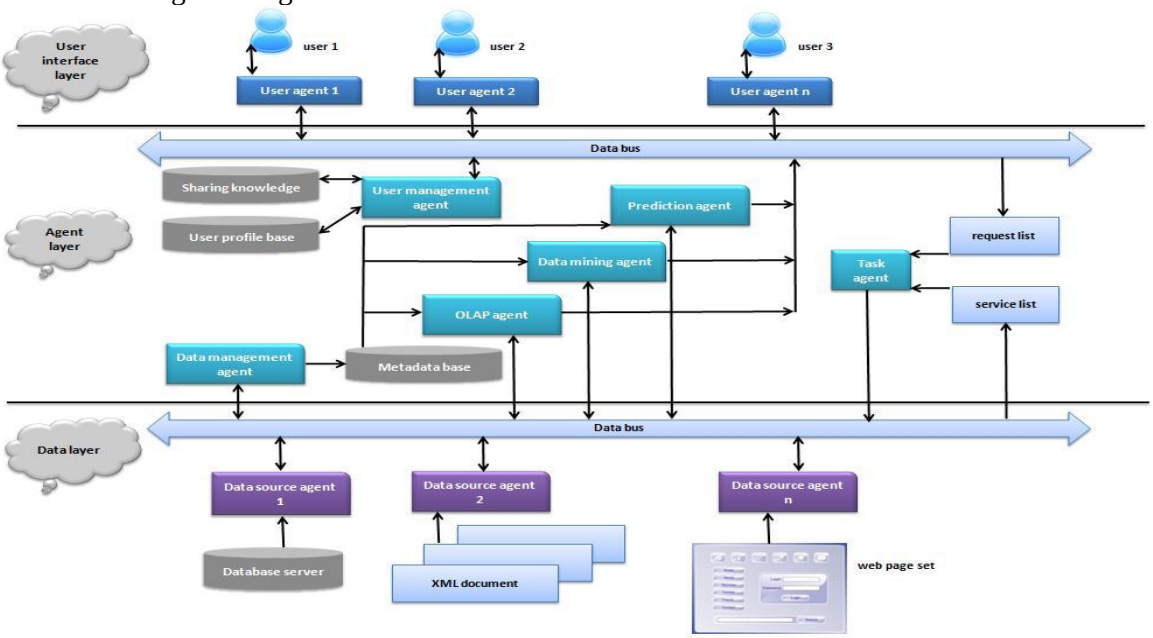


Figure 3. Architecture of BI system.

Source: own

4.2 BI system workflow

The proposed BI system based on the multi-agent approach runs according to the workflow as follows.

After users logging on the BI system user's identity is verified. User management agent automatically creates a user agent for every user. The user agent is also responsible for the standardization of service requests and the visualization of results. User agent's lifecycle ends when user exits the system. When a user requests the service, the user management agent receives the request message from the user agent and tries to retrieve the similar sharing knowledge from the history stored in the sharing knowledge base. If it exists, the user management agent returns the result to the user. This avoids the negative impact on the system performance when similar requests appear. Otherwise, the request is sent to the task agent for farther processing. At the same time, the user management agent can predict the service requests of the user according to the user's history behaviour records stored in the user profile base.

Task agent puts the received service request into the request list, and then sequentially matches the description of the request in the request list with the record of service in the service list. Task agent sends the request to the corresponding agent according to the degree of matchmaking and the assignment strategies. Agents receive the service request sent by the task agent, complete the assigned tasks and directly return the result to the request initiator – to the user agent. The results are also stored in the sharing knowledge base.

Conclusion

This paper proposes the architecture of BI system based on the multi-agent approach. Presented architecture is described in three elements in detail, namely BI system framework, agent description and BI system workflow. The application of designed system can effectively reduce the construction

costs of BI systems and extend the applied scope of BI by minimizing the amount of data transfer and data storage. Using the predictive functionality of the proposal can be a significant competitive advantage of business units.

The outline of the architecture can be seen as a basis for the further research especially in the specifying the algorithms used for prediction and in order to develop such implementation for the real existing companies.

References

[1] Alshammri, G. 2009. Investigation of agent or multi-agent technologies in e-commerce systems. IJCSNS International *Journal of Computer Science and Network security*, Vol. 9, No. 10.

[2] Ariyachandra, T., and Watson, H. 2005. Key factor in selecting a data warehouse architecture. *Business Intelligence Journal*, Vol. 10, No. 2, pp. 19-26.

[3] Ariyachandra, T., and Watson, H. 2006. Which data warehouse Architecture is most successful. *Business Intelligence Journal*, Vol. 11, No. 1, pp. 4-6.

[4] Burian, J. 2010. Multiagentní modely sociálních organizací. Vysoká škola ekonomická, Prague, pp. 6. Available from: https://eldar.cz/honza/articles/burian_agents.doc

[5] Bussler, C. 2003. *B2b Integration*. Springer-Verlag, New York, USA.

[6] Fasli, M. 2006. *Agent Technology for e-Commerce*. Wiley & Sons, Chichester.

[7] Fazlollahi, R. 2004. Multi-agent DSS for supporting e-commerce decisions. *The Journal of Computer Information Systems.*

[8] Inmon, W.H. 2000. Building the Data Warehouse: Getting Started. Billinmon.com. Available from: http://inmoncif.com/inmoncif-old/www/library/whiteprs/ttbuild.pdf

[9] Kubík, A. 2004. *Inteligentní agenty: Tvorba aplikačního software na bázi multiagentových systémů*. Computer Press, Brno.

[10] Nicholls, C. 2006. BI 2.0 – how real time Business Intelligence is irrevocably changing the way that we do business – In Search Inside. Available from: www.seewhy.com

[11] Odell, J. 2010. *Agent Technology: An Overview*. jamesodell.com.

[12] Putman, J., and Boehm, B.2000. *Architecting with RM-ODP*. Prentice Hall, ISBN: 0130191167.

[13] Rui, J.G. 2006. The study of flexible business intelligence platform based on multi-agent for Small and Medium-sized Enterprises. *Commercial Research*, Vol. 346, pp. 43-46.

[14] Spišák, M., and Šperka, R. 2011. Financial market simulation based on intelligent agents – Case Study. *Journal of Applied Economic Sciences*, Volume VI, Issue 3(17).

[15] Tamura, H., Tanno, K., Tanaka, H., and Zhang, Z.2008. Bi-directional function learning method for time series prediction. ICIC Express Letter, Vol. 2, Num. 4, pp. 401-407.

[16] Watson, H., and Wixom, B. 2007. *The current state of business intelligence*. IT Systems Perspectives, pp. 96-99.

[17] Wooldridge, M. 2009. *MultiAgent Systems: An Introduction to*. 2nd edition, John Wiley & Sons Ltd, Chichester, ISBN: 978-0470519462.

[18] Wu, L., Barash, G., and Bartolini, C. 2011. A service-oriented architecture for business Intelligence. HP Software Laboratories. Available from: http://www.hpl.hp.com/personal/ Claudio_Bartolini/download/soca07.pdf.

[19] Yong, Feng, Liu, Yang, Li Xue-Xin, Gao, Chuang, and Xu Hong-Yan. 2010. Design of the low-cost Business Intelligence System Based on multi-agent. Information Science and Management Eingeneering (ISME), International Conference of, ISBN: 978-1-4244-7669-5, pp. 291-294.

