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ИКОНОМИЧЕСКИ ИЗСЛЕДВАНИЯ

ИНСТИТУТ ЗА ИКОНОМИЧЕСКИ ИЗСЛЕДВАНИЯ НА БЪЛГАРСКАТА АКАДЕМИЯ НА НАУКИТЕ

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ИКОНОМИЧЕСКИ ИЗСЛЕДВАНИЯ
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BARGAINING SOLUTIONS AND PUBLIC POLICIES IN MATCHING MODELS

The aim of this paper is to show that usually the literature under or overestimate the effect of public policies on the labor market by using systematically a symmetric Nash bargaining solution to share the surplus between worker and firm. Indeed, using a matching model framework, we compare and analyze Nash, Egalitarian, Kalai-Smorodinsky and Equal-Sacrifice solutions. We show that the effects of public policies, as minimum wage or unemployment benefits, would be more or less significative depending on the bargaining solution. It appears that Nash and egalitarian solutions are less inclined to study the impacts of the introduction of the minimum wage.
JEL: C78; J64; J68

1. Introduction

The basic theoretical models neglect many important aspects of the labor market as the process of creation and destruction of jobs. Furthermore, they omit the possibility of wage negotiations and do not adequately address the issue of labor market participation. To overcome these weaknesses, several studies (Diamond, 1982; Mortensen, 1982; Pissarides, 2000) have developed the matching model as a theoretical framework. The advantage of such a model is to explicit the process of creation and destruction of jobs and the reallocations of workers and jobs. Therefore, this framework takes into account frictional unemployment and introduces the wage bargaining process.

However, the relevance of these models could be questioned since they use systemically Nash as a rule for surplus sharing. Indeed, this kind of solution could not be appropriated in some cases and leads to move away from the labor market reality. Consequently, it could

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skew the analysis and the policy decisions. Experiments due to Siegel and Fouraker (1960), Nydegger and Owen (1974) also suggest that the Nash solution is an unreasonable model of pairwise negotiations. The reason why is that players make an interpersonal comparison of utility gains such as would be the case with for example the equal-gain model of Myerson (1977) but cannot occur with the Nash solution because of the independence of irrelevant alternatives axiom.

There are other more realistic solutions that can bring more precisions in the wage bargaining process. Among them, we can include the Equal-Sacrifice, the Kalai-Smorodinsky solution (KS, thereafter) (Kalai-Smorodinsky, 1975) or the Equal-even-loss solution (Chun, 1988). The choice of solution could be decisive in the interpretation and in determining the effects of public policies on the performance of the labor market. Indeed, most theoretical work studying the effects of minimum wage on the labor market participation and on employment have used Nash surplus sharing rule.

In this perspective, Gerber and Upmann (2006) analyze a classic bargaining problem between a labor union and an employers' federation through the Nash and KS solutions. Notably, they point out the effect of the reservation wage on the employment and on the wage determination. Indeed, they conclude that a higher reservation wage leads to a lower employment level with the Nash Solution, whereas the KS-solution leads up to an ambiguity (Anbarci et al., 2002; Laroque and Salanié, 2004).

Our paper fits into this line and aims to show that usually the literature under or overestimate the effect of public policies on the labor market by using systematically a symmetric Nash bargaining solution to share the surplus between worker and firm. Indeed, using a matching model framework, we compare and analyze Nash, Egalitarian, Kalai-Smorodinsky and Equal-Sacrifice solutions. We show that the effects of public policies, as minimum wage or unemployment benefits, would be more or less significative depending on the bargaining solution. We show that Nash and egalitarian solutions are less inclined to study the impacts of the introduction of the minimum wage.

The rest of paper is organized as follows. The model is presented in Section 2. Then, the comparison of the bargaining solutions is discussed in Section 3. The effects of minimum wage and of unemployment benefits depending on the selected solution are presented in Section 4. Finally, section 5 concludes the paper.

2. Model

We consider a matching model with standard hypothesis according to Pissarides (2000), in which an economy is composed of a large exogenous number of workers and a large endogenous number of firms. Firms are supposed to be identical and offer a single job. The hypothesis of firm free-entry enables to maintain a fixed number of firms at the steady state. Agents are risk neutral and discount the future with the same rate of time preference denoted by r. The exogenous job destruction rate is s.

Frictions are present in the labor market which means that it takes time for firms with a vacant job to find a worker. Such frictions are represented by a constant-returns matching function $m(v,u)$, where u is the number of employable unemployed workers and v is the number of vacant jobs. This matching function (Pissarides, 2000) is an homogenous function of degree 1, increasing in v and u. Instantaneous matching depends on the market tightness, noted $\theta=v/u$. The probability for a firm to meet an employable worker is given by $q(\theta)=m(1,1/\theta)$. This probability is a decreasing function of θ.. A rise in the number of vacancies leads to a negative impact on the rate to fill a job due to the congestion effect. The probability for an employable worker to find a job is given by $p(\theta)=\theta q(\theta)$. This hiring probability is increasing in θ. Indeed, a rise of vacancies implies more opportunities for workers to find a job.

According to the usual Belmann's equations, the expected utility of an employed worker, denoted U_1, depends on his current wage w and on the probability, that he become unemployed (under the destruction rate s):

$$rU_1(w, \theta) = w - s(U_1 - d_1) \quad (1)$$

We denote by d_1, the expected utility of an unemployed worker, depending on the unemployment benefits b and on the probability to find a job $p(\theta)$.

$$rd_1(w, \theta) = b + p(U_1 - d_1) \quad (2)$$

Concerning the firms, we consider that the jobs are either filled or vacant. In the case of a filled job, the profit is composed of the net instantaneous income (y-w) and the future profits with respect to the destruction rate.

$$rU_2(w, \theta) = y - w - s(U_2 - d_2) \quad (3)$$

As long the job is not filled, a firm has to invest c to create a job and to look for a worker. The probability to fill the job is equal to $q(\theta)$. The value of a vacant job d_2 is given by:

$$rd_2(w, \theta) = -c + q(\theta)(U_2 - d_2) \quad (4)$$

The free-entry hypothesis implies that new jobs are created until the optimal value of a vacant job be equal to zero.

3. Wage Bargaining and Surplus Sharing

In the literature, authors usually apply the Nash solution. Why always using this solution? Some bargaining solutions are more realistic and can be used in the framework of matching models.

3.1. Nash solution

The Nash solution is the best-known solution. We respectively define by β and $1-\beta$ the bargaining strength of workers and firms. The generalized Nash optimization program is given by:

$$\text{Nash} : max\ (U_1 - d_1)^{\beta}(U_2 - d_2)^{1-\beta}$$

According to the equations (1) to (4), we deduct that:

$$U_1 - d_1 = \frac{w-b}{r+s+p(\theta)} \tag{5}$$

$$U_2 - d_2 = \frac{y-w+c}{r+s+q(\theta)} \tag{6}$$

It leads to the following negotiated wage:

$$w_N = \frac{y+c+b\Psi(\theta)\left(\frac{1-\beta}{\beta}\right)}{1+\Psi(\theta)\left(\frac{1-\beta}{\beta}\right)} \tag{7}$$

where $\Psi(\theta) = \frac{r+s+q(\theta)}{r+s+p(\theta)}$

Even if it is the most applied, it would be relevant to pursue this analysis by comparing it with the other bargaining solutions.

3.2. Egalitarian solution

In real bargaining situations, each agent makes interpersonal comparisons of its utility. One of these solutions is to apply a principle of equal gains. For any two-person bargaining problem (F,d), we define the egalitarian solution to be the unique point U in the subset F that is weakly efficient in F and satisfies the equal-gains condition:

$$U_1 - d_1 = U_2 - d_2 \tag{8}$$

By applying this solution to the matching model, we have the following result:

$$\frac{w-b}{r+s+p(\theta)} = \frac{y-w+c}{r+s+q(\theta)} \tag{9}$$

$$w_e = \frac{y + c + b\Psi(\theta)}{1 + \Psi(\theta)} \tag{10}$$

The egalitarian solution is a particular case of the Nash solution.

Proposition 1. *The wage issued from the egalitarian solution is equal to the Nash symmetric solution because the negotiation power value is equal to 0.5.*

3.3. KS solution

Amine et al. (2009) compared the Nash and the Kalai-Smorodinsky (KS) solutions in the framework of a standard matching model. They determined the value of the negotiation power in the case of the KS solution:

$$\frac{1-\beta}{\beta} = \frac{y - b + c}{y - b}$$

They proved that the power of the workers (noted β) in KS is less compared to the firms. KS enables to define the maximal utility of each agent ($U_1^{\max}, U_2^{\max}$). This utopia point is not feasible but an agent looks for reaching this point. It makes the bargaining process more realistic. The aim of the negotiation is to go away the least from this point. Each worker and each firm has a maximal payoff represented by an ideal point *I*. Concerning the firm, his ideal is to have a maximum profit resulting from the lowest wage $\tilde{w}$ payed to each worker (*i.e.* a wage equal to the unemployment benefits *b*, $\tilde{w} = b$). The ideal wage $\hat{w}$ for the worker is equal to his productivity ($\hat{w} = y$). In this case, the probability for a worker to find a job $p(\hat{\theta})$ and the probability for a firm to recruit a worker $q(\tilde{\theta})$ are supposed maximal ($p(\hat{\theta}) = 1$ and $q(\tilde{\theta}) = 1$).

The Kalai-Smorodinsky optimization program (11) gives us the following negotiated wage (12):

$$\phi^{KS} = (U_2 - d_2)(U_1^{\max} - d_1) - (U_2^{\max} - d_2)(U_1 - d_1) = 0 \tag{11}$$

$$w_{KS} = \frac{y + c + b\Psi(\theta)\left(\dfrac{y - b + c}{y - b}\right)}{1 + \Psi(\theta)\left(\dfrac{y - b + c}{y - b}\right)} \tag{12}$$

3.4. Equal Sacrifice solution

This solution (Aumann and Maschler, 1985) equalizes the sacrifice from the maximum feasible payoff net of the threat point. The interest of this bargaining solution is that the

negotiation can lead to an equilibrium less than the disagreement utility. For any two-person bargaining problem (F,d), we define the equal sacrifice solution to be the unique point U in F that is weakly efficient in F and satisfies the equal-sacrifice condition:

$$U_1^{\max} - U_1 = U_2^{\max} - U_2 \tag{13}$$

$$(U_1^{\max} - d_1) - (U_1 - d_1) = (U_2^{\max} - d_2) - (U_2 - d_2) \tag{14}$$

$$\frac{\hat{w} - b}{r + s + p(\hat{\theta})} - \frac{w - b}{r + s + p(\theta)} = \frac{y - w + c}{r + s + q(\theta)} - \frac{y - \tilde{w} + c}{r + s + q(\tilde{\theta})} \tag{15}$$

$$\frac{y - b}{r + s + 1} - \frac{w - b}{r + s + p(\theta)} = \frac{y - b + c}{r + s + 1} - \frac{y - w + c}{r + s + q(\theta)} \tag{16}$$

The wage w_{es} is then deducted:

$$w_{es} = \frac{y + \dfrac{1 - q(\theta)}{r + s + 1} c + b\Psi(\theta)}{1 + \Psi(\theta)} \tag{17}$$

3.5. Comparison with the bargaining solutions

The Nash solution introduces the negotiation power through the parameters β and $1-\beta$.. By comparison, we can determine these values for each bargaining equilibrium. (7) and (12) let us estimate the negotiation power for the KS solution, noted β_{KS} :

$$\beta_{KS} = \frac{y - b}{2y - 2b + c} \tag{18}$$

From equations (7) and (17), the bargaining power of the equal sacrifice, noted β_{es} , is characterized by:

$$w_{es} = \frac{\Psi(\theta)\left[(y - b)(r + s + 1) + c(1 - q(\theta))\right]}{\Psi(\theta)\left[(2y - 2b + c)(r + s + 1) + c(r + s + q(\theta))\right] + c(r + s + q(\theta))} \tag{19}$$

At the end to establish the relation between the process of job creation and the negotiated wages, we calculate the first derivatives of the wage equations (7), (10), (12) and (17) with regard to the labor market tightness θ. We obtain a positive relation:

Proposition 2 *The negotiated wages issued from the bargaining solutions are increasing with the labor market tightness.*

Besides, by comparing the expressions of wages (7), (10), (12) and (17) between them, we establish the following result:

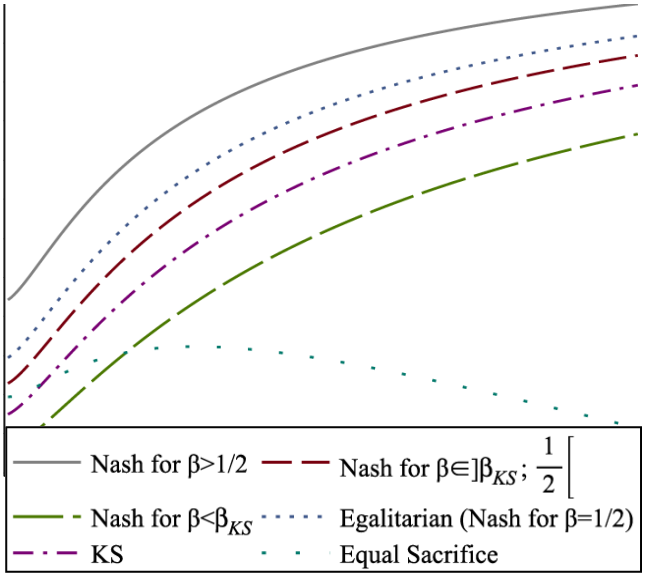
Proposition 3 *The wages determined by the four-bargaining solution are equal if and only if the negotiation power of each agent is equal (β=0.5) and the cost of a vacant job is null (c=0).*

This result is very interesting because it shows that it is not enough that the bargaining power is evenly divided between workers and firms so that the negotiated wage is the same. In addition, it is necessary that the cost of job creation is equal to zero. Already at this level of analysis, we can indeed imagine that certain solutions can discriminate or favor an agent earlier than the other one during the surplus sharing process.

The figure 1 gives the position of the bargaining curves. According to the value of the negotiation power, we deduce that the Nash curve is above the other curves for β>0.5 and between the egalitarian and the KS curves for $\beta \in]0;0.5[$.

Figure 1

Bargaining curves



4. Public Policies Effects

In this section, we will analyze the effects of unemployment benefits and the minimum wage on wages negotiated based on the solution.

4.1. Unemployment benefits

We focus our analysis on the effect of the unemployment benefit on the bargaining equilibria. Analytically by deriving equations of negotiated wages with respect to benefits *b*, we get a positive effect for Nash, Egalitarian and Equal Sacrifice solutions. Concerning KS solution, the negotiated wage is increasing with the unemployment benefits if:

$$(y-b+c)(y-c+b+\Psi(y+c-b))<0 \tag{20}$$

To measure the effect magnitude on negotiated wage, we have to distinguish several cases corresponding to different values of the negotiation power. We denote by $\hat{\beta}$ the negotiated power for which the effect of the unemployment benefits is the same in the Nash and KS solutions:

$$\hat{\beta}=\frac{(y-b)(2\Psi c+(1+\Psi)(y-b))+\Psi c^2}{2\Psi((y-b)^2+c(c+2y-2b))+2(y-b)^2-c^2} \tag{21}$$

Comparing the effect magnitude on wages depending on the value of beta is done in our model by simulation. For this exercise, we retain the Cobb-Douglas matching function: $M(V,U)=V^{1/2}/U^{1/2}$, which gives $q(\theta)=\theta^{1/2}$ and the standard parameters values: c = 0.3; r = 0.05; s = 0.15; y = 1. The results are summarized in the following tables.

Table 1

Unemployment benefits effect for $\beta < 1/2$

	w_N	w_{KS}	w_e	w_{es}
b	+++	+	++	++

Table 2

Unemployment benefits effect for $\beta = 1/2$

	w_N	w_{KS}	w_e	w_{es}
b	++	+	++	++

Table 3

Unemployment benefits effect for $\beta \in]1/2;\beta[$

	w_N	w_{KS}	w_e	w_{es}
b	++	+	+++	+++

Table 4

Unemployment benefits effect for $\beta \in]\beta;1[$

	w_N	w_{KS}	w_e	w_{es}
b	+	++	+++	+++

From these tables, we easily see that the Nash solution, which is most often used in matching models, overestimate the effect of unemployment benefits only when the bargaining power β of workers is less than *1/2*. We also note that the Equal sacrifice solution strengthens the increase in negotiated wage for all values of β. The use of this solution can change or reverse the results of several theoretical studies that often use Nash as a sharing rule. In addition, we establish the relation with Proposition 3 and we obtain the following remark:

Remark 1. *In the case where β =1/2 and c = 0, the effect of the unemployment benefits for all the solutions is the same.*

4.2. Minimum wage

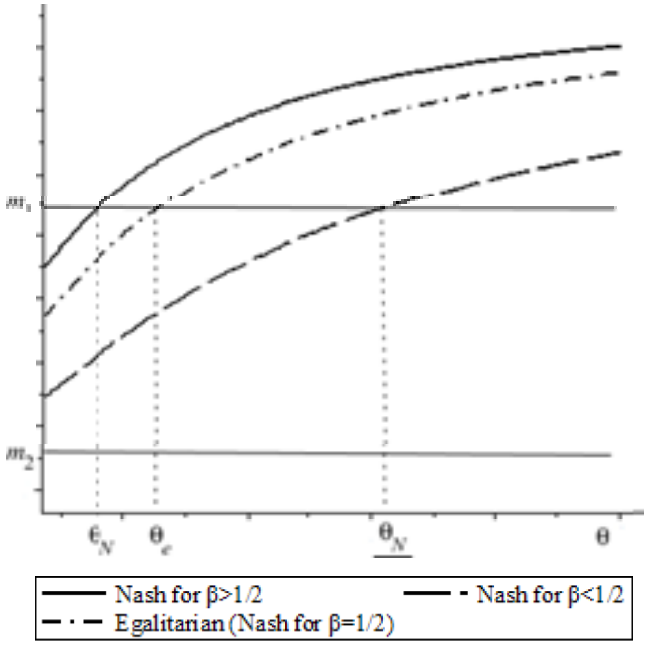
By introducing this device in our model, we have to study two situations: either the wage is constrained by the minimum wage (noted *m*) or the wage stays "free". Indeed, if the negotiated wage *w* is greater than *m*, then the wage setting is free. If the negotiated wage *w* is lower than *m*, then the wage at the equilibrium is equal to the minimal wage such as *w* = *m*.

4.2.1 Nash and Egalitarian solutions

The introduction of the minimum wage in the standard matching models does not have direct consequences on the negotiated wage for the Nash and the Egalitarian solutions. For these cases, the minimum wage only acts as a constraint. Consequently, we get the same wages as the previous section for the Nash and the Egalitarian solutions. We have to characterize two situations resulting from this constraint depending on the value of *m* (Figure 2).

Figure 2

Minimum Wage in the case of the Nash and Egalitarian Solutions



4.2.2 KS and Equal Sacrifice solutions

Concerning the KS and the Equal Sacrifice Solutions, the minimum wage acts both on the negotiated wage and as a constraint. Contrary to the previous solutions, the ideal utility is necessary to determine them. Consequently, the negotiated wage for KS and the Equal Sacrifice differ from those of the previous section. Indeed, it impacts the maximal utility of the firm. The best situation for the firm is to pay the lowest wage to the worker, *i.e.* the minimum wage *m* instead of the unemployment benefits *b*:

$$U_2^{\max} - d_2 = \frac{y - m + c}{r + s + 1} \tag{22}$$

Using this expression (19), we obtain a new negotiated wage for the KS and the Equal Sacrifice solutions:

$$w_{KS} = \frac{(y + c)(y - m) + b\Psi\left(y - m + c\right)}{y - b + \Psi\left(y - m + c\right)} \tag{23}$$

$$w_{ES} = \frac{y + c + \frac{r + s + q}{r + s + 1}(m - b - c) + b\Psi}{1 + \Psi} \tag{24}$$

Showing that the first derivatives of the equations (23) and (24) with respect to the minimum wage are positive ($\frac{\partial w_{KS}}{\partial m} > 0; \frac{\partial w_{ES}}{\partial m} > 0$), we can announce the following result:

Proposition 4 *In a matching model where wage bargaining is done according to the KS and Equal Sacrifice solutions, an increase in the minimum wage has the effect of strengthening the bargaining power of workers by increasing wages negotiated.*

By comparing the magnitude of the impacts of minimum wage in the case of the two solutions, we deduce that the effect of *m* is more important in the KS solution than in the ES solution for:

$$m > \frac{1}{\Psi}(y - b + \Psi(y + c) - (\frac{(y - b)(y - b + c)\left(r + s + 1\right)(1 + \Psi)\Psi}{r + s + q})^{1/2}) \tag{25}$$

The main purpose of the introduction of minimum wage in our model was to show that much of the literature related to matching models uses Nash solution. However, this solution does not capture the effect of minimum wage on the variables of the model since it acts indirectly on wage bargaining. While KS and Equal Sacrifice solutions seem more effective to study the effect of *m* which acts, in this case, directly on the mechanism of surplus sharing between the worker and the firm.

5. Final remarks

As we explained in the introduction of this paper, most of the literature about matching models generally retains the Nash solution, without justifying this choice, and discussing its relevance. However, other solutions can actually be applied, not without consequences. Indeed, by introducing other solutions (Kalai-Smorodinsky, Equal Sacrifice and Egalitarian) in a matching model, we show that the effects of public policies, particularly

the minimum wage and unemployment benefits, are different. We conclude that the choice of the solution may actually be decisive and should therefore be subject to further and systematic analysis. Moreover, given the economic crisis in which the bargaining power of workers is weakened, it is important to be careful and thorough in choosing the bargaining solution. We also believe that a deeper analysis in terms of labor market participation and productivity could give us more details as to the suitability of the studied solutions in this article.

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ИКОНОМИЧЕСКИ ИЗСЛЕДВАНИЯ
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OPERATING EFFICIENCY OF QUALITY MANAGEMENT SYSTEM OF STATE EXECUTIVE AUTHORITIES

This paper is aimed at justifying the application of the methodology for evaluation and improvement of the operating efficiency of the quality management system (QMS) for state executive bodies. The term "operating efficiency of QMS" is considered by the authors as a ratio between the effectiveness of the group of QMS processes "Management responsibility" and the resources used for their development, implementation and improvement. The term "management responsibility" means "the responsibility of officials implementing powers of the authority". The relevance of the article is dictated by the fact that on the one hand, the normative legal acts issued by the Government of the Russian Federation declare the primacy of the problems of life quality improving, health preservation and increasing of citizens' life expectancy, on the other hand, they initiate an increase of the retirement age and practically a "lifelong" need of citizens labor activity. This problem stirred the Russian public and pointed once again to the low quality of the country social management and the need to assess the responsibility of officials implementing powers of the authority.
JEL: O11; O21; O43; P11

1. Purpose, research objectives, theoretical and methodological basis

The purpose of the study is to justify the application of the methodology for evaluation and improvement of the operating efficiency of QMS for state executive bodies with a view to improve the population life quality of the country first of all in the direction of health saving. The term «operating efficiency of QMS» proposed by the authors is considered by the authors as a ratio between the effectiveness of the group of QMS processes «Management responsibility» and the resources used for their development, implementation and improvement. The term «management responsibility» means «the responsibility of officials implementing powers of the authority».

The QMS of Russian enterprises and government executive bodies of the Russian Federation are **the objects of research**.

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The methodological apparatus for evaluation and improvement of the QMS operating efficiency is **the subject of the research**.

The key provisions of domestic and foreign theory and practice of quality management, the works of the aforementioned authors on the issues of development and improvement of the assessment and QMS effectiveness improvement serve as **the theoretical and methodological basis** of the study. System, process, situational and quantitative approaches; general scientific methods of analysis, synthesis, analogy, formal logic, observation, experiment; methods of social research, modeling, expert analysis, economic and statistical methods were used to solve the problems of scientific research.

2. Relevance of the study

The relevance of this paper is dictated by lots of questions from the population to the authorities, and first of all, with regard to the imbalance caused on the one hand by the Government's decision of June 14, 2018 on the gradual increase of the retirement age in the Russian Federation. It is expected that by the year 2034 men will retire at 65 and women at 63 (now 60 and 55 years respectively). On the other hand, today average life expectancy in Russia is 71.9 years with an average life expectancy of 66.5 years for men and 77 for women. Thus, taking into account the gradual increase of the retirement age in the Russian Federation the age of surviving retirement for men will be 1.5 years and 14 years for women. The Russians associate the increase of the retirement age not with the need to reform the pension system (it's the official version) or the lack of sufficient financial security to fulfill the social obligations of the authorities to the population, but with the poor quality of management and the inability to make other decisions to stimulate the national economy growth and the growth of social deductions from working citizens income in the Pension Fund of the Russian Federation.

Indicators of the government programs implementation can also indicate the existence of a quality management problem in government. For example, according to the program "Industry development and increasing its competitiveness" (Programs.gov.ru, n.d) the effectiveness of achieving its indicators for the period 2013-2017 looks as follows:

- in 2013 – 34 out of 94 indicators were achieved (36.2%);
- in 2014 – 81 out of 170 indicators were achieved (47.6%);
- in 2015 – not stated;
- in 2016 – 94 out of 200 indicators were achieved (47%);
- in 2017 – 57 out of 200 indicators were achieved (28.5%).

On the one hand, it is possible to link the low effectiveness of program targets achieving with anti-Russian sanctions, but on the other hand, the first sanctions were introduced on March 17, 2014, and the efficiency indicators were extremely low (36.2%) as early as 2013, so the reasons for the goal-reaching are not so much external as internal ones and are more

connected with the low efficiency of managing state programs and the responsibility of officials for their implementation.

In this regard, the national development goals stated in RF Presidential Edict No.204 (The RF Presidential Edict 204, n.d) and first of all: to ensure sustainable natural growth of the population of the Russian Federation; increase of life expectancy up to 78 years (by the year 2030 – up to 80 years); ensuring sustainable growth of citizens' real income as well as increasing the level of pension provision above the level of inflation should be treated with some prejudice from the point of view of their achievement without changing the existing system of the Russian Federation managing state programs.

So, on the one hand, the normative legal acts issued by the Government of the Russian Federation declare the primacy of the problems of life quality improving, health preservation and increasing of citizens' life expectancy, on the other hand, they initiate an increase of the retirement age and practically a "lifelong" need of citizens' labor activity. This problem stirred the Russian public and pointed once again to the low quality of the country social management and the need to assess the responsibility of officials implementing powers of the authority.

In a number of works we have justified the need to improve the methodology for calculating the rating of the Russian regions for their life quality, including the health-related quality of life indicators, as well as the need to take them into account when assessing the effectiveness of the executive authorities of the subjects of the Russian Federation, districts and municipal areas (Schmeleva, Drukerovskij vestnik, 2017; Schmeleva, Innovation Management, 2016; Schmeleva, Quality and life, 2016).

Having carried out a comparative analysis of indicators for assessing the population life quality used in the methodology of Eurostat (Final report of the expert group, n.d) and the methodology of the "Ranking of Regions of the Russian Federation for the life quality in 2017" (Ranking of Regions of the Russian Federation, n.d) (Table 1), it can be concluded that the indicators of the Eurostat methodology are aimed at assessing the casual effect of the population life + health status + access to health = life expectancy, while the life quality rating in the Russian Federation is only a kind of statement of the facts on the static characteristics of population mortality and infrastructural provision of health care services without revealing the causal relationship of a certain life expectancy of the Russian citizens.

Moreover, in European practice, the indicator of healthy life years (HLY).has been used for quite a long time in assessing of the population life quality and managing the implementation of government programs in the social sphere.

Table 1

Comparison of the “Health” group indicators according to the methodology of Eurostat in 2017 and “Ranking of Regions of the Russian Federation for the life quality in 2017”

Eurostat methodology	The methodology of the "Ranking of Regions of the Russian Federation for the life quality in 2017"
1. Indicator "Results": 1.1 Life expectancy at birth 1.2 Health status: 1.2.1 Healthy Years of Life 1.2.2 Self-perceived health 1.2.3 Self-evaluation of mental health	Life expectancy at birth; Population mortality at working age; Infant mortality; Rate of perinatal mortality; The overall sickness rate of the entire population.
2. Determinants (healthy and unhealthy behavior) 2.1 Body mass index 2.2 Daily smokers 2.3 Hazardous alcohol consumption 2.4 Practice of physical activity 2.5 Fruits and vegetables consumption	
3. Health care access: 3.1 Unmet need for medical care	Health facilities availability: Doctors provision; Nursing staff provision; Doctors’ working load (the number of visits per doctor); The capacity of outpatient clinics; Provision of hospital beds for 100 thousand people; The average bed occupancy per year; The number of departures of ambulance brigades, reaching the place of call within 20 minutes; The number of departures of ambulance brigades arriving to the place of road traffic accident within 20 minutes.

The indicator of healthy life years measures the number of remaining years that a person of specific age is expected to live without any severe or moderate health problems. The notion of health problem for Eurostat's HLY is reflecting a disability dimension and is based on a self-perceived question which aims to measure the extent of any limitations, for at least six months, because of a health problem that may have affected respondents as regards activities they usually do (the so-called GALI – Global Activity Limitation Instrument foreseen in the annual EU-SILC survey). The EU-SILC question is: for at least the past six months, to what extent have you been limited because of a health problem in activities people usually do? Would you say you have been:

- severely limited?
- limited but not severely?
- not limited at all?

Based on this variable the proportions of the population in healthy (answer code: "not limited at all") and unhealthy conditions (answer codes: "severely limited" and "limited but not severely") are calculated by sex and age (Ec.europa.eu, n.d).

The Eurostat report "Final report of the expert group on quality of life indicators 2017 edition" clearly indicates an intention to equate in the future the indicator of "life expectancy at birth" to the indicator of "healthy life". Healthy life expectancy in the Russian Federation is not estimated by region, and only in 2016 this indicator was measured for the capital and it was 62 years old, while the total life expectancy in Moscow is 76 years (M24.ru, n.d). In the Russian study, a healthy life meant the absence of pronounced or complete restrictions on at least one of the six basic activity indicators: the ability to wash, dress, walk around the room, eat, get out of bed and use the toilet without any help (Nodelman, n.d). It is worth noting that the Russian study did not consider the issue of restrictions in the performance of a person's usual work activity and daily exercises. Thus, the substitution of the term "healthy life", interpreted in the Eurostat methodology as an assessment of any restrictions on activities usually performed by a person only on the evaluation of primary human activity, was occurred.

Such a one-sided view of the situation with the life quality of the health-related population of the country is not only not aimed at the implementation of the Federal Law No. 323-FZ of November 21, 2011 "On the fundamentals of protecting the health of citizens in the Russian Federation", but also hinders the conduct of a cause-and-effect analysis: the population way of life + health status + access to health care = life expectancy. This conclusion can be confirmed by the currently being developed Project "Interdepartmental Strategy for Healthy Lifestyle, Prevention and Control of Non-communicable Diseases for the Period until 2025" (Interdepartmental Strategy for Healthy, n.d), according to which "addressing the prevention of non-communicable diseases and the formation of a healthy lifestyle among the population is impossible due to the almost complete absence of intersectoral and interagency cooperation, the absence of any interest in solving the problems of the prevention of non-communicable diseases by the numerous federal executive bodies that do not have specific tasks, indicators of their implementation, legal and public responsibility for their implementation".

So in the current circumstances it is necessary to revise the issue of the evaluation and responsibility of federal and municipal authorities for the Russians' life quality related to health – the main competitive advantage of the country.

3. Study results

Within the research objective, the following approaches to assessing the effectiveness of enterprise management should be emphasized (Shmeleva, Russian journal of entrepreneurship, 2010):

- the functional model of management assessment for management system improving in order to improve the business competitiveness (Maslov, Watson, Chileshche);

- the methodology of managerial added value estimating ("Sony" corporate methodology);
- complex rating assessment of the enterprise management system quality (Svirina);
- the positional diagnostics of control systems (Mashkin);
- the system for the management quality assessing of an industrial enterprise (Stepanova);
- the method of self-assessment of management level at industrial enterprises (Akmayeva).

An overview of these approaches is presented in Table 2.