FACTORS THAT DETERMINE SUCCESS OF SMALL AND MEDIUM ENTEPRISES. THE ROLE OF INTERNAL AND EXTERNAL FACTORS

Wadim STRIELKOWSKI
National University of Ireland Galway, **Republic of Ireland**
Charles University in Prague, **Czech Republic**
strielkowski@fsv.cuni.cz

Abstract

The paper investigates how the success of an enterprise, particularly a small enterprise, can be measured and quantified. The methodology undertakes a review of the state-of-the-art and comes with own suggestions for defining factors (or indicators) that determine success of small and medium enterprises (SMEs). The paper presents different approaches to defining enterprise success and discusses whether subjective or objective measures should be applied.

Our findings directly inform the theoretical model presented in this study. The literature review enabled to draw both the theoretical model and the economic model that would test the success factors and their potential impact.

This study offers an insight into the SMEs issue and their functioning on the market. The results have significant implications for the researches and policy-makers and can become a basis for preparing relevant enterprise support policies.

Keywords: small and medium enterprises, theory of the firm, internal and external factors of enterprise success, economic modelling.

JEL Classification: L25, L26, P36, Q01, Q10, R10

1. Introduction

This paper presents an overview and an insight of both internal and external factors that form the small enterprise success. Amongst various definitions of firm's success that are outlined and discussed in research literature, one can identify factors influencing small and medium enterprise success.

In general, two groups of factors (those internal to the firm and external to the firm) can be outlined. In addition, factors that could potentially have some positive impact on enterprise growth and success might be further selected for an additional analysis and tested by the means of the econometric model.

This paper is organized as follows. Section 2 presents an overview of the definition of a small enterprise success. Section 3 describes the indicators of success. Section 4 discusses some potential pitfalls in using various measures of success. Section 5 introduces the internal and external factors of enterprise success and assessed their impacts. Section 6 outlines an economic model for testing the small enterprise success. Section 7 summarizes the main findings and draws main conclusions and discussions.

2. Defining small enterprise success

In neoclassical and industrial economic theory, the main goal of the enterprise is to maximize profits or minimize costs (so-called "duality theory"). According to neoclassical and industrial economics, the most successful enterprise will be the one with the highest profits. Moreover, profits and costs are easily quantifiable factors that can be relatively easily measured. Therefore, it is not difficult to define an enterprise's "success" using the neoclassical approach.

However, enterprises in the real world may have goals other than maximizing their profits and minimizing their costs. Therefore, their measures of "success" might be not easy to put into quantifiable (or objective) terms. For instance one can see that in small enterprises, financial performance and success is not the same thing (Kotey, and Meredith 1997). The entrepreneurship route to success is not just creative, but also opportunity-driven (Fry 1993). According to Timmons (1999), enterprise success cannot just be explained by a single definition but is a rather complex and holistic fit and balance of several factors. However, neither the compendious *Encyclopedia of Small*

Business (Hillstrom, and Collier 1998), or indeed the authoritative *Handbook of Entrepreneurship* (Sexton, and Landstrom 2000) and likewise the *Handbook of Entrepreneurial Research* (Acs, and Audretsch 2003) expressly index either success or failure.

Some authors define enterprise "success" as an enterprise's survival on the market for a period of at least two to three years (Carter *et al*. 1997; Boden, and Nucci 2000). Hornaday, and Bunker (1970) define a "successful" entrepreneur as an individual who started a business, built it up where no previous business had been functioning, and continued for a period of at least five years to the present profit-making structure (Hornaday, and Bunker 1970). Other studies on the personality of entrepreneurs (Gatewood, 1995; Perry *et al*. 1988; Begley, and Boyd 1987) defined "success" more in financial terms, linking the most common characteristics found among entrepreneurs to measures like return on investment, growth in sales, and yearly profit, or to the personal income of the owner/manager of the business. According to Driessen, and Zwart (2006), three main characteristics of success can be deduced, followed by five secondary ones: (i) the need for achievement, (ii) an internal locus of control and (iii) a risk-taking propensity. The secondary characteristics include: (i) the need for autonomy, (ii) the need for power, (iii) a tolerance of ambiguity, (iv) the need for affiliation, and (v) endurance.

Though the relationship between the characteristics of enterprise and success measured in terms of survival is more convincing than that of success measured in financial terms, there are reasons to believe that it might not be so in some countries (Honig 1998; Kantor 2002).

In this discussion of enterprise success, it should be noted that there is one main difference separating micro-enterprises from large and medium enterprises. In micro-enterprises, which are the focus of this research, the goals of the enterprise are usually determined by the enterprise's manager who is in the majority of cases also its owner. Thus, the micro-enterprise's success is something that its owner/manager considers to be his or her ultimate end-goal and desire. In another words, the manager/owner sees success as a personal subjective evaluation of the enterprise's success.

Studies on the role of the entrepreneur in small firms show that small business success can be measured by financial and non-financial criteria, although the former has been given most attention in the literature (Walker, and Brown 2004). Things like personal satisfaction, achievement, following friends or family, and the need for change might be of higher value for small enterprises' owners/managers than increase in profit or turnover and/or a higher numbers of employees. The only problem with those criteria is their qualitative (and subjective) nature that differs from person to person. With regard to this issue, Dess, and Robinson (1984) suggest using a combination of objective and subjective measures to assess the success of the enterprise (Dess, and Robinson 1984).

Therefore, which measure of enterprise success makes the most sense? It depends on conditions and methodology. Entrepreneurial research literature usually focuses on such economic outcomes of enterprise (and particularly micro-enterprise) success as: profitability, turnover, sales and employment (Chaganti, Chaganti, and Mahajan 1989; Du Rietz, and Henrekson 2000; Hornaday, and Wheatley 1986). Honig (1998) looked for determinants of success in 215 selected Jamaican micro-enterprises using a log of average monthly profit as the measure of success, determined through extensive interviews with business owners at the site of their activities (Honig 1998). The author concluded that studies which try to estimate such criteria as enterprise success often: "*rely upon household surveys conducted by census takers or large scale research projects funded by multilateral organizations. Although these techniques provide a robust number of cases, there continues to be considerable speculation as to their accuracy, particularly regarding issues such as income, which are sensitive to regulation and taxation*" (Honig 1998). Hence, the economic literature suggests that objective (financial) measures of success should prevail over the subjective (qualitative) ones. Accordingly, a micro-enterprise's success can be equated to the achievement of positive economic growth in terms of its economic indicators: profitability and employment.

Generally, in every sector of the economy there is a proportion of micro-firms that achieve rapid growth. This group of firms is of special interest for a number of reasons:

(i) These firms are the major direct providers of new employment opportunities within the sector of micro-firms;

(ii) Fast-growing micro-firms are of interest to providers of finance, whether in the form of loan or equity capital;

(iii) Fast-growing micro-firms are potentially interesting for different types of advisory services – such as accountants, management consultants, etc., because such firms are more likely to seek such advisory services.

Every business firm experiences a cycle: at first its priorities are basically surviving on the market and stabilizing its position, while in the long run the priorities change to the attainment of positive profit and success, which can be measured using different indicators - from profit per employee to gains per unit of production (Storey 1994).