Table 2

Comparative characteristics of approaches for assessing the QMS efficiency

Comparative criteria	Approaches for assessing the enterprises QMS efficiency					
	Functional model	Management value appraisal	Rating assessment	Positional diagnostics	Management quality assessing	Assessment of management development level
1. The methodology of constant improvement of E. Deming	✓		✓		✓	✓
2. Directors and managers receive a tool to search for "narrow" areas of the organization's management, as well as the ability to compare the results of "before" and "after" corrective and preventive actions.	✓		✓	✓	✓	✓
3. The universal nature and the possibility of using various business entities in activity assessing, regardless of their property category.	✓		✓	✓	✓	✓
4. The requirement of high competence of directors and managers of the enterprise in the field of management theory and quality philosophy.	✓		✓		✓	✓
5. Development of staff teamwork	✓	✓	✓		✓	✓
6. Economic dimension of the personal contribution of a whole		✓				

division of managers or a group of managers.						
7. Accounting for both financial and non-financial indicators of the enterprise.			✓			
8. Characterizes the quality of management functions according to Fayol H.	✓		✓		✓	
9. It is based on an assessment of the position of the individual in society, according to which people differ in their attitude to themselves and to the society, to norms and knowledge.				✓		
10. Evaluates the nature of management ties, using the organizational structure of the company as a "foundation".				✓		
11. The enterprise management system is considered as the main object.				✓		
12. It is based on the use of questionnaires and interviewing.	✓		✓		✓	
13. Representatives of the expert group act as subjects of assessing the quality / performance / contribution / management benefits.			✓	✓	✓	✓
14. It is specially targeted at enterprises implemented QMS in accordance with ISO 9000.						
15. It identifies not only resources for effective management, but also external barriers to its development.						✓

For the purpose of forming a methodical apparatus for the operating efficiency of the company's QMS, approaches to assessing the efficiency of the QMS were identified (Table 3).

Table 3

Comparative analysis of approaches for assessing the QMS efficiency

Approaches for assessing the enterprises QMS efficiency	Analytical aspects of approaches
1. Determining the economic efficiency of QMS based on the establishment of a causal relationship between the QMS implementation and the economic indicators of companies: 1.1 Determining the QMS economic efficiency based on the correlation of results and costs.	Economic efficiency = Results / Costs (or payback period) The following cost indicators are considered as economic results: production volume, gross income (or turnover), profit, net income. Since the costs and results are time-spaced, it is suggested that they can be considered at the same time by using the discounting procedure.
1.2 Determination of economic efficiency based on the relationship between benefits and costs.	Kachalov V. (Kachalov, 2005) points out that the return of capital spent on the quality system certification usually comes within 9-16 months depending on the firm.
1.3 Determining the QMS impact on the financial position of an enterprise.	A comparative analysis of the financial situation of enterprises that have implemented and certified quality systems and enterprises that do not have similar systems is carried out. The financial position of companies is assessed on the basis of four criteria: the rate of return per assets unit; the Tobin test; the ratio of the cost price of the sold products to the sales volume; assets turnover. The methodology of Barber and Lyon is used to study the impact of certification on financial indicators.
2. Estimation of economic efficiency of enterprise activity as a whole and QMS based on customer satisfaction.	The approach is based on the use of the Swedish Quality Index (SQI) and the American Customer Satisfaction Index (ACSI). The interaction of customer satisfaction and the economic indicators of the enterprise are revealed in the process of assessing SQI and ACSI.
3. Assessment of QMS efficiency based on a balanced scorecard (BSC).	The use of the BSC makes it possible to assess the QMS efficiency for different stakeholders from the perspective of its impact on the enterprise financial indicators, customer satisfaction and loyalty, the performance and efficiency of internal processes, as well as the satisfaction of the enterprise personnel.
4. Assessment of QMS efficiency by Kopnov V., Rogov A.	In addition to the task of assessing the QMS efficiency, the BSC performs the function of broadcasting the organization's strategy (including policy and quality objectives) to the executors and affects budgeting processes (through management review). For enterprises that are only mastering the ISO 9000 standards methodology a modified simplified version of the BSC is proposed, close to the ideology of quality management. Such a model is considered as a benchmark when starting the processes of continuous QMS improvement.
5. Assessment of QMS efficiency by Samorodov V.	The enterprise QMS efficiency is determined by the processes QMS efficiency taking into account the scale of gravity: from 0 (QMS does not function and requires development) to 1 (QMS works effectively and does not require the development of any

	actions).
6. Assessment of QMS efficiency by Shabalina S., Artemenko E.	The evaluation of QMS efficiency is carried out as a weighted average evaluation of the partial performance criteria: customer satisfaction with the products quality; compliance with product requirements; the degree of compliance with the requirements of GOST R ISO 9001, depending on the activity type of the enterprise; degree of implementation of established performance criteria processes; suppliers' products quality. Weighting factors are formed expertly.
7. Assessment of QMS efficiency by Shvets V.	The approach involves the development of method 1.1, which is described above. The economic effect of the QMS implementation is reflected through the increase in output of high-quality products in the t-year. This indicator is compared with the costs that were incurred during the years of implementation and functioning of the QMS.

The analysis of approaches for assessing the QMS efficiency confirms the lack of attention to the problem of assessing the involvement, responsibility, leadership and competence of enterprise management in the processes of designing, developing and improving the QMS – i.e. evaluation and improvement of the performance of the group of QMS processes "Management responsibility".

The analysis of normative legal acts containing a list of indicators for assessing the activity effectiveness of the executive authorities of the constituent entities of the Russian Federation, local self-government bodies of the city districts and municipal districts also showed the absence of indicators (except life expectancy at birth) reflecting the life quality of the health-related population (Table 4).

Table 4

The list of indicators for assessing the activity effectiveness of the executive authorities of the constituent entities of the Russian Federation, local self-government bodies of the city districts and municipal districts

The RF regulatory legal act	Indicators for assessing the activity effectiveness
The RF Presidential Edict No. 548 of November 14, 2017 "On the assessing the activity effectiveness of the executive bodies of the subjects of the Russian Federation". The list of indicators for assessing the activity effectiveness of state executive authorities of the Russian Federation. (The RF Presidential Edict 548, n.d)	1. Life expectancy at birth. 2. Dynamics of real average monthly accrued wages. 3. The ratio of per capita monetary population income, minus the sums of mandatory payments and payment for housing and communal services to the cost of a fixed set of basic consumer goods and services. 4. The share of the population whose cash incomes is lower than the subsistence minimum established in the constituent entity of the Russian Federation. 5. The coefficient of housing availability (the number of years required by a family of three people to purchase a standard apartment with a total area of 54 square meters, taking into account the average annual aggregate family income). 6. The coefficient of migration gain (by 10 thousand people). 7. Crude birth rate. 8. Crime rate. 9. The quality and accessibility of housing and communal services (the

	number of days with a failure to water, heat and electricity supply for an average per capita, the ratio of average per capita spending on housing services to the cost of a fixed set of basic consumer goods and services, the share of recycled solid municipal waste in the total volume of solid municipal waste, the proportion of the normatively treated wastewater in the total volume of wastewater). 10. Dynamics of gross regional product per capita. 11. The volume of fixed capital investment (except budgetary funds of the federal budget, investments in extractive industries) per capita. 12. Integral index of the subject of the Russian Federation in the national rating of the state of the investment climate in the subjects of the Russian Federation. 13. The ratio of the average number of employees of small business and medium-sized enterprises to the population. 14. The density of the public road network (except federal roads) that meet the regulatory requirements for transport performance indicators. 15. The volume of tax revenues of the consolidated budget of a constituent entity of the Russian Federation (minus: transport tax, mining tax, excise taxes on automobile and straight-run gasoline, diesel fuel, motor oils for diesel and (or) carburetor (injector) engines produced in the Russian Federation , profit tax and other payments in the performance of production sharing agreements, including payments for the use of subsoil, regular payments for the extraction of minerals (royalties), one-time income) per capita, adjusted for the index of budget expenditures. 16. The ratio of the public debt volume of the Russian Federation constituent entity dated January, 1 of the year following the reporting year to the total annual income (excluding gratuitous receipts) of the budget of the subject of the Russian Federation. 17. The share of overdue accounts payable in the expenses of the consolidated budget of the subject of the Russian Federation. 18. The unemployment rate (according to the methodology of the International Labor Organization). 19. The population's assessment of the self-realization conditions, including the children self-realization. 20. The assessment of population's satisfaction with educational, health, culture and social services. 21. The proportion of residents of the Russian Federation subject who faced corruption. 22. The population's assessment of the activities of executive authorities of a constituent entity of the Russian Federation. 23. The population's assessment of the activity effectiveness of the public authorities of the Russian Federation. 24. The results of an independent assessment of the quality of service delivery by social organizations.
RF Presidential Decree 607 from 28.04.2008 'On assessment of efficiency of government bodies in urban regions and municipal units' (as revised in 14.10.2012, number of Decree 1384). The list of indicators of efficiency assessment of government bodies	1. Number of small and medium businesses per 10000 of population. 2. Proportion of average staffing number (excluding external part-timers) in small and medium business to average staffing number (excluding external part-timers) in all businesses. 3. Proportion of public auto-roads mileage that does not meet the requirements to the total mileage of local public auto-car roads. 4. Proportion of population in inhabited localities without regular bus or railroad communication with the administrative center of the urban

in urban regions and municipal units. (The RF Presidential Edict 2008; 607, n.d)	district or municipal unit to total population of the urban district or municipal unit. 5. Proportion of lands taxable by land tax to total area of urban region or municipal unit. 6. Proportion of infants and children aged from 1 to 6 years registered for designation to municipal preschool to total number of infants and children of this age group. 7. Proportion of graduates of municipal general schools who successfully passed Uniform state exam in Russian language and mathematics to total number of graduates from these schools who took the exams. 8. Total area oh housing per one citizen including houses put in service in current year. 9. Proportion of private companies that produce services in the sphere of public utilities (plumbing, electricity supply, heating etc.) owned by government by no more than 25% to total number of such companies that work in the territory of urban region or municipal unit. 10. Proportion of apartment houses built on territories included in State Immovable Property Cadaster. 11. Specific value of consumption of energy resources (electricity and heating energy, water, gas) in apartment houses (per 1 square meter or per 1 person). 12. Specific value of consumption of energy resources (electricity and heating energy, water, gas) in municipal public establishments (per 1 square meter or per 1 person). 13. Satisfaction of population with the work of local government bodies in urban district (municipal unit) (percent of respondents).
RF Government Regulation 1317 from 17.12.2012 with additions and corrections from 26th December, 2014 and 12th October, 2015. The list of additional indicators of efficiency assessment of heads of local government bodies (urban districts and municipal units). (The RF Government Decree 2012; 1317, n.d)	*I. Economic development:* 1. Monthly average nominal salary of workers (in rubles) of: big and medium non-commercial businesses, municipal preschool educational facilities, municipal general schools, including teachers, municipal cultural and art establishments, municipal facilities of sports and physical culture. 2. Amount of investments in fixed capital (excluding public funds) per capita (rubles). 3. Proportion of profit-making agricultural organizations in their total number (percent). *II. Preschool education:* 4. Proportion of infants and children aged from 1 to 6 years receiving preschool education or sponsorship for it in municipal educational facilities in total number of infants and children aged from 1 to 6 years (percent). 5. Proportion of municipal preschool educational facilities the buildings of which are in critical condition or in need of repairs in total number of such facilities (percent). *III. General and supplementary education:* 6. Proportion of graduates from general municipal schools without diploma in total number of graduates of municipal general schools (percent). 7. Proportion of municipal general schools the buildings of which are in critical condition or in need of repairs in total number of such schools (percent). 8. Proportion of municipal general schools that meet modern standards

	of education in total number of such schools (percent). 9. Proportion of children of the first and second health groups in total number of pupils in general municipal schools (percent). 10. Proportion of pupils in municipal general schools that attend second (third) school in total number of pupils in such schools (percent). 11. Spending of public funds on general education per 1 pupil in general municipal schools (thousands of rubles). 12. Proportion of children aged from 5 to 18 years that receive additional educational services in organizations of all types of legal forms and forms of ownership in total number of all children of this age group (percent). *IV. Culture:* 13. Proportion of municipal cultural establishments the buildings of which are in critical condition or in need of repairs in total number of such establishments (percent). 14. Proportion of municipally-owned cultural heritage sites in need of conservation or restoration in total number of such sites (percent). 15. Factual funding ratio of cultural establishment of required level (percent): clubs, libraries, parks for recreation and leisure. *V. Physical training and sports:* 16. Proportion of population that regularly engages in sports and physical training (percent). 16.1. Proportion of students and pupils that regularly engages in sports and physical training in total number of students and pupils (percent). *VI. Housebuilding and provision of housing:* 17. Proportion of land property for housebuilding for which no use permit has been issued for three years (for housing buildings) or five years (for other types of buildings) 18. Land area for housebuilding per 10000 of population, including land property for housing buildings, individual building, and integrated residential development (ha). *VII. Housing and utilities infrastructure:* 19. Proportion of apartment houses the owners of which selected and currently use one of the management methods in total number of apartment houses where owners have yet to select management method (percent) 20. Proportion of the population that received new housing or improved living conditions in the report year in total population registered as in need of housing space (percent). *VIII. Municipal administration:* 21. Proportion of the overdue accounts payable for labor compensation (including indirect labor charges) of municipal facilities in total volume of expenses of these facilities on remuneration of labor (including indirect labor charges) (percent). 22. Proportion of tax and non-tax income of local budget (excluding tax income from additional sources) in total volume of own budget incomes of municipal unit (excluding subventions) (percent). 23. Office expenses of the employees of local self-governing bodies spent from the budget of municipal unit per one citizen of the municipal unit (rubles). 24. Capital fund of bankrupt businesses of municipal form of ownership in total capital fund of all such organizations (at the year-end, at gross book value) (percent)

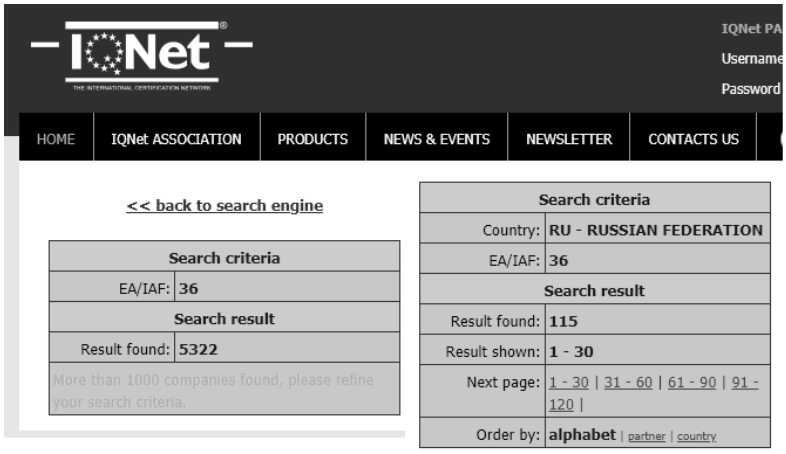
	25. Constructed volume not finished in established period from resources of local budget (urban region or municipal unit) (thousands of rubles) 26. Presence of approved general plan of urban district (municipal unit) (yes/no). 27. Mid-year constant population (thousands of people).

It is proposed to use quality management methods to improve the activity quality of the executive bodies of the subjects of the Russian Federation, local governments of urban districts and municipal districts. Methods of quality management can be applied in the following forms: quality management system in accordance with the requirements of ISO standards; models of self-evaluation according to the criteria of various quality awards; various rating estimates.

Today according to the International Certification Network IQNet (Iqnet-certification.com, n.d), more than 5,000 state and municipal authorities in different countries of the world use the QMS in their activities, while only 115 organizations use it in the Russian Federation (Figure 1). The pace of the QMS implementation in the public authorities of the Russian Federation is low, which can be explained by the fact that the ISO 9000 standards were initially oriented towards organizations that conduct commercial activities which doesn't fully reflect the specifics of the state and municipal service.

Figure 1

QMS implementation in sector 36 "Public administration"



Since May 1, 2016 GOST R 56577-2015 "Government bodies' quality management systems: Requirements" has been introduced in order to improve the public services quality, aimed primarily at improving the life quality of the population of the country (GOST R 56577-2015, n.d). The standard's requirements are aimed at raising of the customer satisfaction and the degree of their trust to government bodies through the quality

management system effective application, including the processes of its continuous improvement, and ensuring compliance with customer requirements and relevant mandatory requirements. In the section "Terms and definitions" of this standard, the following interpretation of the term "top management" is given: an official or a group of officials carrying out a mandate of the authority. The section "Requirements to the management of the authority in the quality management system" contains practically the same requirements as the requirements to the management of commercial organizations, including: "The top management of the authority should ensure the availability of evidence of acceptance of its obligations to develop, implement, operate (keeping in working condition), as well as constant improvement of the QMS performance and efficiency. The authority top management should consider the development, implementation, maintenance and improvement of the QMS performance that meets the requirements of the standard as a strategic project."

The development of the ideas of quality management in the Russian Federation allows us to recommend the use of **author methods** for assessing and improving the QMS operational efficiency at the level of state executive bodies (Shmeleva Economic and management 2010). New quality management principles, reflected in the standard GOST R 56577-2015: "operativeness – self-analysis and self-development – transparency of activities – ethical behavior" also favor this proposal.

The methodology involves the development of a responsibility distribution matrix across the entire QMS process group "Management responsibility" (Table 5), as well as "role chains by departments" of this group of processes that transform traditional degrees of participation in the process (executor, responsible, matching, evaluation) by the following roles:

- the "sponsor" of the process;
- the "master" of the process;
- the auditor of the process;
- the participant of the process with indication of its importance for the process: (P1 – executes the operations of the process, consumes the resources allocated by the "sponsor" and distributed by the "master", P2 – is responsible for the results of the process to the "owner" and "sponsor" of the process, P3 – identifies inconsistencies and carries out continuous improvement of the process at his workplace, P4 – informs the "owner" about the progress and results of the process, the use of resources, inconsistencies and risks of the process. Based on expert assessments of the representative of quality management or external consultants, QMS companies are assigned weighting coefficients of the "role" of each division in a specific QMS process "Management responsibility". The weighting coefficient of the "role" of subdivision *i* in the administrative management of QMS *y* will be denoted as Ki_y. The sum of the weighting coefficients of the "roles" of the subdivisions for each process should be 1, i.e. $\sum Ki_y = 1$.

Table 5

Responsibility distribution matrix for the process group "Management responsibility"

The QMS process group "Management responsibility"	Participants of the QMS process group "Management responsibility"				Process-outcome indicators	
	Subdivision 1	Subdivision 2	Subdivision 3	General director	Planned Ip_y	Factual If_y
Providing evidence of commitment to the QMS development and implementation as well as continuous improvement of its performance	$K1_1$	$K2_1$	$K3_1$	$K4_1$	Ip_1	If_1
Identification and implementation of customer requirements to increase their satisfaction	$K1_2$	$K2_2$	$K3_2$	$K4_2$	Ip_2	If_2
Management of the policy in the field of quality	$K1_3$	$K2_3$	$K3_3$	$K4_3$	Ip_3	If_3
Management of quality objectives	$K1_4$	$K2_4$	$K3_4$	$K4_4$	Ip_4	If_4
QMS planning	$K1_5$	$K2_5$	$K3_5$	$K4_5$	Ip_5	If_5
Definition and bringing the responsibility and authority in the sphere of quality to the attention of the organization's personnel	$K1_6$	$K2_6$	$K3_6$	$K4_6$	Ip_6	If_6
Development of appropriate information exchange processes in the organization, including the QMS performance issues	$K1_7$	$K2_7$	$K3_7$	$K4_7$	Ip_7	If_7
Analysis of QMS organization at scheduled intervals	$K1_8$	$K2_8$	$K3_8$	$K4_8$	Ip_8	If_8

In order to assess the performance of each QMS process "Management responsibility", a plan-factual comparison of the actual measured output of the process and its planned value is made by the following formula (1):

$$P_y = If_y/Ip_y, \quad (1)$$

where:

If_y is the actual measured quantity indicator of the process outcome;

Ip_y – planned target;

P_y – performance of the process y of the group "Management responsibility".

The assessment of the performance of a particular subdivision i in a particular process y "Management responsibility" (PSi_y) is carried out according to the formula (2):

$$PSi_y = P_y * K_{iy}, \ (2)$$

The evaluation of the performance of a particular subdivision *i* in all eight processes "Management responsibility" (TP*i*) can be represented by the following formula (3):

$$TPi = \sum_{y=1}^{8} PSi_y, \ \% \ (3)$$

The obtained performance of each managerial subdivision across the whole process group is interlinked with the motivation system of management personnel, stimulating it to implement the quality strategy.

The assessment of the operating efficiency of the company's QMS can be represented by the formula (4):

$$AE_{QMS} = \frac{TAP_{MS}}{\% PF_{MR}}, \ (4)$$

where:

TAP_{MS} – the total average performance of all management subdivisions involved in the QMS processes "Management responsibility";

$\% PF_{MR}$ – the percentage of planned funds aimed at achieving the current level of total averaged performance of all management subdivisions involved in the QMS processes "Management responsibility".

To assess the QMS operating efficiency it is necessary to take into account the costs associated with the development, implementation, improvement of the administrative processes of QMS and the improvement of the management's competence in the sphere of quality. It is proposed to include into the costs such elements as the costs of developing, implementing and improving the administrative processes of QMS; costs to increase the top-managers' competence in the sphere of quality (taking into account current and future needs); guaranteed minimum wages for management personnel; bonus (%) for the results of the organization's work as a whole (including bonus for the QMS development); bonus (%) for the work of the department, incl. % for work on administrative processes of QMS (once a year); bonus (%) for individual contribution: (%) for the level and quality of work; (%) qualification; (%) for the QMS development (once a year); costs for management error eliminating (returns, claims).

This methodology has the following advantages in contrast to existing approaches to assessing the effectiveness of QMS:

- it is focused on the "chain of roles" of each QMS administrative process; the object of method management is a group of QMS processes "Management responsibility";
- the importance of top-managers in the QMS administrative processes is assessed using the weighting coefficient of participation of their "roles";

- it includes changes in the motivational component of the company's management, taking into account the weighting coefficients of its participation in the QMS administrative processes and processes effectiveness;
- it allows to evaluate the effectiveness of each process of the group "Management responsibility";
- it is aimed at evaluating and enhancing the professional competence of the company's management in the field of quality;
- it reflects the objective role and contribution of top-management into the implemented administrative processes of the QMS;
- it involves the accounting of costs associated with the development, implementation, improvement of the QMS administrative processes and increasing the management competence in the field of quality.

4. Conclusions

The application of this **author methodology of evaluating and improvement of the operating efficiency of QMS of state executive authorities** allows predicting the following effects:

- work improvement within the framework of the most problematic administrative processes of the QMS;
- improvement of the process of budgeting of managerial human resources involved in the administrative processes of the QMS;
- transformation of the motivational component of managerial human resources depending on the achieved performance indicators of administrative processes and QMS operating efficiency;
- increase of competitiveness (rating of management bodies of different levels) on the basis of increasing the performance of the group of QMS processes "Management responsibility".

In conclusion, it should be noted that it is extremely necessary to create a modern system of public administration in Russian public authorities working for the population and in the interests of the population, and effective working management is also needed to ensure the creation of values that satisfy consumers. The QMS and its continuous improvement based on the application of the methodology for assessing and improving the QMS operating efficiency (QMS processes groups "Management responsibility") can become one of these tools.

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ИКОНОМИЧЕСКИ ИЗСЛЕДВАНИЯ
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MECHANISM OF DETERMINING COMPETITIVE ADVANTAGES OF BUSINESS SYSTEMS IN GLOBAL ENVIRONMENT

In a global environment, it is impossible to apply national principles of business and the requirements of the laws of an individual state, business systems develop and interact with each other, which requires constant monitoring and forecasting of possible directions of development, therefore, the purpose of the research is to create a mechanism for the identification and evaluation of the competitive advantages of international business entities. Particular importance is the ability of business systems to gain combined competitive advantages in international and local markets, which uses methods of comparative, factor and system-structural analysis, expert evaluations. As a result of the research, the process of ensuring the implementation of competitive advantages of international business entities was formed, which will allow the firm to hold a competitive advantage longer, since the sources of competitive advantage are determined. Advantages of a low level, such as cheap labor or raw materials, can easily be obtained by competitors. Advantages of a higher order are proprietary technology, differentiation based on unique goods or services, reputation of a firm based on enhanced marketing activities, or close customer relationships require more elaboration and resources. Determination of competitive advantages becomes the basis for the formation of information for planning the activities of subjects of international business in conditions of disintegration of the economy. The formed mechanism for identifying competitive advantages has been adapted to the peculiarities of the activities of international business entities, which has made it possible to consistently identify, analyze and exploit competitive advantages in the relevant markets. In the process of implementing the mechanism, it is proposed to use an integral indicator of the assessment of the competitive advantages of subsystems of international business entities, which is adapted at the enterprises of machine building of Ukraine.
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1. Introduction

With today's global changes, businesses adapt and become innovative, changing their own business models and development strategies. In addition, the needs and wishes of consumers are constantly changing, which leads to the emergence of new requirements for goods and services. International business players in foreign markets need to increase their own resources and investments in order to meet growing demand.

The main goal of any business system is to ensure its sustainable position in the future. This is impossible without such factors as: dynamism and flexibility; adaptability; predictability; ability to carry out activities in conditions of a shortage of resources; decision-making under conditions of uncertainty.

In the competitive international business environment, results can be achieved by introducing innovations and timely adjustments to change. The exit of the company into external markets requires the presence of a certain competitive advantage of the subject of international business, which will provide financial stability and opportunities for development.

The global environment of business systems can be estimated taking into account the global components that lead to standardization and are driven by the economies of scale, competition, behavior and consumer expectations, and by analyzing the local components that study local features: legal norms, culture, consumption, network marketing, etc. The environment of organizations operating at the international level is more complicated, as the unique system of factors characterizing each country is influenced by the business system: economy, culture, quantity and quality of labor and material resources, laws, state regulation, technological development. The global environmental analysis is a process by which strategists monitor the world economic, governmental/legal, market/competitive, supplier/technological, geographic, and social settings to determine opportunities and threats.

2. Literature Review

Theoretical problems of ensuring competitiveness and the formation of competitive advantages have been researched by foreign and Ukrainian scientists, including I. Ansoff (1999), M. Porter (2007), R. Fatkhuddinov (2004), A. Voronkova (2008), Yu. Ivanov (2008) and others.

I. Ansoff (1999), who based on the market and on the products, has defined four basic competitive strategies.

M. Porter (2007) argues that analysis of the competitive sphere can be done with the help of his five forces model which will help enterprises to achieve the competitive advantage in the market. Thus, competitive advantage depicts a company’s competencies and its capability to survive against the factors prevailing in the enterprise’s external environment. Interaction of I. Ansoff (1999) is close to the notion of competitive advantage in the

interpretation of M. Porter (2007), since the researchers believe that in order to obtain competitive advantages, it is necessary to determine the ratio of actual and basic productivity of utilization of enterprise resources.

At the same time R. Fatkhutdinov (2004) proposes to determine the essence of competitive advantage on the basis of the concept of value, and a set of values determines competitive advantages.

Yu. Ivanov (2008) identifies specific approaches to determining the competitive advantage, comparative, resource and value-competent approach. The competitive advantages are positive differences of the enterprise from competitors in some or all types of activities that ensure the improvement of socioeconomic efficiency in the short-term and long-term survival through the constant search for new opportunities and rapid adaptation to the environment and the conditions of competition, changing.

Scientific publications do not provide a uniform classification of competitive advantages. M. Porter (2005) distinguishes two competitive advantages: lower costs and differentiation (uniqueness) of the product. T. Copeland, T. Koller and D. Murrin (2005) further differentiate the advantage of more efficient use of capital. K. Hessig (1995) and G. L. Asoev (2000) singled out the advantage of the speed of responding to the needs of the market. G.L. Asoyev (2000) suggests considering the competitive advantage of the possibility of simulation and the nature of the dynamics of goods. R.A. Fatkhuddinov (2004) emphasizes the following criteria of competitive advantage: the field of advantage; content of the factor of advantage; method or means of obtaining an advantage.

Of particular interest is the definition of competitive advantages in international business systems, which is a little-studied phenomenon. Suslov V. (2008) under the business system understands the entire set of business processes implemented by the organizational unit to achieve its strategic goals. In a global environment, such a set will represent a chaotic synthesis of various difficult-to-forecast in various fields of activity with certain counterparties. The researcher of the theory of business systems V.S. Efremov (2008) adds the commercial component to the essence of the business system, arguing that "if the profit is identified with the synergetic effect of interaction of elements and conditions of business activity in the processes of organization, production, sale of products, as well as the processes of investment and competition, the very system in which such interaction, can be called a business system". That is, the business system is the system of relations, creating and implementing a commercial benefit certain use-value. Characterizing the competitive advantages, the content of the business system is complemented by industry subordination of interests of competing companies. That is, business systems interdependence in the competition involves not only the choice of personal competitive advantage strategy, but also the development of the development strategy of the whole business system, in which the benefits are many, or all member companies. According to Kupriyanov Yu. (2015) elements of the business system that determine the competitive advantages are those elements that determine the strategic advantage of the business system and form its uniqueness. That is, critical competitive advantages as elements of the global business system are search and construction of a unique innovative business model, creation of a strategic portfolio balanced in terms and technologies, rational configuration of the organizational architecture, programming of business space.

Typically, experts identify such approaches to the formation of competitive advantages of the enterprise, market, resource, institutional approaches. The resource approach M. Porter (2005), etc. focuses on the efficient use of resources. The market approach R. Fatkhudinov (2004) determines the competitive advantages in terms of opportunities to use the competencies and values of the enterprise, which enable it to form and develop competitive advantages, as well as strategic directions of ensuring the corresponding competitive status on the market. The comparative approach G. Azoyev (2000) involves searching for opportunities ahead of their competitors by comparing and comparing certain characteristics of different enterprises, which gives an idea of the ability of the company to compete successfully in a definite market.

In this case, market and resource approaches are one-sided and do not provide maximum success. The institutional approach that benefits long-term relationships with consumers, the partnership is based on the network nature of the operation of enterprises, promotes the integration of competitive and cooperative relationships among market participants, which minimizes costs and improves access to information flows, and so on.

The given characteristic indicates the possibility of allocating additional approaches to the definition of competitive advantages, namely: the factor and productive approach, where it is possible to draw attention to the results and effects that an international enterprise receives due to a certain set of factors; the approach based on the potential in which accentuates the focus on the competitiveness of the enterprise's potential and the combination and development of its constituent elements; the process approach, where competitive advantages are considered as a process carried out by an enterprise in a global environment.

On the basis of the content of the concept of competitive advantage, we can conclude that the difference from competitors must be significant. At the same time, it cannot be considered without identifying the competence or value of the international company. In a competitive international environment, the types of resources that do not have a material form become more important, but they influence the formation of the results of the activity and the development of the international enterprise. A more reliable way to increase competitiveness in the international environment is to increase and use intangible competitive advantages, to develop relationships with customers, maintain loyalty and develop new market segments, introduce new products and services, implement information technologies and systems, etc. That is, a competitive advantage can be defined as the competence or value created by the enterprise to provide increased efficiency, profitability, flexibility through the search for new opportunities and rapid adaptation to the challenges and transformations of the international global environment. This methodological approach allows us to trace the causal relationships and identify the existing and potential opportunities of the international enterprise.

Regarding the subjects of international business, research on the issues of ensuring competitive advantages, the development of recommendations for improving the formation of competitive advantages in terms of disintegration remain undetermined.

3. Methodology of the Empirical Research

3.1. Research aim and design

The purpose of the article is to form and evaluate the competitive advantages of international business entities regarding the timely and effective definition of the areas of their business activities.

As international business is an activity that involves transactions between two or more contracting countries the formation of competitive advantages in each country is different. The main subjects of international business, which can be individuals, firms, unions of entrepreneurs, representatives of states, international organizations, multinational corporations, while pursuing their activities obtain the appropriate competitive advantages.

First, the subjects of international business can create national or comparable competitive advantages. Thus, Chinese international business entities export predominantly low-cost goods of superior quality. Indian contracting companies use differentiation for products that are exported. Japanese exporters specialize in producing quality brand products and innovations. The competitive advantage of American counterparties is innovation.

Business entities operating in two or more markets are developing and using combined competitive advantages that take into account: access to markets and resources, local adaptation, and more.

Due to access to new markets, international business entities can quickly increase sales volumes by targeting new markets and new market segments. Ukrainian international businesses companies according to the sphere of activity apply as wide coverage, that is, increase in the range of serviced countries; and wide penetration by finding new customers and distributing new types of goods in existing markets. Representation in foreign markets of goods of various price segments is a significant competitive advantage for international business. Subjects of international business orientate products to countries with different income levels. Thus, international business entities offering goods to developed countries should focus on innovation and a high price segment. In turn, international business subjects oriented towards developing countries should offer goods at lower prices.

Increasing access to the market for subjects of international business allows improving the efficiency of marketing and sales opportunities; effective management of distribution channels; forming partnerships through coordination and integration.

Access to resources of international business entities can maximize their competitive advantages. Reducing the costs of operations of international business entities facilitates the transfer of production and business processes to countries with cheap material, labor and financial resources. The subjects of international business, in this case, should take into account the instability of the exchange rate, the change in demand and the decrease in the dynamics of expenditure. They should also consider supply chain constraints, transport costs, customs tariffs, etc. Increasing access to resources can allow international business entities to change the cost structure and create flexible supply chains that will increase their competitiveness.