The significance of the micro-firm's growth is usually expressed by the contribution it makes to employment (i.e. the creation of new work places, improving the social situation). Although some authors suggest that only a modest proportion of small firms make the most significant contribution to job generation (Gallagher, and Miller 1991), their impact on job creation is surely indisputable. The samples reveal different stories, and it is clear that small firms are not homogeneous. Firms are usually divided into "failures", "trundlers" and "flyers" (i.e. those high-flying firms, the family's silver). The long-term contribution of the "flyers" in terms of job creation substantially exceeds that of the two other groups (Storey 1994). In addition, the five stages of enterprise growth (from Inception to Maturity) can be classified (Table 1).

The five stage model (Table 1) has some limitations. As Storey (1994) points out, there are four major considerations to be taken into account. Not all firms begin at Stage One and move to Stage Five. Some of the firms never progress beyond Stage Two. In practice, the firm may well have a management style which is more or less advanced than the stage, for example, of its organizational structure. Firms may achieve a particular stage (survival) and never have any intention to move beyond that stage. Stage theorists (such as Bruce himself) assume that the movements from one stage to another are "triggered" by a point of crisis (Storey 1994).

Table 1. Management role and style in the five stages of small business growth

Stage	Top management role	Management style	Organization structure
1. Inception	Direct supervision	Entrepreneurial, individualistic	Unstructured
2. Survival	Supervised supervision	Entrepreneurial, administrative	Simple
3. Growth	Delegated/co-ordination	Entrepreneurial, co-ordinate	Functional, centralized
4.Expansion	Decentralization	Professional, administrative	Functional, decentralised
5. Maturity	Decentralization	Watchdog	Decentralised functional/product

Source: Scott, and Bruce (1987)

By and large, when considering the growth of a small firm, three basic components can be identified on the grounds of existing literature: (i) the starting resources of the entrepreneur (start-up capital); (ii) the firm itself; and (iii) the strategy of the firm. In general, there are 15 factors according to Storey (1994) that might influence the growth of small firms (Table 2).

Speaking about small business failure, it is useful to understand that failure is a ubiquitous part of the business sector. It also appears that the owners of young firms are more likely to suffer from inadequate funding, poor products and inefficient marketing (Hall, and Young 1991). As their companies age, they are more likely to be damaged by strategic and environmental shocks for which they did not have the managerial skills to respond and take necessary measures.

There is a long history of research on the risk of business failure, which derives its intellectual inspiration from the contribution of Altman, and colleagues (Altman 1968). They took conventional financial ratios measuring liquidity, profitability, gearing, etc. and identified the most appropriate combination that provides the points that best distinguish these failed from non-failed businesses. It is possible to use this combination of ratios, appropriately weighted, to produce a so-called "ZETA-score,"[25] which would provide an indicator of the extent to which an individual business was the risk

[25] ZETA-score is an indicator of the extent to which an individual business is at risk of failure, calculated using the conventional financial ratios measuring liquidity, profitability, gearing, etc. and identifying the most appropriate combination that provides the best distinguishing points of these failed and non-failed businesses (Altman 1968).

of failure. This ZETA score can be calculated or predict impending failure. This type of work is, however, open to criticism due to its absence of any clear theoretical criteria, the lack of explanation for business failure, its insufficient analysis based on financial ratios and its use of a methodology suitable for large firms (Storey 1994).

Table 2. Factors influencing growth in small firms

The entrepreneur/resources	The firm	Strategy
1. Motivation	1. Age	1. Workforce training
2. Unemployment	2. Sector	2. Management training
3. Education	3. Legal form	3. External equity
4. Management experience	4. Location	4. Technological sophistication
5. Number of founders	5. Size	5. Market positioning
6. Prior self-employment	6. Ownership	6. Market adjustments
7. Family history		7. Planning
8. Social marginality		8. New Products
9. Functional skills		9. Management recruitment
10. Training		10. State support
11. Age		11. Customer cooperation
12. Prior business failure		12. Competition
13. Prior sector experience		13. Information and advice
14. Prior firm size experience		14. Exporting
15. Gender		

Source: Storey (1994), p.123

North *et al.* (1992) examines characteristics of survivors and non-survivors to identify the characteristics of adjustments which the surviving firms made over a long period of time. The results were: (i) product and market adjustments; (ii) production process adjustments; (iii) employment and labour process adjustments; (iv) ownership and organizational adjustments; and (v) location adjustments (North *et al.* 1992). The research clearly confirmed the hypothesis that the firms which were most active in making adjustments were the most successful in employment change and survival. (Smallbone *et al.* 1992).

Another research study came to the conclusion that management development of markets was essential for most firms for both survival and growth, but that "achieving real growth" required active market development in terms of both the identification of new market opportunities and increasing the breadth of the customer base (Storey 1994).

As Storey (1994) points out, enterprise research also drew an interesting distinction: survival was possible with relatively conservative market strategies, but that managing the product profile was apparently necessary for both survival and growth, in the sense that firms with very different performances all made significant adjustments in their range or mix of products. It was also shown that the declining firms were the ones which undertook the fewest steps to improve competitiveness, and that, when these steps were taken, they tended to focus more on reducing costs, rather than on other dimensions of competitiveness, such as quality improvement.

It is worth mentioning that multiple research studies have identified "internal organisational adjustment" as the second most common type of adjustment characterising surviving firms. High-performing firms were most likely to make to organizational changes which enabled top managers to free themselves of making operational decisions, and instead allowed them to delegate responsibilities more extensively.

In conclusion it should be noted that the enterprise death is particularly typical of the entire small business sector. Although not all micro-firms fail, certain types are more likely to fail than the others. It appears that younger firms are more likely to fail than more mature ones, and that very small enterprises are more likely to fail than their larger counterparts. It also seems reasonable to assume that in the case of young firms, the most powerful influence on their further survival is whether or not they start to grow within a short period of their start-up.

3. Indicators of enterprises success

In this sub-section, indicators used for measuring the success of micro-enterprises are discussed in greater detail.

3.1. Profit and profit per employee as a measure of success

Profit (π) may be defined as total revenue (TR) minus total cost (TC), that is:

$$\pi(y) = TR(y) - TC(y) = py - TC(y),$$

where y is the total output and p is the price unit output. TC is either the firm's short run cost function or its long run cost function, depending on whether we are interested in short run or long run supply. According to the economic theory, the firm chooses its output *y* to maximize its profit $\pi(y)$, taking price as given (see for example Varian (1999) or Mas-Colell (1995) for more rigorous notations on these issues).

It is quite easy to show that profit maximization will be preferable to such objectives as sales revenues maximization or maximization of the size of the firm. Under reasonable assumptions, profit maximization is the goal all owners of firms will agree upon[26]. This can be shown in the following example from a basic microeconomic analysis.

Suppose that a firm with a set of production *Y* is owned by consumers. Each consumer $i = 1, \ldots, I$ shares $\theta_i > 0$ of profits where $\Sigma_i\theta_i = 1$ (some of the thetas can be equal to zero), Thus, if the production decision is $y \in Y$, then a consumer *i* with a utility function $u_i(.)$ achieves the utility level:

$$Max_{x_i \geq 0} \; u_i(x_i) \quad s.t. px_i \leq w_i + \theta_i py,$$

where w_i is the consumer's *i'th* non-profit wealth. At fixed prices, a higher profit increases the consumer's (who might also be the owner of the enterprise) overall wealth and expands the consumer-owner's budget set, which is clearly a desirable outcome (Mas-Colell 1995).