Access to resources by the international business company is realized through the globalization of research activities, the attraction of innovative potential, the use of attractive local opportunities, the use of resources of the countries with the best prices, offshore business processes to reduce costs and increase productivity, attract qualified personnel.

Local adaptation of international business entities allows you to use know-how in the local market, understand local customers, and effectively segregate customers for the development of an individual product and service delivery; adjust pricing policy, focusing on target value even at zero profitability; differentiate approaches to enter the market, taking into account the unique conditions of each country and segment, localize business activity to fully utilize the opportunities of each market and simultaneous use of opportunities available in different markets.

When adapting to local conditions, international business actors maximize their impact by using a global network for sharing practices, knowledge, technologies, and more. This can allow the distribution of the benefits of resources in different markets. Coordination of actions of subjects of international business gives several advantages. First, it provides economies of scale by applying such tools as standardizing the process, sharing best practices. Secondly, the use of the diversified and distributed global network allows you to earn extra revenue.

Coordination of the activities of international business entities can be achieved through various means, including the following measures: the implementation of common standards and processes, the promotion of the transfer of innovation and the exchange of best practices, the possibility of exchanging information, the introduction of a common set of values and cultures in a particular market. Consequently, taking into account competitive advantages, the subjects of international business in the modern business environment need to quickly adopt changes adapt to the market and use innovative opportunities.

Effective promising activity of subjects of international business depends on the timely identification and implementation of their own competitive advantages, which are conditioned by their competitiveness, financial and market stability, international capabilities, etc. This allows international business entities to have stable positions in international markets for goods and services, and to produce and sell products that are in demand from foreign consumers. Such a position of the subjects of international business should be supported, as it is constantly changing, so the implementation of innovative solutions supports high performance. Management activity of subjects of international business is constantly adjusted in accordance with the policy of management, changes in international markets are monitored, and changes are being made in the system of production and sales of goods.

Competitive advantages are different forms of manifestation, based on economic factors, regulatory documents defined by the level of infrastructure, geographic and demographic constituents, technical advantages, better information security, etc.

The competitive advantages of international business entities may depend on positions in the international rating of the country's competitiveness, which are formed in accordance

with the indicators of the macroeconomic environment, level of development of the financial market, credit rating of the country, etc. The indicators indicate the possibility of obtaining financing in the domestic and foreign markets, which is conditioned by the number of investors and the level of the economic situation. Ukraine holds high positions in the ranking due to the presence of scientific and engineering staff, the quality of research institutions and the number of patents for inventions. These indicators indicate that innovation is a significant potential for economic growth. The level of corruption, the difficulty in obtaining financial resources, the degree of inflation, political instability; level of taxes, regulation of the foreign exchange market and the labor market; low quality of infrastructure and so on reduces the competitive advantages of international business entities.

The methodology that we will use to determine competitive advantages in the global environment, which allow us to assess the competitiveness of the enterprise, is based on the theory of effective competition, which is included in the integrated methods. The method allows carrying out a detailed analysis of all aspects of the economic activity of an international company, taking into account its work in a changing global environment. The methodology provides an opportunity to receive information about competitive positions in the market quickly and objectively, identifying the strengths and weaknesses, as well as reacting to the manifestations of the external environment. Groups of indicators that allow you to assess the company's competitive advantages are listed in Table. 1. Each of the indicators has a different degree of importance in determining the competitive advantages of an international enterprise. Expertly, the coefficients of weighting the criteria recommended for international enterprises.

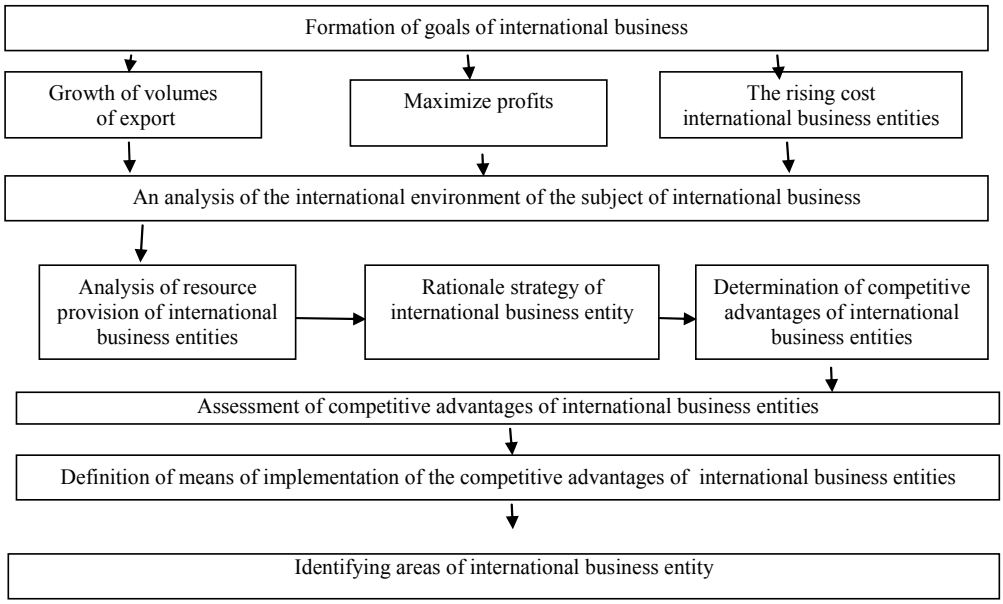
This method has advantages and disadvantages. The advantages include the exclusion of duplication of certain indicators, the coverage of the most important characteristics of the economic activity of an international enterprise, the possibility of objectively obtaining a picture of the situation of the enterprise in the global market environment, and others. We will mention to the disadvantages the complexity of collecting the necessary information and the high complexity of mathematical processing.

3.2. Research instruments

We consider the process of ensuring the competitive advantages of international business entities. Determination of competitive advantages becomes the basis for the formation of information for planning the activities of subjects of international business in conditions of disintegration of the economy. Information support research of the competitive advantages of international business subjects involves the study of internal and external information: economic, legal, social, international; technical and technological; organizational that is, continuous monitoring of the dynamics of development of subjects of international business and international processes.

Figure 1

The process of ensuring the implementation of competitive advantages of international business entities



Source: Research result, 2018

On the basis of the information provided, it is possible to manage the subjects of international business, ensuring their competitive advantages. The existing management mechanism should be adapted in accordance with the peculiarities of the activities of the subjects of international business, which enables to consistently identify, analyze and use competitive advantages in the relevant international markets. In the process of implementing the mechanism, you can use a variety of schemes for evaluating subsystems of international business entities.

The process of ensuring the implementation of the competitive advantages of international business entities is a set of procedures for a favorable business in competitive external markets. The effectiveness of providing competitive advantages takes into account the systematic evaluation, interactivity, dynamic support, multicriteria, ongoing analytical work on the study of the state and trends in the development of foreign markets.

4. Findings Results

In order to preserve the competitive advantages of the subjects of international business, changes, improvements and innovations are needed. Sources of innovation that provide competitive advantages to international business actors are new technologies; new consumer requests; change in the cost of production; the emergence of a new segment; change in government regulation. New technology creates new opportunities for production and promotion of products by international business entities. When changing the cost of components of production, namely raw materials and labor, transport and energy costs, etc., the subject of international business may receive or lose its competitive advantage. The source of obtaining a competitive advantage by the subject of international business is the creation of new segments. Recent government policies in the field of standardization, trade restrictions, competition law, etc. also lead to finding innovations and obtain competitive advantages. The achievement of competitive advantages by the subjects of international business is ensured primarily due to the innovation of products and technological processes, time and cost savings, and flexibility.

Thus, competitive advantages in terms of flexibility are achieved through the rapid opportunity to take into account changes in demand, the timely development of new products, and shortening delivery times. Increasing the level of competition in international markets, changing requests and wishes leads to the positive results of those international business actors who have competitive advantages by reducing costs, improving quality, flexibility and adaptability, innovation and time-saving.

Consequently, it is advisable to assess the competitive advantages of international business entities due to the difference in the regulatory and legislative framework, the distribution of consumers, the levels of development of foreign markets.

The analysis of the activities of international business entities and their comparison with competitors focuses on increasing the innovation potential, which includes scientific, technical, infrastructural, economic, financial, legal, social and cultural opportunities.

Identification of competitive advantages of international business entities can establish competitive advantages at the level of goods or services of subjects of international business; at the level of the subject of international business; at the level of the market of activity of the subject of international business.

The determined set of indicators for assessing the competitive advantages of international business entities is the basis for calculating the integral indicator.

Table 1

The main competitive advantages of international business entities and indicators for their evaluation

Competitive Advantages	Characteristics of benefits	Indicators of competitive advantage assessment
Production and technological	Efficiency of using funds for international operations, saving resources and expenses on foreign economic activity, modernity of technologies and technological processes in the manufacture of export products, characteristics of export products	share of new goods in export, return on capital assets covered by export business, return on assets the level of innovation activity of export-import activity
Personnel	Qualification and creativity of the personnel engaged in the production of export products, productivity, propensity for innovation	output per employee in international activity, personnel potential of foreign workers
Organizational and managerial	Flexibility of organizational structure and effectiveness of management of subjects of international business	quality management of international activities
Financial and economic	Solvency, liquidity, profitability, return on international operations	profitability of export-import activity, coefficient of coverage of own working capital of international activity, indicators of the financial condition of international activity, currency efficiency
Market	Conditions of activity of subjects of international business, competitive environment of international business, proximity to sources of resources and markets	export and import volumes, commodity structure of export and import, the ratio between the growth rate of export of the enterprise's products and the growth of sales of the corresponding products in international markets
Marketing	The image of the subject of international business in international markets, the level of prices for export products, diversified portfolio of orders, communication capabilities of international business entities	fulfillment of export obligations, the average duration of the turnover of export (import) operations, number and amount of claims received from international activities

Source: Research result, 2018.

The integral indicator of the competitive advantages of international business entities should be presented in the form of the function of such groups of variables: competitive

preferences of subjects of international business (Competitive position i), weighted coefficient of the corresponding competitive advantage (Ki), adjustment factor taking into account the influence of factors of the environment (ei):

$$CP = f(\{\text{Competitive position i}\}, \{Ki\}, \{ei\}).$$

The assessment of competitive advantage, its quantitative characteristics is to determine the indicators of competitive advantage for each component; determining the level of influence of this component on the competitiveness of subjects of international business and determining the level of influence of factors of the environment on the corresponding indicator.

We consider the set of competitive advantages given in table. 1, detailing and taking into account the performance indicators of the enterprises of Kharkiv region (Ukraine), which successfully operate in international markets. We will also carry out appropriate calculations, which will create the preconditions for applying a methodological approach to assessing the competitive advantages of enterprises in the global environment. This approach will identify disadvantages in the implementation of the strategy for managing the competitive advantages of international markets, given that the factors of the global environment are influential (Table 2).

The proposed methodological approach allows us to assess the adequacy of the parameters of competitive advantage, based on the results of which it is possible to make operational decisions regarding the strategy of further development of the international activity of the enterprise in the conditions of the global environment and the formation of a stable competitive position.

The situation of subjects of international business is characterized not by certain competitive advantage, but by their aggregate. Taking into account the complexity of the object of evaluation to the system of integral assessment included indicators that reflect a certain direction of activity of subjects of international business in the dynamics. In this case, it is expedient to use such coefficients and relative indicators as they characterize the level of competitive advantages, are informative. Determining the level of influence of this component on the competitiveness of international business entities should be carried out on the basis of scoring by experts, and the impact of environmental factors should be implemented using correction factors, taking into account real changes in external markets.

Due to the assessment of the competitive advantages of international business entities, timely management decisions on tactics and strategies for further development of the subject of international business are possible.

Table 2

Assessment of competitive advantages of machine-building enterprises of the Kharkiv region (Ukraine)

Indicators	Amount	State Enterprise "Plant Electrotyazhmash"	PJSC "Turboatom"	PJSC "HARP"	PJSC "Kharkiv Electrotechnical Plant Ukrelectromash"	PJSC Kharkiv Machine Tool Plant"	JSC Avtramat"	PJSC "Light Miner"
Production and technological (0.20)								
share of new goods in export	0.35	17.4	7.3	9.2	11.4	4.6	6.5	6.6
return on capital assets covered by export business	0.23	8.55	3.1	8.3	7.3	6.4	7.6	5.9
return on assets the level of innovation activity of export-import activity	0.42	21.0	17.6	15.9	12.2	13.6	11.9	11.4
Personnel (0.15)								
output per employee in international activity	0.45	22.5	43.0	33.4	24.0	27.4	12.6	17.8
personnel potential of foreign workers	0.55	11.2	17.9	9.7	3.6	2.5	2.8	2.7
Organizational and managerial (0.15)								
quality management of international activities	1.0	0.67	0.62	0.55	0.89	0.63	0.72	0.86
Financial and economic (0.20)								
profitability of export-import activity	0.3	0.24	0.18	0.23	0.28	0.18	0.20	0.33
coefficient of coverage of own working capital of international activity	0.2	1.5	1.27	1.7	2.1	2.6	1.9	2.0
indicators of the financial condition of international activity	0.25	0.71	0.75	0.71	0.7	0.68	0.76	0.78

Indicators	Amount	State Enterprise "Plant Electrotyazhmash"	PJSC "Turboatom"	PJSC "HARP"	PJSC "Kharkiv Electrotechnical Plant Ukrelectromash"	PJSC Kharkiv Machine Tool Plant"	JSC Avtramat	PJSC "Light Miner
currency efficiency	0.25	0.14	0.12	0.07	0.09	0.16	0.14	0.21
Market (0.15)								
export and import volumes	0.4	0.62	0.76	0.74	0.79	0.81	0.6	0.58
efficiency of commodity structure of export and import	0.3	0.79	0.71	0.77	0.85	0.82	0.74	0.74
ratio between the growth rate of export of the enterprise's products and the growth of sales of the corresponding products in international markets	0.3	0.05	0.06	0.06	0.09	0.09	0.07	0.06
Marketing (0.15)								
fulfillment of export obligations	0.4	0.99	0.98	0.99	0.9	1.0	1.0	0.98
average duration of the turnover of export (import) operations	0.3	8	9	12	14	7	8	14
amount of claims received from international activities	0.3	0	1	0	1	0	0	1
Integral score of competitive advantage		8.9	7.3	6.4	5.3	4.7	3.7	4.2

Source: Research result, 2018.

In the complex consideration of all indicators of the activity of the subject of international business, as well as important factors of external influence, forming a competitive advantage, it is possible to diagnose the activity of the subject of international business in foreign markets and develop its development strategy, taking into account the capacity of the market and directions of its development, in the relevant market, especially the

competition. The weighted average of the normalized integral index of competitive advantages can range from 0 to 1. The value of the integrated indicator of competitive advantage from 0.7 to 1 indicates the significant competitive advantages of the subject of international business in comparison with competitors, which allow to stably act on new markets, expanding them; to innovate and to improve export products. The indicator value of 0.3 to 0.7 demonstrates sustainable competitive advantages that are not quite significant and positive dynamics indistinguishable, suggesting the need to improve financial, industrial, innovation, investment, management, marketing, international business entity. The value of the integrated indicator from 0 to 0,3 suggests that the subject of international business loses competitive advantages, the effectiveness and efficiency of international activity is decreasing, which requires the development and improvement of various areas of activity of the subject of international business, economical use of resources, rationalization opportunities, careful attention to the formation of competitive advantages.

The calculations were carried out on the basis of the results of the activity of the machine-building enterprises of Ukraine in the Kharkiv region, which are international business entities. The main competitive advantages of the State Enterprise "Plant Electrotyazhmash" are highly demanding compliance with the technologies of each operation, and the implementation of full-scale testing of finished products, which allows you to increase sales volumes, the overall integrated indicator speaks of stable competitive advantages on the market. Competitive advantages of PJSC "Turboatom" are the conditions for effective work of employees, their training, stimulation of initiative and professional growth. Competitive advantages of PJSC "HARP" are the satisfaction of importers' needs regarding quality and terms of delivery, full complex of quality control of products. The competitive advantage of PJSC "Ukrelectromash" is the quality management with effective import control of materials import. As a competitive advantage of PJSC "Kharkiv Machine-Tool Plant", it was chosen to create its own service network of the enterprise in order to increase the efficiency of the company's product use by customers. Competitive advantage JSC "Avtramat" is the focus on the needs of demanding customers. PJSC "Light Miner" is one of the leaders in the business rating among Ukrainian enterprises based on the results of the national statistical ranking of economic entities on the basis of a set of indicators of their financial and economic activity, indicating financial and economic and organizational and local managerial competitive advantages.

5. Conclusions

The current conditions for the disintegration of the economy require timely diagnosis and evaluation of competitive advantages, since competition in international markets for Ukrainian business is rather fierce. The subject of international business should assess in detail the competitive position and use the available competitive advantages in a timely manner. The results of timely evaluation provide an opportunity for the subjects of international business to timely adjust the strategy. An integral indicator of the competitive advantages of an international business entity is the basis for its competitiveness in international markets. The availability of calculations of the integrated indicator of

competitive advantages gives the opportunity of tactical management, development strategy development, the formation of the potential of the subject of international business.

Thus, the study analyzed the essence of the competitive advantage of the subject of international business and its components. The process of ensuring the realization of competitive advantages of the subjects of international business is formed, which allows to quickly determine the components of competitive advantages and to carry out their evaluation. A list of indicators for assessing the competitive advantages of international business entities that measure the competitiveness of the subject of international business in foreign markets is established. The degree of competitive advantage of a subject of international business in a certain period of time is determined by the influence of interconnected factors. The assessment of competitive advantages ensures their realization and definition of the major directions of activity of subjects of international business, which is a prerequisite for the effectiveness of management, the formation of the potential of the subject of international business.

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ИКОНОМИЧЕСКИ ИЗСЛЕДВАНИЯ
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CORRELATION DYNAMICS BETWEEN SOUTHEAST EUROPEAN CAPITAL MARKETS

This study examines the linkages between eight South East European emerging stock markets and three reference ones during the period 2005-2015 In this study we prove that there is a weak or moderate positive correlation between the reference capital markets of Turkey, Greece and Croatia and the other examined markets. All things considered, it seems reasonable to assume that there is a strong relationship between SEE capital markets. What is more, the degree of the development of the SEE capital markets determines the linkages between them, while the reference capital markets are with weaker correlation in the group than the developing markets. The developing capital markets of the explored group are strongly determined by country-specific factors, but five of them are strongly influenced by the Greek innovations. However, the market integration is anticipated to strengthen, as a result of EU expansion, as the implementation of Strategy 2020. These countries will take profit if their capital markets are more accessible to foreign investors, reorganizing them in conditions to international law in order to defend foreign investors.
JEL: C32; E27; G15

1. Introduction

Over the last 30 years, financial markets have become more integrated mainly because of reducing the value of information, the development of electronic trading systems and the removal of the legal restrictions on international capital flows. These changes lead to a stronger interaction between the international financial markets and also expend the capital movements. What is more, according to the portfolio theory, profits from the international diversification of the financial instruments portfolio are inversely related to the correlation of returns of these financial instruments. In the context of this theory, investors are becoming more active by investing in the foreign capital markets as a part of the risk

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diversification strategy. The tendency for the global markets to become integrated and harmonized is a result of the increasing tendency toward liberalization and deregulation in the money and capital markets, both in developed and developing countries. Such liberalization is important to introduce structural reforms, to promote market efficiency, to estimate investment, and to create a necessary climate for promoting sustainable economic growth. As a result, in the contest of portfolio theory, there is an increase in correlations between financial markets leading to reduce the benefits of international diversification. The analysis of the capital markets integration represents an important topic in the financial area as it possesses essential practical implications for assets allocation and investment management.

Capital markets in different countries or regions may show a diversified degree of integration, harmonization and segmentation. Rational investors should arbitrage between prices of the stock assets which actually resulting in more integrated markets. Since the last financial crisis, European countries have faced various challenges: consolidating their budgets while at the same time promoting economic growth and a collapse in the gross domestic product (Stoilova, 2017). Further financial development and integration can help to improve the effectiveness of and the political incentives for structural reform.

As Ganchev (2015) emphasizes the last global financial crisis of 2007- 2008 is considered by many economists as the worst economic turmoil since the Great Depression. Over the last few years, the development of Southeast European capital markets (SEE) has attracted more local investors, especially after the financial crisis. In addition, the countries in the same geographic region and also with the same group of investors are likely to have correlated capital markets. Consequently, the issue of the co-movement of the SEE capital markets is important for the local investors and companies in the region that are making capital budgeting decisions. In this study the joint movement of the SEE capital markets is examined although there are significant differences between SEE stock markets' characteristics.

In this study we find enough evidence that SEE capital markets are correlated and integrated and therefore these markets are characterized with harmonized and homogeneous market dynamics. The degree of the development of the SEE capital markets determines the linkages between them, while the reference capital markets are with weaker correlation in the group than the developing markets. The results reveal that there is a weak or moderate positive correlation between the reference capital markets of Turkey, Greece and Croatia and the other examined markets. The results show that strength of co-movement between Bulgarian stock market and the rest markets in Southeast Europe (SEE) is strong, especially with Serbian, Romanian and Croatian markets. The developing capital markets of the explored SEE group are determined mainly by their country-specific risk. The main contribution of this paper is that it provides further evidence on stock market integration and correlations in several SEE developing capital markets and three reference capital ones, emphasizing new linkages between Greek, Croatian, Turkish capital markets and the developing SEE stock ones. All things considered, it seems reasonable to assume that there is a strong correlation between SEE capital markets.

In this paper, we analyze the joint movement of eleven financial markets of South East Europe (SEE) - Bulgaria, Croatia, Greece, Serbia, Slovenia, Turkey, Romania, Montenegro,

Macedonia, Banja Luka and Sarajevo (Bosnia and Herzegovina) using correlation analysis during the period 2005-2015.

The methodological and theoretical basis of the research can be formulated in the following sequence:

1. Theoretical analysis based on previous theoretical and empirical researches;
2. Development and implementation of practical econometric models. The analysis which reflects the quantitative results of the application of econometric methodology is based on the correlation analysis and VAR;

Restrictive conditions of this research are determined in the following aspects:

1. *Time range*-this research is restricted in the time interval from 2005- 2015;
2. *Methodological restrictions* –they are set by the statistical properties of the researched data imposing the application of specific econometric tests and models giving an opportunity for the reflection. The proposed and used methodology does not claim to be the only possible and applicable when inspecting and proving the research thesis of this study.
3. *Place restrictions* – the analysis and the inspection of the research thesis are concentrated on Southeast European Capital Markets
4. Due to the aforementioned facts, conclusions drawn of this research do not engage the processes and circumstances of other markets of the category of Southeast European Capital Markets.

The paper is organized in the following way. The first section initiates with the introduction. Section 2 summarizes the literature review. Section 3 discusses the data and the research method employed. Section 4 shows the main estimation results. The final section provides a summary and conclusions.

2. Literature review

Many studies analyze the stock market co-movements among developed countries (Longin and Solnik, 1995; Forbes and Rigobon, 2002; Johnson and Soenen, 2003). Also, there are numerous studies concerning Central and Eastern Europe stock market co-movements (Kasch-Haroutounian and Price, 2001; Voronkova, 2004; Cappieollo, et al., 2006; Babetskii et al., 2007; Egert and Kocenda, 2007; Černý and Koblas, 2008; Gilmore et al., 2008; Kocenda and Egert, 2011). In comparison, the studies for the stock markets co-movements in South Eastern Europe are just a few. Kenourgios and Samitas (2011) use conventional test, regime-switching co-integration tests and Monte Carlo simulation to analyze long-run relationships among five Southeastern European (SEE) stock markets (Turkey, Romania, Bulgaria, Croatia, Serbia), the United States and three developed European markets (UK, Germany, Greece), during the period 2000–2009. The authors find enough evidence for a long-run cointegrating relationship between the SEE markets within

the region and globally. Gradojevic and Dobardzic (2012) use a frequency domain approach to examine the causal relationship between the returns on major indexes of Croatia, Slovenia, Hungary and Germany and the return of the main Serbian index. The results reveal that there is a predominant effect of the Croatian and Slovenian indexes on Serbian stock exchange index across a range of frequencies. Applying GARCH models, Horvath and Petrovski (2013) examine the stock market co-movements between Western and Central Europe (the Czech Republic, Hungary and Poland) on the one hand, and South Eastern Europe (Croatia, Macedonia and Serbia) on the other hand, in the period 2006–2011. The results show that the degree of co-movements is much higher for Central Europe than for South Eastern Europe.

Stoica and Diaconaşu (2013) find out the existence of more than one cointegration vectors signifies comovements and linkages for the CEE analysed markets, indicating a stationary long-run relationship. In their study, no dramatic shock was detected in stock market dynamics after the expansion of the Vienna Stock Exchange, but still the findings highlighted an increased integration between it and CEE markets in the second subperiod. Additionally, the increasing response to the arrival of price innovations from Austria is registered only in the case of EU markets.

Syllignakis and Kouretas (2010) reveal that the financial linkages between the CEE markets and the world markets increased with the beginning of the EU accession process and also conclude that the global financial crisis of 2007–2009 caused a slowdown in the convergence process. Syriopoulos and Roumpis (2009) note that the Balkan stock markets are seen to exhibit time-varying correlations as a peer group, although correlations with the mature markets remain relatively modest.

A large number of existing studies establishes that due to increasing similarity of returns of different capital markets, the benefits of international diversification of portfolios have gradually faded (Gilmore and McManus, 2004; Aggarwal and Kyaw, 2004; Darrat and Zhong, 2005; Longin and Solnik, 2001). All things considered, stronger integration of financial markets in the presence of internationalization may reduce the power and advantage of diversification; nonetheless, the dissemination of information across financial markets is vital for portfolio managers to construct optimal portfolios. It is further apparent that stock markets have become increasingly important as a source of raising funds for public companies in CEE countries (Stoica et al., 2005).

Gradojević and Djaković, (2013) find substantial causality interactions at stock returns at various frequencies between stock market indices in Croatia, Slovenia relative to the returns of Serbian index Belex 15.

In order to assess the impact of the 2008 financial crisis on the interconnection among the SEE stock markets (Macedonian, Croatian, Slovenian, Serbian, and Bulgarian) Zdravkovski (2016) finds out no evidence of cointegration between studied markets during the pre- and post-crisis periods. However, during the 2008 financial crisis, the empirical findings support the existence of three co-integration vectors. This means that the recent global financial crisis and the subsequent euro crisis strengthened the connection between the investigated stock markets. Furthermore, the analysis reveals that during periods of financial turmoil, the Macedonian stock market is positively and actively influenced by the

Croatian and Serbian markets. A significant implication of these results is that the integration between SEE stock markets tends to alter over time, particularly during stages of financial disturbances.

Analyzing the Bulgarian and Serbian capital markets, taking into account the 2008 crisis Simeonov (2015) points out that even similarities between two economies, their markets show a different reaction to the effects of the crisis. Despite the normally highly volatile capital markets the Serbian investment activity is more vital and more optimistic, than the Bulgarian, which supports the real sector and the economy, as a whole. While, the investors on the BSE-Sofia are expressively disposed to undervalue the economic activity, they have continued to behave markedly timorous since 2008. The last fact is a result partially of the naive optimism, spread by the end of 2007.

Todorov (2017) concludes that Bulgaria is characterizing by ineffective money market which stays under the equilibrium levels during stagnation. In his research he indicates about stimulating economic growth by increasing money supply and improving the efficiency of Bulgarian capital market. Studying the impact of 2008 financial crisis on the efficiency of the capital markets of Central and Eastern European (CEE) countries Tsenkov (2015) finds differences in the market reaction of two of studied markets in comparison with the rest CEE markets. The Bulgarian and the Romanian indices show a disposition for faster and more sensitive reaction to negative market impulses, typical for the Crisis Period, in contrast to a moderate incorporation of the positive market impulses specific to the Pre-crisis Period. The incorporation of the market information by Bulgarian SOFIX during Crisis Period is so accelerated that when it becomes publicly available much of the content is already included in the values of SOFIX under the form of strongly followed market trend. This type of reaction is opposite to the behavior from other CEE indices which follows more sustainable market trends during the pre-crisis period and gives much lower significance of the new market information. This market behavior has changed during the Crisis Period, demonstrating an enhanced response only to the short-term market fluctuations. During the Post-crisis Period the Bulgarian and the Romanian indices are showing a predisposition to the short-term market trends. This is opposite to the other CEE indices which tend to form and pursue longer-term market trends.

Yang et al. (2004) explores contagion effects and information transmission channels between nine stock markets – Hong Kong, Indonesia, Korea, Malaysia, Thailand, Philippines, Singapore, Taiwan and Japan) by applying VAR methodology. He tries to reveal interactions between the aforementioned markets during a crisis period. Shamurove (2005) reveals the interaction between markets in the Middle East, namely Egypt, Israel, Jordan, Lebanon, Morocco, Oman and Turkey. The applied methodology is VAR model. The results expose that none of the explored financial markets is independent.

3. Methodology

Before proceeding the econometric analysis of the returns of stock market indexes, we should analyze the graphical dynamic of the explored indexes and their return during the explored period. Their dynamic is revealed in Appendixes 1. It is proved that all graphs expose volatility clusters, especially expressed between the time period of 2007- 2009. We observe almost the same dynamic for all of the explored capital markets. Only for the Greek index ATHEX we observe more expressed volatility clusters at the end of the explored period. It may due to the sovereign debt crisis in Greece.

3.1. Augmented Dickey-Fuller (ADF) test

According to Tanchev (2016): "Before proceeding to the election of the econometric method, it is necessary to apply a test to establish the stationarity". The null hypothesis of the Augmented Dickey and Fuller (ADF) is non-stationary. The Augmented Dickey-Fuller unit root tests is performed on each series. The tests reject the non-stationary null hypothesis for the stock price index at 1 %, 5 % and 10% significance level for all monthly stock returns at level.

The Augmented Dickey-Fuller (ADF) test constructs a parametric correction for higher-order correlation by assuming that the y series follows an AR (p) process and adding p lagged difference terms of the dependent variable y to the right-hand side of the test regression:

$$(1)\ \Delta y_t = \alpha y_{t-1} + x_t^{'}\delta + \beta_1 \Delta y_{t-1} + \beta_2 \Delta y_{t-2} + ... + \beta_p \Delta y_{t-p} + \nu_t$$

3.2. Descriptive Statistics

Table I

Descriptive Statistics for SEE stock market indices

	RATHEX	RBELEX	RBET	RBIFX	RBIRS	RBIST	RCROBEX	RMBI	RMONEX	RSBITOP	RSOFIX
Mean	-0.010485	-0.003972	0.003449	-0.006677	-0.003949	0.009159	0.000679	0.004200	0.011761	-0.004325	-0.002579
Median	0.002666	0.003293	0.011076	-0.012899	-0.008940	0.007646	0.000828	-0.009416	-0.000576	0.000220	-0.000127
Maximum	0.222195	0.276658	0.236225	0.284238	0.307819	0.258045	0.329743	0.418677	0.449368	0.160444	0.310345
Minimum	-0.312754	-0.398026	-0.377969	-0.210969	-0.256846	-0.210731	-0.395540	-0.376864	-0.325570	-0.195710	-0.509278
Std. Dev.	0.096368	0.094793	0.090531	0.076111	0.068390	0.082279	0.086153	0.105123	0.114887	0.059442	0.091216
Skewness	-0.386752	-0.608950	-0.933076	0.776436	0.870484	-0.044665	-0.604120	0.793063	0.739286	-0.466496	-1.320319
Kurtosis	3.576876	6.222918	6.167721	5.705056	7.919202	3.212425	8.604285	6.651975	6.024136	4.259510	11.44921
Jarque-Bera	5.043432	59.84701	73.21697	52.69735	147.4932	0.287648	178.0342	85.86888	61.37935	11.66999	424.4611
Probability	0.080322	0.000000	0.000000	0.000000	0.000000	0.866040	0.000000	0.000000	0.000000	0.002923	0.000000
Sum	-1.363014	-0.480607	0.448319	-0.867978	-0.513333	1.190637	0.088238	0.546046	1.528968	-0.493062	-0.335241
Sum Sq. Dev.	1.197989	1.078279	1.057267	0.747288	0.603357	0.873308	0.957490	1.425567	1.702668	0.399263	1.073321
Observations	130	121	130	130	130	130	130	130	130	114	130

Source: Authors' calculations.