Therefore, it follows that at any fixed price vector *p*, the consumer (or owner, as far as we have accepted the assumption that he or she can also own the firm) unanimously prefers that the firm implements a production plan $y^1 \in Y$ instead of $y \in Y$ whenever $py^1 > py$. Hence, it can be concluded that if the assumption of price-taking behaviour is maintained, all owners would agree, whatever their utility functions, to instruct the manager of the firm to maximize profits.

This result stems from microeconomic analysis and has serious theoretical grounds that support it. However, there are some problems that appear in practice. Obtaining profit data is quite complicated (due to the unwillingness of managers/owners of small enterprises to reveal information on their enterprises' profits) which has limited its application in research (Callanan 2005).

Speaking about profit per employee as the indicator of success, it is obvious that it might be a controversial measure. Profit per employee in micro-enterprises and LEs differs greatly, since an enterprise with higher profits as such but more employees might end up being regarded as less successful in comparison to a sole-trader. However, there are sectors of the economy where profit per employee can be used as a measure of success, such as those where the number of employees in a firm is a reasonable proxy for the firm's capital. Those firms might include small crafts, micro food-processing and the like.

[26] This issue is even clear if there is only one owner of the firm. In this case, a firm owned by a single individual has well-defined objectives, which are those of the consumer. The only remaining issue is whether these objectives coincide with profit-maximization. The implications of the case when the firm is owned by a group of owners also hold true in this case.

3.2. Turnover as a measure of success

The term "turnover" comes from financial terminology but has different meanings in the US and in Europe: while in financial terminology of US "turnover" refers to the rate at which an employer gains and loses his staff, financial terminology in Europe defines turnover as "revenue" (personnel turnover in European financial terminology is called "staff turnover"). Enterprise turnover is a "*business term for the amount of money that a company can receive from its activities, mostly from sales of products and/or services to customers. The equivalent term for individuals is "income"* "(Williamson 1987). Adjusted for inflation, turnover can be a very good measure of an enterprise's growth/success. Several studies have used turnover as a growth indicator (Loscocco *et al.* 1991; North, and Smallbone 2004) in order to explain the correlation between innovation and a firm's growth.

3.3. Employment as a measure of success

Employment in micro-enterprises (or more precisely, the change in the number of full-time employees) is one of the most widely used measures of their success (Varyam, and Kraybill 1994; North, and Smallbone 2000; Hart, and McGuinness 2000; Eröcal 2005). First, increasing the number of employees usually occurs when the enterprise is expanding (Hart *el al.* 2000). Thus, increasing employment represents the most reliable measure of small enterprise growth. Second, one of the most important roles of small enterprises is increasing the economic well-being of its population through the creation of employment. Policy-makers are concerned with this matter, which explains why they are interested in factors that impact employment creation in micro-firms (Barkham *et al.* 1996). All of these items make employment as a criterion of enterprise success a focus point for many studies.

Additionally, the number of a small enterprise's employees is often used as the measure of its size (Loscocco *et al.* 1991). What should be noticed here is that when the employment criterion is used as both the measure of the enterprise size and of its growth/success, some correlation problems might appear.

On the whole, employment can be a good measure of success, although the situation varies from country to country. Sometimes excessive administrative barriers and employment laws (i.e. making entrepreneurs pay their employees different social benefits, certain minimum wage, etc.) might create a situation in which growth/success and employment are negatively correlated.

The number of employees can also be a good measure of success in the scenario when it is a reliable proxy for the value of the firm's capital. Firms producing the same goods are likely to have the same number of employees as far the production process involves the same skills and techniques. In that case it can be implied that an enterprise with 10 employees is two times more successful than the enterprise with 5 employees. However, these results should be carefully interpreted when comparing large and small firms.

3.4. Subjective measures as a measure of success

As it has been noted above, enterprise managers/owners might determine their own measures of success: lifestyle choices, following family tradition or friends, independence, etc. Those criteria are different from conventional objective measures of growth/success, such as profitability or employment (Haslam McKenzie, and Ryan 2000).

The problem these personal measures present is the difficulty one faces when trying to quantify them. However, in some cases, a correlation between the subjective and objective measures of success can be noted. For instance, Besser (1999) who conducted a survey of 1008 managers/owners of small enterprises in 30 small towns in Iowa (USA), asked enterprise managers/owners to rate the success of their businesses on a scale of 1 to 5, and found the responses to be significantly associated with the two objective indicators of enterprise success: % change in employees and forward-planning (Besser 1999).

3.5. Combined methods as a measure of success

Some researchers have attempted to develop methods that use a combination of objective and subjective measures to determine enterprise success. The list of such methods include the Entrepreneurship Scan® (E-Scan) developed by Martyn Driessen, and Peter Zwart from University of Groningen (Driessen, and Zwart 2006), and the method of evaluating business performance involving the use of a "Balanced Scorecard" (BSC) which incorporates financial and non-financial data (Kaplan,

and Norton 1992). However, in the majority of these applications subjective methods only serve as a back-up for quantitative methods (which are often incorporated into computer codes and other sophisticated tools of evaluation).

4. Problems with indicators for measuring success

In general, the problems of measuring specific indicators of enterprise success can be divided into three different groups: access to sensitive data and financial information, methodological and data bias, and subjective indicators bias.

4.1. Access to sensitive data and financial information

The most serious problem with measuring enterprise success lies in obtaining sensitive (usually financial) information from an enterprise's owner/manager. "Sensitive" information is that which cannot be revealed by the enterprise due to some concerns, and may, for example, include profits, tax base, revenues, etc. In most cases, managers/owners are not eager to convey this information to researchers due to the fear of spreading this information to competitors and/or tax offices or other state institutions.

With regard to this issue, Besser (1999) stresses that the consequences of participants' non-responsiveness are not only the reduction in the sample size, but also the introduction of a bias of unknown dimensions into the remaining sample.

It is obvious that in the countries with a totalitarian past (i.e. Poland), the lack of trust in governmental bodies and organs might be higher than in developed market economies. As Kozarzewski (2002) points out, Polish owners/managers of micro-enterprises are very sceptical about the role of the state in their business, particularly when it comes to receiving assistance from the state (Kozarzewski 2002). This is why obtaining financial information about enterprises in Poland is extremely difficult (no direct questions on the state of profits, revenues etc. should be asked).

4.2. Methodological and data bias

Some methodological bias in the data relates to the fact that the data actually gathered represent enterprises that "survived" on the market (Johnson *et al.* 1999). By using the 'survival on the market for a number of years' measure to evaluate outcomes, researchers are left with analysing only "successful" firms and cannot compare them to "unsuccessful" ones. Although some techniques (e.g. econometric tools such as the Tobit model) can be of some help here, the absence of non-survivors could bias the results.

Another bias that could exist is the implementation of the survey itself. It is possible that biases will be introduced through the specific phrasing of questions, or the absence of relevant questions (Callanan 2005).