Table I shows the descriptive statistics of the monthly returns for each SEE stock index. We can assume that the Turkish and Montenegrin markets, offers, on average the highest return over the examined period (0,009% and 0,012% respectively). On the other hand, the mean excess return is lower in Greece, Serbia, Bosna and Herzegovina, Banja Luka, Slovenia and Bulgaria. These results confirm previously established results (Stoica and Diaconasu, 2013). The lower standard deviation values indicates that the SEE capital markets exhibit lower volatility, but the highest value is registered for Montenegro. Most of the analyzed index series (7 of the 11 SEE indices) are negatively skewed (except from Bosna and Herzegovina, Banja Luka, Macedonia and Montenegro). There is a higher probability for investors to get negative returns from Bulgaria rather than positive returns due to the highest negative skewness value (-1.32). The kurtosis values of all indices returns are larger than the value of normal distribution (the kurtosis of the normal distribution is 3), indicating that big shocks are more likely to be present for this markets. The Jarque–Bera test (test for normality) rejects normality of distribution of the analyzed markets, which means that all indices exhibit significant departures from normality.

3.3. Correlation

Correlation is any of a broad class of statistical relationships involving dependence, though in common usage it most often refers to the extent to which two variables have a linear relationship with each other.

The population correlation coefficient $\hat{\rho}(X,Y)$ between two random variables X and Y is defined as:

$$(2)\ \hat{\rho}(X,Y) = \frac{\hat{\sigma}(X,Y)}{(\hat{\sigma}(X,X).\hat{\sigma}(Y,Y))^{1/2}}$$

A correlation coefficient is a number that quantifies a type of correlation and dependence, meaning statistical relationships between two or more values in fundamental statistics

3.4. VAR methodology

The technique of Correlation Analysis is a technique, related with some of the following limitations: it estimates the contemporaneous relationship between the variables, but VAR methodology is a procedure that gives useful insights for lagged links (Patonov, 2016). The vector autoregression (VAR) is commonly used for forecasting systems of interrelated time series and for analyzing the dynamic impact of random disturbances on the system of variables. The VAR approach sidesteps the need for structural modeling by treating every endogenous variable in the system as a function of the lagged values of all of the endogenous variables in the system.

The mathematical representation of a VAR is:

$$(3)\ y_t = A_1 y_{t-1} + ... + A_p y_{t-p} + Bx_t + \varepsilon_t$$

where y_t is a *k* vector of endogenous variables, x_t is a*d* vector of exogenous variables, $A_1,...,A_p$ and *B* are matrices of coefficients to be estimated, and ε_t is a vector of innovations that may be contemporaneously correlated but are uncorrelated with their own lagged values and uncorrelated with all of the right-hand side variables.

Since only lagged values of the endogenous variables appear on the right-hand side of the equations, simultaneity is not an issue and OLS yields consistent estimates. Moreover, even though the innovations ε_t may be contemporaneously correlated, OLS is efficient and equivalent to GLS since all equations have identical regressors. VAR model is a parameter estimation method. Applying VAR model, we reveal possible relations between current and past values of the explored variables. We apply this model, within the framework of a vector autoregression (VAR) model, to examine the dynamics of interdependency between the reference SEE capital markets and developing SEE capital markets. The most important advantage of VAR models is that they provide an opportunity to investigate the reaction of each national stock market to its own price shocks and the price innovations from the reference capital market as well (Stoica and Diaconaşu (2013).

The econometric models have undergone diagnosis analyses for testing their statistical properties, the main steps taken being:

I. Testing for stationarity of the variables;

II. Choosing the most appropriate lag length of the VAR model;

III. Testing the stability of VAR;

IV. Testing for autocorrelations, heteroskedasticity of residual terms and checking for their normal distribution.

We apply variance decomposition and impulse- response function in order to reveal market integration and interaction of SEE capital markets.

To estimate the VAR model we have defined as endogenous variables the returns of each index-the Bulgarian *SOFIX*, the Banja Luka *BIR*S, the Sarajevo *BIFX*, the Greek *Athex Composite Share Price Index (ACSP)*, the Macedonian *MBI10*, the Romanian *BET*, the Serbian *BELEX15*, the Croatian *CROBEX,* the Slovenian *SBI TOP*, the Turkish *BIST100* and the *Montenegrin* MONEX and as exogenous variables the past values (2 lags) of the same variables. The lag-length of VAR is determined by the use of information criteria – Akaike's information criteria (AIC) and Schwarz information criterion (SIC). The Akaike Information Criterion and the Schwarz information criterion (SIC) are tools to select the best model, and we chose the lag that minimizes the AIC and the SIC value. As a best model, we accept the one, in which AIC and SIC's statistics possess the lowest values (Table II).

Table II

VAR Order Selection Criteria

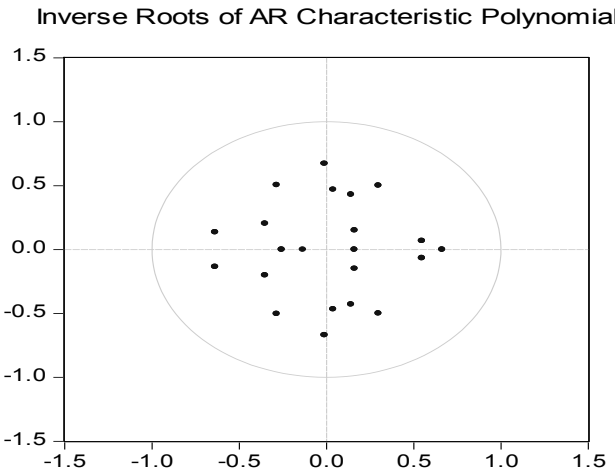
Lag	AIC	SIC
0	-29.72709	-26.45069
1	-30.56166	-27.24492
2	-31.83495*	-28.47787*
3	-29.85167	-20.45425
4	-30.64728	-18.20952
5	-30.36653	-15.88843
6	-29.49035	-13.97191
7	-30.24189	-13.68311
8	-29.16045	-16.56133

Source: Authors' calculations

The stability condition of a VAR is that the characteristic equation roots of the estimated coefficients matrix of VAR should be inside the unit circle (Graph 1). All modulus are smaller than one and this means that the system is stationary. The stability of a system assumes that the shocks are transient and disappear after a certain period of time, and their lack of steadiness implies that certain results, such as the standard errors for the impulse-response function, are not valid (Geamanu, 2014). According to tests, the estimated VAR is stationary.

Graph 1

Inverse Roots of AR Characteristic Polynomial



Source: Authors' results

In order to see if there is any autocorrelation, we use Lagrange Multiplier (Table III).

Table III

VAR Residual Serial Correlation LM Tests

Lags	LM-Stat	Probability
1	149.4488	0.0605
2	129.9325	0.2732
3	148.6294	0.0547

Source: Authors' results.

The null hypothesis that **H0: no serial correlation at lag order** his confirmed**.** This means that it does not exist autocorrelations in first, second and third order and the applied VAR model may be considered as an appropriate one to capture the dynamics and interactions between explored capital markets. The White Heteroskedasticity test to detect the existence of heteroskedasticity (the lack of a constant variance) is applied. The test results are satisfactory, the assumptions of the existence of autocorrelation and existence of homoskedasticity can be rejected at the conventional 5% significant level (Table III, Appendix II).

We apply the Lutkepol test to check the normality of the series (Appendix III). Although small number of the errors do not have a normal distribution, we chose to ignore this problem considering the appropriate models in terms of theory, and the lack of normality does not mean that the model is invalid, but only that there are other variables which explain the model (Geamanu, 2014).

3.5. Data

In this paper, we examine the co-movement of the SEE capital markets using correlation and VAR analysis. Throughout this study, it is aimed to reveal that none of the analysed markets is absolutely independent, even though the interrelationships are not so significant. The indices under examination are eleven indices represent all capital markets of South East Europe: the Bulgarian *SOFIX*, the Banja Luka *BIR*S, the Sarajevo *BIFX*, the Greek *Athex Composite Share Price Index (ACSP)*, the Macedonian *MBI10*, the Romanian *BET*, the Serbian *BELEX15*, the Croatian *CROBEX,* the Slovenian *SBI TOP*, the Turkish *BIST100* and the *Montenegrin* MONEX. The stock exchanges of SEE can be divided into two groups in the context of their development, using the stock market capitalization as a criterion (Table V). According to Stavrova (2017): "The process of global financial and economic development has reached a varying degree…" The first group contains the emerging markets – Bulgaria, Romania, Banja Luka and Sarajevo (Bosnia and Herzegovina), Serbia, Montenegro, Macedonia, Slovenia and the second one – reference capital markets – Croatia, Turkey and Greece (Table IV and Table V). Daily closing prices of eleven SEE market indices were available on the Stock Exchanges' websites of the investigated countries. The data range is 1st January 2005 to 4th November 2015. We use the values of the returns of the indices with a monthly frequency. We calculate the percentage change between the opening value of the index on the first working day of the month *(Vt)* and the opening value on the first working day of next month *(Vt+1),* or:

$$(4)\ R_t = \frac{V_{t+1} - V_t}{V_t}$$

Table IV

Analyzed stock exchanges, indices and a number of observations

Country	Stock exchange	Index
Bulgaria	Bulgarian Stock Exchange	SOFIX
Bosnia and Herzegovina	Banja Luka stock exchange	BIRS
Bosnia and Herzegovina	Sarajevo stock exchange	BIFX
Greece	Athens Stock Exchange	Athex Composite Share Price
Macedonia	Macedonian Stock Exchange	MBI10
Romania	Bucharest Stock Exchange	BET
Serbia	Belgrade Stock Exchange	BELEX15
Croatia	Zagreb Stock Exchange	CROBEX
Slovenia	Ljubljana Stock Exchange	SBI TOP
Turkey	Borsa Istanbul	BIST100
Montenegro	Montenegro Stock Exchange	MONEX

Notes for Table 1: Southeast Europe includes 10 countries: Bulgaria, Bosnia and Herzegovina (two capital markets-Sarajevo and Banja Luka), Greece, Macedonia, Romania, Serbia, Croatia, Slovenia, Turkey and Montenegro.
Source: Author's calculations.

Table V

Market capitalization of SEE capital markets for 2011

SEE capital markets	Market capitalization (US$)
Country	**2011 (billion)**
Bulgaria	8,253.25 US$
Croatia	22,558.38 US$
Greece	33,778.89 US$
Banja Luka (Bosnia and Herzegovina)	2,601.39 US$
Sarajevo (Bosnia and Herzegovina)	2,263.89 US$
Montenegro	3,509.11 US$
Romania	14,023.92 US$
Serbia	4,055.58 US$
Slovenia	6,325.86 US$
Turkey	197,074.46 US$
Macedonia	580.36 US$

Notes for Table 2: The total market capitalization of each capital market is for 2011 (approximately in the middle of the examined period 2005-2015).
Source: The websites of the SEE stock exchanges.

Table VI

Developing and reference capital markets (according to the market capitalization)

Developing SEE capital markets	Reference SEE capital markets
Bulgaria	**Greece**
Banja Luka (Bosnia and Herzegovina)	**Croatia**
Sarajevo (Bosnia and Herzegovina)	**Turkey**
Macedonia	
Montenegro	
Romania	
Serbia	
Slovenia	

Notes for Table 3: Median market capitalization is US $ 6,325.86 billion.
Source: Author's calculations.

4. Empirical results

4.1. Stationary

Before analyzing the co-movement of the SEE financial markets, the Augmented Dickey-Fuller (ADF) test is applied to examine the stationary properties of the return series. The null hypothesis of ADF test is that the series has a unit root (non-stationary process). It can be seen from the above table, the series **are stationary at level**.

Table VII

Estimating results of Augmented Dickey –Fuller (ADF) test

Country/Indices	**Parameters**		Stock index Return*
Bulgaria	**ADF statistic**		-7.597629
	Critical Values	**1%**	-3.481623
		5%	-2.883930
		10%	-2.578788
	p-value		*0.0000*
Croatia	**ADF statistic**		-10.75016
	Critical Values	**1%**	-3.481623
		5%	-2.883930
		10%	-2.578788
	p-value		*0.0000*
Greece	**ADF statistic**		-9.675144
	Critical Values	**1%**	-3.481623
		5%	-2.883930
		10%	-2.578788
	p-value		*0.0000*
Macedonia	**ADF statistic**		-6.088729
	Critical Values	**1%**	-3.600987
		5%	-2.935001
		10%	-2.605836
	p-value		*0.0000*

Montenegro	**ADF statistic**		-5.213145
	Critical Values	**1%**	-3.610453
		5%	-2.938987
		10%	-2.607932
	p-value		*0.0001*
Romania	**ADF statistic**		-9.291294
	Critical Values	**1%**	-3.481623
		5%	-2.883930
		10%	-2.578788
	p-value		*0.0000*
Slovenia	**ADF statistic**		-7.233281
	Critical Values	**1%**	-3.488063
		5%	-2.886732
		10%	-2.580281
	p-value		*0.0000*
Turkey	**ADF statistic**		-9.430183
	Critical Values	**1%**	-3.496346
		5%	-2.890327
		10%	-2.582196
	p-value		*0.0000*
Serbia	**ADF statistic**		-4.391736
	Critical Values	**1%**	-3.486551
		5%	-2.886074
		10%	-2.579931
	p-value		*0.0005*
Banja Luka	**ADF statistic**		-7.030134
	Critical Values	**1%**	-3.481623
		5%	-2.883930
		10%	-2.578788
	p-value		*0.0000*
Sarajevo	**ADF statistic**		-5.970411
	Critical Values	**1%**	-3.482035
		5%	-2.884109
		10%	-2.578884
	p-value		*0.0000*

**All of the stock index returns are stationary at level.*
Source: Authors' calculations.

4.2. Correlation analysis

In order to examine the co-movement of the SEE capital markets, the correlation analysis is applied. Analyzing the results of the correlation matrix the major conclusions for the harmonization of the examined indices in the region. The correlation matrix is presented in Table 5. The Serbian index BELEX15 registers the highest correlations with the other examined indices. In contrast, the least connected capital market in the region is that of Banja Luka, considering the lowest values of registered correlation coefficients. In addition, the Montenegrin index MONEX is relatively closely correlated with the Serbian index

BELEX15 (0.685317), the Croatian index CROBEX (0.679181) and the Macedonian index MBI10 (0.690677), which can be attributed to the existing integration between these financial markets with close and similar development and characteristics. Additionally, these capital markets face similar challenges and problems - corruption, judicial independence, law enforcement, shadow economy, a limited number of foreign investors and the issue of free movement of capital. The Croatian index CROBEX is predictably high associated with BELEX15 (0.669970), BET (0.608768), MONEX (0.679181), MBI10 (0.690677) and SOFIX (0.616263) due to the symmetric market shocks on these capital markets, and their close economic development and growth. It was proved that the index BIST100 of the reference Turkish capital market registered a low or moderate correlation with the other indices in the region, which means that the market dynamics of this market does not affect the other financial markets in SEE. In addition, the Turkish market show relatively high correlation (compared to other SEE capital markets SEE) with reference Greek capital market (0.516566).

Table VIII

Correlation matrix of examined SEE market indices

	ACSP	BELEX15	BET	BIFX	BIRS	BIST100	CROBEX	MBI10	MONEX	SBITOP	SOFIX
ACSP	**1.000000**										
BELEX15	0.450656	**1.000000**									
BET	0.642541	0.533182	**1.000000**								
BIFX	0.289116	0.658350	0.327432	**1.000000**							
BIRS	0.159478	0.536066	0.212359	0.524708	**1.000000**						
BIST100	0.516566	0.299001	0.546841	0.275759	0.167652	**1.000000**					
CROBEX	0.507915	0.669970	0.608768	0.479733	0.368159	0.481318	**1.000000**				
MBI10	0.340126	0.653152	0.385513	0.423698	0.470494	0.234876	0.600676	**1.000000**			
MONEX	0.345074	0.685317	0.310752	0.540538	0.504158	0.343549	0.679181	0.690677	**1.000000**		
SBITOP	0.536818	0.576229	0.490587	0.500012	0.287006	0.390038	0.542098	0.547407	0.467569	**1.000000**	
SOFIX	0.515429	0.603714	0.661221	0.370920	0.271405	0.406721	0.616263	0.379637	0.350571	0.549255	**1.000000**

Source: Author's calculations.

On the other hand, the countries that are not part of the European Union (EU) - Montenegro, Macedonia, Bosnia and Herzegovina (Sarajevo and Banja Luka) are characterized with moderate or low values of correlation coefficients, probably due to different market dynamics during the financial crisis of 2008. Additionally, for reference capital markets in the region, namely Turkey, Greece and Croatia is registered low or moderate positive correlation, suggesting that there are not leading and dominant financial market to influence the market dynamics of all other SEE indices. Several additions can be made here. Firstly, the Greek market is weakly correlated with all developing SEE capital markets (Macedonia, Serbia, Montenegro, Slovenia, Banja Luka, Sarajevo, Bulgaria), with the exception of the Romanian one, considering the low positive correlation coefficients. Secondly, the Turkish capital market has shown a low correlation with all emerging markets in the region. In addition, the Slovenian index is characterized by a low or moderate relationship with other SEE equity markets. A possible explanation for such weak correlation between the Slovenian capital market and the other SEE markets can be sought in the overtaking and rapid development of this market and the growth in market turnover in the last few years as a result of the introduction of new financial instruments

(derivatives), attracting international portfolio investors, as well as local institutional investors.