Yet, another problem might be posed by the various measures of success themselves. For instance, one widely-used indicator of employment, the change in the number of full-time employees, can be of a problematic nature for several reasons. Firstly, small firms may have less flexibility in adjusting employment (Barkham *et al.* 1996). Secondly, due to their size and administrative problems, small firms might employ some people illegally, a notorious trend witnessed in post-communist countries (Chmiel 2001; Kozarzewski 2002). Then the problem arises of what indicator of employment should be used: annual employment, average employment, changes in absolute terms, etc. In addition, if there is a high fluctuation of employees within an enterprise, it might be difficult to indicate the right number of employees and the appropriate time interval to be used for measurement.

Another issue is that different indicators of growth/success can give different results if they are combined together. For instance, an enterprise might seem to grow according to the positive change in its number of employees, but its profit might remain the same. Furthermore, the type of the enterprise and the sample might play a role as well: i.e. enterprises run by younger managers/owners might grow faster (Barkham *et al.* 1996).

4.3. Subjective indicators bias

A survey's subjective answer options (e.g. "very successful," "rather successful," etc.) represent a problem in and of themselves, since they are decided via the personal interpretation of the respondent, and therefore may vary considerably. For instance, using the scales "very successful"

and/or "rather successful" might express a whole different meaning for two different given enterprises or managers/owners, who input their own subjective judgments when answering the surveys.

5. Factors that determine micro-enterprise success

Factors that could have an impact on growth/success can be divided into two main groups: those internal to the firm (owner/manager characteristics and enterprise characteristics) and those external to the firm (see for example Storey 1994; Davidsson, and Wiklund 2001; Barringer 2005). Although it has been attempted to review more recent entrepreneurial literature on factors influencing the success of small business firms, it has to be noted that the substantial part of this research took place in the 1990s and that not much has been done in the 2000s.

Therefore, in some cases the literature review is based on scientific articles that are 10 or more years old. However, this should not be regarded as a limitation of this work, as far as the quality of those works is up-to-date and can be used for the reasoning employed in this thesis.

5.1. Internal factors of small enterprise growth/success

Internal factors include the characteristics of the enterprise, the owner/manager's characteristics (personal and acquired characteristics), motivations, background and strategies. The section below outlines the main internal factors that might influence the growth and success of an enterprise.

(i) Owner/manager characteristics

According to some authors, the manager/owner's characteristics are crucial for the growth and success of a small enterprise (Keats, and Bracker 1988; Gaskill *et al.* 1993; Storey 1994; Davidsson, and Wiklind 2001; Barringer *et al.* 2005; Driessen, and Zwart 2006; Bogdanoiu 2008). Small business literature states that the greatest determinant of a business's success is the entrepreneur him/herself (Mullins 1996; Driessen, and Zwart 2006). By reviewing the entrepreneurial literature, fifteen characteristics of successful rapid-growth firms have been selected. Those manager/owner characteristics are summarized in Table 3 that follows.

Table 3. Entrepreneurial characteristics and their impact on enterprise growth

	Barkham 1992	Hakim (1989)	Woo et al 1994	Kinsella et al (1994)	(1991), Sarasvathy and Wynarczyk	Jones (1991)	Macrae (1991)	Wynarczyk et al (1991)	Storey (1982a)	Storey (1994)	Dunkelberg et al (1987)	Dunkelberg and Cooper (1982)	Kalleberg & Leicht (1991)	Solem & Steiner (1989)	Reynolds & Miller (1989)	Westhead & Birley (1993a)	Reynolds (1993)	Watson et al. (2003)	Fesser & Willard (1990)	Singer (1995)	Sapienza and Grmm (1997)	Hansen (11995)	Barkman (1994(
1. Motivation	+			+	+	+			x			x						x				(+)		X	x
2. Unemployment push				x	x				-	-	-					x	x	-			x	x			
3. Education	x		x	+	+(x)	+	+	+	x	x	(+)	x	+	x	X	x	x	+	+	+	x	+			+
4. Management experience	+		x	x		+		+			x	-	+		X		x				(+)				+
5. No. of founders	+		+	+		(+)						+					x	+	-	-					-
6. Prior self-employment				x		x					x	-		x		x	x								
7. Family history																	x								
8. Social marginality			-								+	x					x			x					+	+
9. Functional skills							+		+											x					+	+
10. Training			x				x		x													x			(+)
11. Age $(Age)^2$				(+) (-)		x x		x x	x x		(+) -		-	-	x x	x x	x x	+ -		x x					
12. Prior business failure						x																			
13. Prior sector experience						x	-				+	-		x	X	x	x	-			+		(+)		+
14. Prior firm size experience			x	x		x						x	-				+				(+)				(+)
15. Gender		x	x	x	x	x	-	x	x		x	x		x		x	x	+		x		x			x

"+" positive relationship between the element and growth of the firm; "-" negative relationship between the element and growth of the firm
"() "Relationship present in a univariate context, but weak in multivariate context. "x" Element not shown to be significant in influencing growth.

Source: Storey (1994); Davidsson, and Wiklind (2001); Barringer *et al*. (2005); own compilation.

(ii) Enterprise characteristics

Certain enterprise characteristics can have a strong impact on a small business's performance. The review of the research literature helped identify eight enterprise characteristics that were found to be important in determining enterprise growth: age, sector/markets, legal form, location, size, ownership, technical advancement (see for example Fratostiteanu 2010) and innovation (Table 4). General review showed that the key characteristics impacting enterprise success and growth usually are: age of the enterprise, legal status of the enterprise and size of the enterprise (Storey 1994; Davidsson, and Wiklind 2001; Prihatin Dwi Riyanti 2004).

Table 4. Entrepreneurial strategies and their impact on enterprise growth

	Cambridge Small Business Research Centre (1992)	Dune and Hughes (1992)	Westhead and Birley (1993a)	Barkham (1992)	Variyam and Kraybill (1992)	Storey (1994)	Hakim (1989)	Kalleberg & Leicht (1991)	Jones (1991)	Dunne et al. (1989)	Johnson (1989)	Raynolds& Miller (1988)	Macrae (1991)	Storey et al (1987)	Kirchhoff (1989b), Zolnierski (2005), Gillet and Lehr (1999)	Aldeida & Kogut (1997), Porter (1998)	Barkman (1994), Watson et al. (2003)	Jaffe et al. (1993)
1. Age	-	-			-	+	-	x	-	(-)				-	X		x	
2. Sector / markets	+	+	+	x	+	+	x	+	+			+	x	x		+		+
3. Legal form						+	+	+			+	+			x		+	
4. Location	+						+		+		+					+		+
5. Size	-	-			-		+	+	-	-	+			-			(-)	
6. Ownership	x				+					+							-	
7. Technical advancement															+			
8. Innovation															(+)	(+		

"+" positive relationship between the element and growth of the firm; "-" negative relationship between the element and growth of the firm; "() "Relationship present in a univariate context, but weak in multivariate context. "x" Element not shown to be significant in influencing growth.

Source: Storey (1994, p. 138); Davidsson, and Wiklind (2001); Barringer *et al*. (2005); own compilations.

5.2. External factors of small enterprise growth and success

External factors of enterprise success are represented by factors that are outside the area of firm's direct influence. However, at the same time, those factors are developed at the local (or micro) level, which is the level we can describe as the micro-environment and which includes single firms and consumers. In what follows, some external factors that can influence the growth and success of small firms are discussed in detail.

The analysis of the entrepreneurial literature included twenty-two original research papers, and helped to identify fourteen different characteristics which can be considered elements of business strategy adopted by the enterprise (the strategy is identified as actions which are taken by the small business owner and enterprise once in business). Four elements in particular are identified as important: sharing equity with external individuals or organizations, creating market positioning, introducing new products and recruiting managers (Table 5).

Table 5. Entrepreneurial strategies and their impact on enterprise growth

	Woo et al (1989)	Dunkelberg et al (1987)	Macrae (1991)	Cambridge SBRC (1992)	Kinsella et al (1994)	Solem and Steiner (1989)	Wynarczyk et al (1993)	Storey et al (1989)	Kalleberg and Leicht (1991)	Westhead and Birley (1993a)	Birley and Westhead (1990)	Siegel et al (1993)	Barringer & Greening (1998), Reid & Smith (2000)	Harrison & Taylor (1997)	Roper et al. (1997), Doorley and Donovan (19990	Pouder & St.Jihn (1996), Porter (1998)
1. Workforce training				x	x		x	(+)					(+)	+	x	+
2. Managerial training			+		(+)		x				+		(+)		x	+
3. External Equity				+	(+)	+		(+)								
4. Technological sophistication				+		+		x	x			+		+		
5. Market positioning			+			+		(+)	x	x	+	+			(+)	+
6. Market adjustments																(+)
7. Planning	+				(+)								+		(+)	
8. New product introduction	+	+			x	+	+	(+)	x		x			+	+	
9. Management recruitment			+				+	(+)				+				
10. State support				(+)	(+)			(+)		x	x					
11. Customer concentration					x			x		-						(+)
12. Competition			x						x	x	x			x		(-)
13. Information advice		+		+	x			(+)		x				+		
14. Exporting				x	(+)			(+)		x					+	

Note: "+" positive relationship between the element and growth of the firm; "-" negative relationship between the element and growth of the firm, "() "Relationship present in a univariate context, but weak in multivariate context, "x" Element not shown to be significant in influencing growth.

Source: Storey (1994); Davidsson, and Wiklind (2001); Barringer *et al.* (2005); own compilations.

6. Economic model

Previous economic analyses of enterprise success are mainly focused on the validity of alternative stochastic growth models that hypothesize the effect of enterprise size, age, legal form, and the like. Most of the studies that try to find determinants of enterprise success are concerned with Gibrat's Law of Proportionate Growth (Evans 1987). However, it seems that more and more studies contradict Gibrat's Law and find a positive correlation between growth and the size of the enterprise (Wagner 1995; Burgel *et al.* 2004). Furthermore, multivariate models with other determinants have been computed. The most frequent determinants include enterprise characteristics, owner/manager characteristics and enterprise strategies.

Most econometric models measuring enterprise success use growth as the success measure (although there are studies that also use average profit or profit per firm or per employee as the measure of success; see for example Honig 1998; Prihatin Dwi Riyanti 2004). Enterprise success is usually explained by the stochastic growth models. Stochastic growth models are the modification of basic growth models with incorporated random shocks (in order to understand business cycles), such as technological progress, shock on the supply or demand side, etc. The best example of a stochastic model on the macro-level is the stochastic version of the Cass-Koopmans model (Romer 2001). Recently, there has been an attempt to adjust stochastic models for the micro-level (small firms, microscopic view). Stochastic growth models (the best example on the micro-level is Gibrat's Law) are characterized by the following features: (i) macro/aggregated dynamics of the model, and (ii) no

fluctuations (Storey 1994). Their basic aim is to reproduce observed power-law distributions, derive growth dynamics from the macro-level and allow for the fitting of real data.

The traditional outlook of any stochastic growth model is presented as a model with two deterministic components (exogenous growth and endogenous growth) and one stochastic component (random growth term ε_t). A model such as Gibrat's Law (the Law of Proportionate Effect) expressed in terms of a stochastic model has two basic assumptions: (i) $\log \varepsilon_t$ is normally distributed and is independent of the size of the enterprise in time t (initial period); and (ii) the mean proportionate growth of a group of enterprises of the same initial size is independent of the initial size (Reid 1993).

Vans (1987) used a modified version of this model, stating that the departures from Gibrat's Law decrease as the firm size increases (Evans 1987). Also in Evans (1987), a modified version of the log-linear form model is developed. The enterprise size is expressed as the number of its employees (Evans uses the term "employment size" and denotes it with S) and the growth rate of the enterprise is expressed as the following:

$$\log(S_{t'} / S_t) / (t' - t) \quad (1)$$

where $S_{t'}$ is the employment size in 1980, S_t is the employment size in 1976 and (t' - t) is the number of years between these two dates (Evans 1987). The growth equation was then expressed by the following regression equation:

$$\log(S_{t'} / S_t) / d = \log g(A_t, S_t, B_t) + u_t \quad (2)$$

where d = t'-t, t'>t, g is a growth function, A, S and B denote age, size and the number of plants respectively. The regression model estimated by Evans (1987) has the following form:

$$\log(S_{t'} / S_t) / d = \beta_0 + \beta_1 \log S_t + \beta_2 \log A_t + \beta_3 (\log S_t)^2 + \beta_4 (\log A_t)^2 + \beta_5 (\log S_t)(\log A_t) + \mu_t \quad (3)$$

Evans's model became an inspiration for the other few researchers. For instance, in their paper on managerial inputs and the growth of small enterprises, Variyam, and Kraybill (1994) began with the model presented by Evans (1987). They first estimated the regression model developed by Evans without the squared and cross product terms, and tested for nonlinearities implied by these terms using Theil's BLUS residual tests. Then they estimated several model extensions that have additional sources of heterogeneity in firm growth rates. Their main findings were that independent firms, sole proprietorships and firms owned by women are found to have significantly lower-than-average growth rates; in addition, they find that firm growth is negatively related to firm size and age (Variyam, and Kraybill 1994).

Reid (1993) discussed profitability as one of the determinants of growth, noting the endogeniety of growth and profitability and the implied simultaneity of growth and profitability relationships using the evidence from small firms (Reid 1993). It appears from his analysis using the empirical data that the growth/profitability trade off (known as the "Penrose Effect"[27]) can be confirmed. Furthermore, it appears that the form of enterprise is an important determinant of profitability. The further the managerial organization moves from a pure owner-management form, the lower its profitability.

According to Dobson, and Gerrard (1989), the growth and profitability relationship can be summarized by the two equations:

Growth = F (Profitability, Size, Age, Location, Degree of Supervisory Control, Intra - Industry Differences)

[27] The "Penrose Effect" was defined by Penrose (1959) and states that there may be managerial costs to higher growth which erode profitability (Penrose, 1959).

Profitability = F (Growth, Size, Age, Location, Degree of Supervisory Control, Intra-Industry Differences)

The central idea contained in both models is that of two-way causation (Dobson, and Gerrard 1989). Growth generates profits and profits stimulate growth. Thus, it seems that profit is a good proxy for enterprise growth and thence its success.

Moreover, a number of models and tools have been designed to deal with determining the influence of the various factors on enterprise success. One of the models that attempted to identify causality, which is a general aim of this type of quantitative analysis, was the study conducted by Honig (1998) of the performance of 215 micro-enterprises in Jamaica, This model, that worked with very "personal" measures of both success and "sensitive" financial information, tried to explain the determinants of success of Jamaican micro-enterprises expressed as average monthly profit (log average of monthly earnings). The general model used by Honig (1998) can be presented in the following form:

$$\log\ Y_t = \beta_0 + \beta_1 S_t + SK_t 1 + SK_t 2 + SES_t 2 + K_t 1\ + K_t 2\ + \beta_2 T_t + T_t^2 + E \qquad (4)$$

where Y_t is the log of average monthly earnings, S_i is the range of dummy variables for the level of schooling, $S_{Ki}1$ and $S_{Ki}2$ are two measures of social capital, $SES_i 1$ and $SES_i 2$ are measures of socioeconomic status, K1 and K2 represent variables for starting capital and loans, and T_t and T_i^2 are years of experience in the trade or business occupation (Honig 1998).

Additionally, specific models related to small enterprises have been devised to deal with the selection bias issue. For instance, in a study of the performance of Slovenian enterprises after the privatization of 1995-1999, it was stated that the initial break up of companies into groups of public, internal and external companies was not independent of the initial differences in companies' performances (i.e. the so-called selection bias). At the time of the selection of privatization modes, the operational characteristics and performance of companies influenced the ownership structure and not *vice versa*. There was a strong bias in the selection of privatization modes in Slovenia due to the principle of autonomy of companies in the selection of privatization methods (Simoneti *et al*. 2002). Because of the presence of selection bias, the Heckman two-step method was employed. In the first phase, a multinomial logit model was used to evaluate the optional multiple selection of enterprises among the three dominant privatization models (public, internal and external) on the basis of their operational characteristics in 1994. In the second phase of evaluation, the Amemiya procedure (Amemiya 1984) served to calculate the appropriate correction factors (the so-called 'inverse Mills ratios', i.e. lambda) on the basis of the probability (likelihood) of the selection of the individual privatization model (Simoneti *et al*. 2002).

To sum up, the studies related to identifying causality as a form of quantitative analysis generally use the econometric model expressed in the following form:

$$Y = X'\beta + \varepsilon \qquad (5)$$

where Y is the measure of enterprise success and X is the vector of factors internal to the firm (owner/manager and enterprise characteristics) and factors external to the firm (enterprise strategies).

Conclusions

This paper presented analysed the theories of enterprise success and the determinants of its success. Although many measures of success are used in research literature, the most robust and commonly used factors are: enterprise profits, employment and turnover change over a given period.

Throughout the analysis conducted in this study the research literature was reviewed to find factors influencing enterprise success. Two groups of factors (those internal to the firm and external to the firm) have been outlined and described in detail. In addition, factors that could potentially have some positive impact on enterprise growth and success have been selected for further analysis. The literature that has been reviewed directly informs the theoretical model and methodology used in this

study. All these gave us the grounds to formalize both the theoretical model and the econometric model of determining the factors that influence success of small and medium enterprises.

References

[1] Acs, Z., Audretsch, D. 1989. Birth and firm size. *Southern Economic Journal*, No. 55: 467-475

[2] Acs, Z.J., Audretsch, D.B., Evans, D.S. 1991. *The Determinants of Variations in Self Employment Rates Across Countries and Over Time*, National Economic Research Associates, Cambridge, MA

[3] Altman, E. 1968. Financial ratios, discriminant analysis and the prediction of the corporate Bankruptcy. *Journal of Finance*, vol. 23, No. 4: 189-209

[4] Amemiya, T. 1984. Tobit models: a survey. *Journal of Econometrics*, 24: 3-61

[5] Audretsch, D.B., Thurik, A.R., Verheul, I., and Wennekers, A.R.M. 2002. *Entrepreneurship: Determinants and policies in the new economy*. Boston/Dordrecht: Kluwer Academic Publishers.

[6] Barkham, R., Gudgin, G., Hart, M., and Hanvey, E. 1996. *The determinants of small firms' growth: and inter-regional study in the United Kingdom 1986-1990*, Jessica Kingsley, London, Regional Studies Association

[7] Barringer, B.R., Jones, F., Neubaum, D. 2005. A quantitative content analysis of the characteristics of rapid-growth firms and their founders. *Journal of Business Venturing* 20: 663–687.

[8] Begley, T., and Boyd, D. 1987. Psychological characteristics associated with performance in entrepreneurial firms and smaller businesses. *Journal of Business Venturing*, 2: 79-93.

[9] Besser, T. 1999. Community involvement and the perception of success among small business operators in Small Towns. *Journal of Small Business Management*, 37(4): 16-30.

[10] Boden, Jr., R.J., Nucci, A.R. 2000. On the survival prospects of men's and women's new business venture. *Journal of Business Venturing* 15 (4): 347–362.

[11] Bogdanoiu, C.L. 2008. Risk taking in economical – financial activity. *Journal of Applied Economic Sciences*, Vol. III, Issue 2 (4): 79-84.

[12] Burgel, O., Murray, G. *et al*. 1998. The Internationalization of British and German start-up companies in high-technology industries Centre for European Economic Research (ZEW), Mannheim.

[13] Callanan, S., Lijun, Cuddy, M. 2003. *Rural enterprise development and sustainability: innovative approach to the need of rural SMEs*, REDS WP, NUIG, Republic of Ireland.

[14] Callanan, S. 2005. Factors Influencing Irish Rural SME Growth, Thesis submitted to the National University of Ireland for the degree of Doctor of Philosophy, July.

[15] Carter, N.M., Williams, M., Reynolds, P.D. 1997. Discontinuance among new firms in retail: the influence of initial resources, strategy, and gender. *Journal of Business Venturing* 12 (2): 125–145.

[16] Chagantim, R., Chaganti, R. 1989. Profitable small business strategies under different types of competition, *Entrepreneurship Theory and Practice*, 13(3): 21-35.

[17] Chmiel, J. 1999. Problemy statystycznego pomiaru a analiza tendencji rozwojowych sektora prywatnych przedsiebiorstw w Polsce w latach 1990-1998. CASE, Warszawa.

[18] Chmiel, J. 2002. *Stan sektoru MSP w Polsce*, CASE, Warszawa.

[19] Davidsson, P. 1994. Small firms as job creators - myth or fact. Paper presented at the RENT VIII, Tampere, Finland.

[20] Davidsson, P., and Wiklund, J. 2001. Levels of analysis in entrepreneurship research: Current research practice and suggestions for the future. *Entrepreneurship Theory and Practice*, 25(4): 81–100.

[21] Dess, G., Robinson, R. 1984. Measuring organizational performance in the absence of objective measures: The case of the privately held firm and the conglomerate business unit. *Strategic management journal*, 5: 265-273.

[22] Dobson, S., Gerrard, B. 1989. Growth and profitability in the Leeds engineering sector. *Scottish Journal of Political Economy*, 36: 334-352.

[23] Driessen, M.P., Zwart, P.S. 2006. *The role of the entrepreneur in small business success: the Entrepreneurship Scan*, University of Groningen, Netherlands.

[24] Du Rietz, A., Henrekson, M. 2000. Testing the female under performance hypothesis. *Small Business Economics*, Vol. 14 (1): 1-10.

[25] Erocal, D. 2005. *Case study of successful companies in the services sector and lessons for public policy,* STI WP 2005/7.

[26] Evans, D.S. 1987. Tests of alternative theories of firm growth. *Journal of Political Economy,* 95: 649-670.

[27] Fratostiteanu, C. 2010. Guidelines for promoting science, technology and technical–scientific creativity by analyzing the companies' performances, in the context of the globalized economy. *Journal of Applied Economic Sciences*, Vol. V, Issue 3(13): 247-257.

[28] Fry, F. 1993. *Entrepreneurship: A Planning Approach.* West Publishing, New York

[29] Gallagher, C., Miller, P. 1991. New Fast Growing Companies Create Job. *Long Range Planning*, Vol. 24, No.1: 96-101.

[30] Gaskill, L.R., Van Auken, H.E., Manning, R.A. 1993. A factor analytic study of the perceived causes of small business failure. *Journal of Small Business Management*, Vol. 31(4): 18-31.

[31] Gatewood, E., Shaver, K., and Gartner, W. 1995. A longitudinal study of cognitive factors influencing start-up behaviours and success at venture creation. *Journal of Business Venturing*, 10: 371-391.

[32] Hall, G., Young, B. 1991. Factors Associated with Insolvency Amongst Small Firms. *International Small Business Journal*, No. 9 (2): 54-63.

[33] Hart, M., McGuinness, S., O'Reilly, M., Gudgin, G. 2000. Public Policy and SME performance: The case of Northern Ireland in the 1990s. *Journal of Small Business and Enterprise Development*, Vol.7, No.1: 27-41.

[34] Hart, M., McGuinness, S. 2000. Exploring Small Firm Growth in the UK Regions 1994-1997", NIERC Working Papers, No.50, Belfast, Republic of Ireland.

[35] Haslam, McKenzie, F., Ryan, M. 2000. Regional Development and Small Business Success in Rural Western Australia, Paper presented at the ICSB World Conference, Brisbane, Australia.

[36] Hausman, J.A. 1978. Specification tests in econometrics. *Econometrica*, Vol. 46, No.6: 1251-1271.

[37] Hillstrom, K., Collier, L. 1998. *Encyclopaedia of Small Business*, Gale Research, Detroit.

[38] Honig, B. 1998. *The human, financial and social capital of Jamaican micro-entrepreneurs*, WP, Tel Aviv International School of Management, Israel.

[39] Hornaday, J., Bunker, C. 1970. The nature of the entrepreneur. *Personnel Psychology*, 23: 47-54

[40] Hornaday, R., Wheatley, W. 1986. Managerial characteristics and the financial performance of small business. *Journal of Small Business Management*, Vol. 24: 267-276.

[41] Kantor, P. 2002. A sectoral approach to the study of gender constraints on economic opportunities in the informal sector in India. *Gender & Society*, 16 (3): 285-302.

[42] Kaplan, S., Norton, D. 1992. The balanced Scorecard-measures that drive performance. *Harvard Business Review*, Vol.78: 71-79.

[43] Karlsson, C. 1993. *Discussion, in: "Small Business Dynamics: International, National and Regional Perspectives*", C. Karlsson, B. Johannison, D.J. Storey (red.) Rutledge, London.

[44] Keats, B.W., Bracker, J.S. 1988. Toward a theory of small firm performance: A conceptual model. *American Journal of Small Business*, 12(4): 41-58.

[45] Kotey, B., Meredith, G. 1997. Relationships among owner/manager personal values, business strategies and enterprise performance. *Journal of Small Business Management*, 35 (2): 37-64.

[46] Kozarzewski, P. 2002. *Psychospoleczny portret przedsiebiorstw* , CASE Warszawa

[47] Loscocco, K., Robinson, J., Hall, R., Allen, J. 1991. Gender and small business success: An inquiry into women's relative disadvantage. *Social Forces*, 70(1): 65-85.

[48] Mas-Colell, M. 1995. *Microeconomic theory*, Oxford University Press.

[49] Mullins, J.W. 1996. Early growth decisions of entrepreneurs: the influence of competency and prior performance under changing market conditions. *Journal of Business Venturing* 11 (2): 89–105.

[50] North, D. *et al*. 1992. A Comparison of surviving and non-surviving small and medium sized manufacturing firms in London during the 1980s, in Caley, K. *et al*. *Small Enterprise Development: Policy and Practice in Action*, Paul Chapman Publishing, London.

[51] North, D., and Smallbone, D. 1993. Employment generation in small business growth in different geographical environments, 16th National Small Firms Policy and Research Conference, Nottingham, United Kingdom.

[52] Perry, M. 1999. *Small Firms and Network Economies*. Rutledge, London.

[53] Perry, C., Meredith, G., Cunnington, H. 1988. Relationship between small business growth and personal characteristics of owner/managers in Australia. *International Small Business Management*, 19: 76-79.

[54] Prihatin Dwi Riyanti, B. 2004. *Factors influencing the success of small-scale entrepreneurs in Indonesia*. In B. N. Setiadi, A. Supratiknya, W. J. Lonner, & Y. H. Poortinga (Eds.). *Ongoing themes in psychology and culture* (Online Ed.). Melbourne, FL: International Association for Cross-Cultural Psychology. Retrieved from http://www.iaccp.org.

[55] Reid, G. 1993. *Small Business Enterprise: An Economic Analysis*, Routledge, London.

[56] Romer, D. 2001. *Advanced Macroeconomics*. Routledge, London.

[57] Sexton, D., Landstrom, H. 2000. *The Blackwell Handbook of Entrepreneurship*. Blackwell, Oxford.

[58] Simonneti, M. *et al*: 2002. *Performance after Mass privatization: a case of Slovenia*, WP 10, University College London.

[59] Smallbone, D. 1995. The Survival, Growth and Support Needs of Manufacturing SMEs in Poland and the Baltic States: Developing a Research Agenda, Materialy konferencyjne, Uniwersytet Lodzki.

[60] Smallbone, D. *et al.* 1992. Managing Change for Growth and Survival: A Study of Mature Manufacturing firms in London in the 1980s, WP No.3, Planning Research Center, Middlesex, U.K

[61] Storey, D.J. 1994. *Understanding the Small Business Sector*. London, Routledge, London.

[62] Varian, H. 1999. *Intermediate Microeconomics*, 4th edition, W.W Norton and Company.

[63] Variyam, J., and Kraybill, D. 1992. Empirical Evidence on Determinants of Firm Growth. *Economic Letters*, Vol. 38: 31-36.

[64] Veerbek, M. 2002. *A guide to modern econometrics*. KU Leuven Academic Press, Lueven.

[65] Wagner, J. 1995. Firm size and job creation in germany. *Small Business Economics*, No. 7 (6): 459-474

[66] Walker, E., Brown, A. 2004. What Success Factors are important for small Business owners? *International Small Business Journal*, Vol. 22, No.6: 577-594

[67] Williamson, O. 1987. *The Economic Institutions of Capitalism*. The Free Press, NY