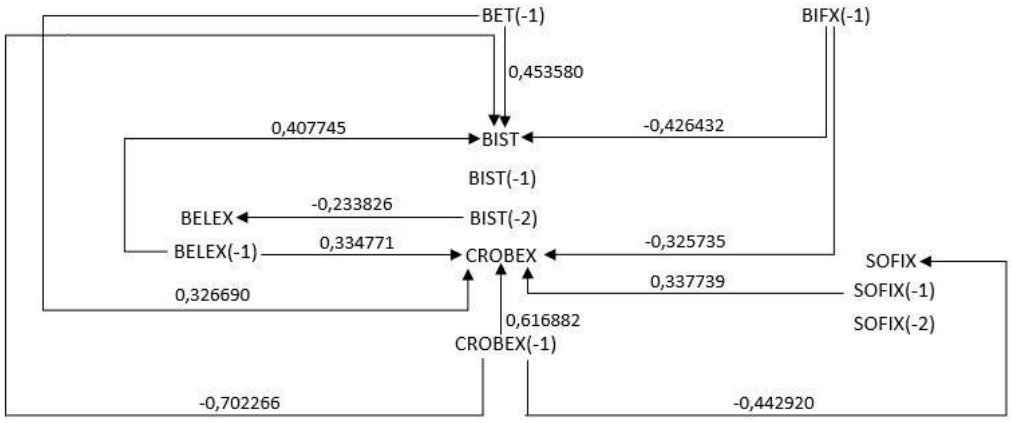
Bulgaria is relatively synchronized with other countries in the region considering the highest correlation with Serbia (0.603714), Romania (0.661221) and Croatia (0.616263). It can be assumed that this is due to the symmetrical shocks to which the Bulgarian and other capital markets are exposed, as well as to the geographic proximity between these countries and the correspondingly intensive flows of capital assets between them.

4.3. VAR model

Graph 2 and Graph 3 show the estimated results of the applied VAR model, where only statistically significant values and interrelations are exposed. Graph 2 includes the interactions between the reference and the emerging capital markets. Graph 3 exposes the statistically significant relations only between emerging markets.

Graph 2

VAR results for interactions between reference and developing capital markets



Notes: They are exposed only statistically significant relationships
Source: Authors' calculations.

For BIST returns we have found that the values of t- statistics associated with BELEX (-1), BET (-1), BIFX (-1) and CROBEX (-1) are higher than 2 (in absolute values), so it means that these observations are statistically relevant to explain the current values of BIST. Consequently, we may conclude that the returns of BELEX, BET, BIFX and CROBEX with one lag have an impact on the current of BIST returns. We observe positive influence over BIST from BELEX (-1) and BET (-1) with coefficient values equal to (0.407745) and

(0.453580). This means that an increase in the values of the aforementioned indexes indicates an increase in BIST values. The strongest negative interaction is revealed between the current return of BIST and CROBEX (-1). The coefficient value is equal to (-0.702266). This indicates that in average when CROBEX returns from a month before increase with 1 pp the current returns from BIST decreases 70.22%, assuming that the rest remains constant. This leads to the conclusion that the strongest negative relationship is proved between two of the reference capital markets. The coefficient value of BIFX (-1) is negative with the weight of the coefficient (-0.426432), either. This indicates for an inverse relation between BIST returns and BIFX (-1). BIST (-2) returns influence negatively to BELEX current returns with coefficient value (-0.233826). In direct comparison between both interactions reference-developing capital markets and vice versa, the current BELEX returns incorporate the information from BIST with two lags and the relation is inverse. The Turkish BIST100 incorporates the information from BELEX with one lag and the relation is straightforward. As an explanation for the aforementioned results, we may point out the higher information efficiency of Turkish BIST100. It is proved by the faster information incorporation of BELEX values and the higher value of the coefficient (0.407745).

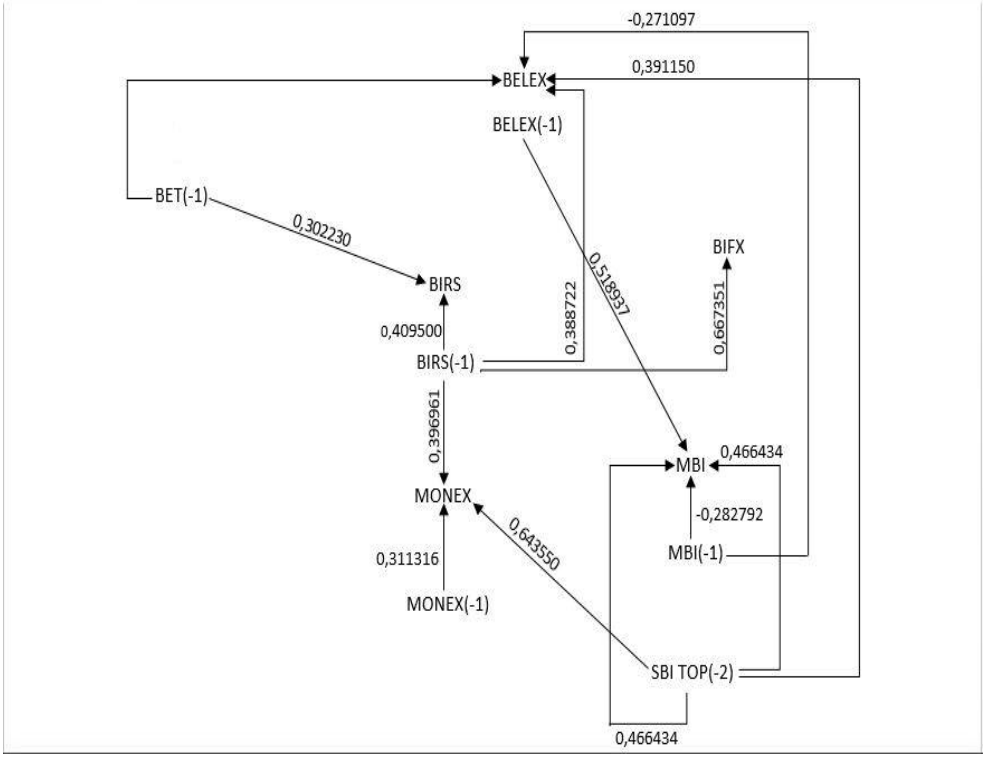
For CROBEX returns we have found that the values of t- statistics associated with BELEX (-1), BET (-1), BIFX (-1), CROBEX (-1) are higher than 2 (in absolute values), so it means that these observations are statistically relevant to explain the current values of CROBEX. Consequently, we may conclude that the returns of BELEX, BET, BIFX, and CROBEX with one lag have an impact on the current of CROBEX. From the lag period, we should mention that CROBEX current returns incorporate the information flows from the aforementioned indexes fast. The coefficient values indicate for moderate interaction between these financial markets. CROBEX (-1) and BIFX (-1) have negative signs of their coefficients equal to (-0.616882) and (-0.325735). The strongest relation we observe for the past values of CROBEX returns for 61.68 %. BELEX (-1), BET (-1) and SOFIX (-1) influence CROBEX with the following coefficient values (0.334771), (0.326690) and (0.337739). This indicates that in average when BELEX (-1), BET (-1) and SOFIX (-1) returns from a month before increase with 1 pp the current returns from CROBEX increase respectively with 33.47%, 32.66% and 33.77% assuming that the rest remains constant. We observe a bilateral relationship between CROBEX and SOFIX. For SOFIX returns, we have found that the coefficient value of CROBEX (-1) is statistically significant. It is equal to (-0.422920). This relationship indicates for fast information incorporation of both markets with one lag. The influence of CROBEX (-1) in the returns of SOFIX is stronger than the influence of SOFIX (-1) in the current returns of CROBEX (0.337739). The Romanian BET current returns are determined by CROBEX (-1), either. The coefficient value is equal to (-0.549878) with a negative sign. This indicates that in average when CROBEX returns from a month before increases by 1pp the current returns from BET decrease 54.98%, assuming that the rest remains constant. We observe higher coefficient values of CROBEX (-1) for the Romanian BET returns than the Bulgarian SOFIX with difference equal to 12.69%.

From the exposed interactions in Graph 2, we reveal significant relations between capital markets of SEE independent of the separation of reference and developing capital markets. The results reveal that for the reference Greek capital market, we do not register significant

relationships. Turkish BIST and the Croatian CROBEX are determined by the dynamic of indexes of the developing stock markets. The results of VAR model confirm the ones of the correlation test that BELEX 15 is highly correlated with the markets from the group, especially for the reference ones. The Bulgarian capital market indicates a significant bilateral relationship with the Croatian capital market. It is revealed that the Bulgarian, Romanian and Serbian capital markets are interacting with the reference capital markets from SEE group.

Graph 3

VAR results for interactions between developing capital markets of SEE group



Notes: They are exposed only statistically significant relationships
Source: Authors' calculations.

For BELEX returns, we have proved that the values of t- statistics associated with BET (-1), BIRS (-1), BIST (-2), MBI (-1) and SBI TOP (-2) are statistically significant. Consequently, we may conclude that the returns of BET, BIRS and MBI with one lag and the returns of SBI TOP and BIST with two lags have an impact on the current of BELEX returns. Positive influence we reveal for BET (-1) (0.473961), BIRS (-1) (0.388722) and SBI TOP (0.391150). These results indicate that an increase in the values of the aforementioned indexes indicates an increase in the values of BELEX. The strongest

interaction is revealed between BET (-1) and BELEX with a coefficient value equal to (0.473961). This indicates that in average when BET returns from the month before increase by 1 pp the current returns of BELEX increase 47.39 %, assuming that the rest remains constant. Negative influence, we reveal for MBI (-1) and BIST (-2) with coefficient values respectively equal to (-0.271097) and (-0.233826) (Graph 1). The significant interactions confirm the results from the correlation analysis, namely The Serbian capital market is highly determined by the other markets of the SEE group. The coefficient value of BELEX (-1) is statistically significant in determining the current returns of MBI 10. Its value is equal to (0.518937). This indicates that in average when BELEX returns from the month before increase by 1 pp the current returns of Macedonian MBI increase 51.89 %, assuming that the rest remains constant.

BIRS current returns are determined by its past values BIRS (-1) and BET (-1) with positive coefficient values respectively equal to (0.409500) and (0.302230). The past values of BIRS with one lag- BIRS (-1) determine the current returns of BIFX with a positive coefficient equal to (0.667351) and the current values of MONEX with a lower coefficient value equal to (0.396961). The capital market of Banja Luka is small and limited so these characteristics may explain the lack of significant relations between BIRS and the capital markets indexes of the SEE group.

The dynamic of the Macedonian index MBI 10 is determined by the dynamic of the following indexes: BELEX (-1) (0.518937), MBI (-1) (-0.282792) and the Slovenian SBI TOP (-2) (0.466434). As we have mentioned before, the dynamic of the Serbian BELEX has the strongest influence for the MBI 10. The dynamic of the Slovenian SBI TOP (-2) is in a positive relationship with MBI 10. The Macedonian MBI incorporates the information from the Slovenian index more slowly than the information from the Serbian capital market. It is proved by the lag interdependences.

For MONEX returns, we have proved that the values of t- statistics associated with BET (-1), BIRS (-1), MONEX (-1) and SBI TOP (-2) are statistically significant. Consequently, we may conclude that the returns of BET, BIRS and MONEX with one lag and the returns of SBI TOP with two lags have an impact on the current of MONEX returns. We observe that the information from the Slovenian capital market is not incorporated in the values of the Macedonian index and MONEX returns as quickly as the information from the other statistically significant dynamic of stock market indexes. The strongest positive influence is revealed from the SBI TOP with a coefficient value equal to (0.643550). The coefficient value of the Romanian BET is positive and it is equal to (0.386703). The past values of MONEX- MONEX (-1) possess the lowest influence from the statistically significant indexes that determine the dynamic of MONEX. It is equal to (0.311316). For MONEX returns, we have proved that the dynamic of BET (-1), BIRS (-1), MONEX (-1) and SBI TOP (-2) have a positive influence for the dynamic of MONEX.

We should mention that for the Slovenian capital market we do not register significant capital markets from SEE group to determine its dynamic.

By Graph 3, we reveal the significant relations only between developing capital markets in SEE group. We prove the moderate degree of interaction between them. The dynamics of BIFX, BIRS, MBI and MONEX are not determined by the dynamic of the reference capital

markets from SEE group. They interact and incorporate the information between themselves.

Table IX

Forecast Error of Variance Decomposition

Country	Days	Own	Greece	Croatia	Turkey
Bulgaria	3	36.68	25.40	3.77	0.59
	5	34.27	25.25	3.57	0.57
	10	33.50	25.21	3.60	0.61
Banja Luka	3	64.29	4.12	1.91	1.54
	5	61.49	5.53	1.80	1.56
	10	60.71	5.64	1.78	1.56
Sarajevo	3	40.19	7.83	1.33	1.33
	5	36.50	8.49	1.21	1.35
	10	35.61	8.88	1.18	1.37
Macedonia	3	38.41	1.33	5.79	1.33
	5	35.80	1.35	5.39	1.90
	10	35.04	1.37	5.29	1.90
Montenegro	3	27.28	38.41	8.39	5.68
	5	25.78	35.80	7.94	5.72
	10	25.38	35.04	7.84	5.71
Romania	3	35.04	37.62	8.99	0.05
	5	33.01	36.46	8.68	0.06
	10	32.69	36.05	8.64	0.14
Serbia	3	43.35	23.00	2.70	2.94
	5	40.76	22.08	2.63	3.32
	10	40.23	22.18	2.60	3.33
Slovenia	3	44.94	25.04	2.49	2.54
	5	43.53	25.01	2.39	2.44
	10	42.94	25.20	2.35	2.40

Source: Authors' Calculations.

Table IX provides a quantitative measure of short-run dynamic interdependences of the developing capital SEE with the reference capital markets. In this study, we apply Choleski decomposition to orthogonalise the shocks method. So, in Table IX are studied the variance decomposition results of 3-day, 5-day and 10-day horizon ahead forecast error variances of each developing stock market with the reference capital ones.

Table IX suggests that in all countries by day 3 or 5 ahead, the behaviour has settled down to a steady condition. Therefore Table IX suggests that in the most of the analysed countries, the national market price innovations account for more of the error variance while Greek, Croatian and Turkish price innovations account for less of the forecast error variance. These results confirm that the expected returns of the investment in the developing SEE stock markets are determined mainly by country-specific risk factors The implication of the low level of the interactions is that expected returns of the investment in the emerging stock markets should be determined mostly by the country-specific risk

factors (Li and Majerowska, 2008; Stoica, 2013). The highest shocks that affect the series in the system is observed on the basis till 37.62% of the variation in the returns of analysed indices is caused by the Greek market. The capital markets of Banja Luka, Sarajevo and Macedonia are the ones which are weakly linked and affected by the influence of the reference capital markets. In addition, in the capital markets of Montenegro and Romania the national market price innovations do not account for more of the error variance. They are more influenced by the innovations of the Greek capital market. Bulgarian, Serbian and Slovenian capital markets are determined by their country-specific risk but they are strongly affected by the innovations of the Greek stock market. On the basis that about 0.57-8.99% of the variation in the returns of analysed indices is caused by shocks to Croatian and Turkish markets, indeed the extent of influence of the reference capital markets on the returns of the developing markets in SEE is not weak. Bulgarian and Romanian capital markets are the ones which are influenced by the Turkish innovations in a lowest degree – about 0.05-0.61%. The capital market of Banja Luka is the one which is determined by its own innovations in a stronger value – about 60.71- 64.29% compared to the others explored developing markets in SEE group. The extent of influence of the reference capital markets on the returns of the Banja Luka market is small, indicating a weak integration of Banja Luka market with the reference capital ones in the area.

The implication of the low level of the linkages is that expected returns of the investment in the explored developing stock markets would be determined mainly by the country-specific risk factors (Li and Majerowska, 2008). Five countries appear more sensitive to shocks from the Greek market.

We utilize impulse-response function to address the question of how rapidly events in one variable are transmitted to the others. The advantage of the impulse response function is that it allows "innovation accounting". The impulse response functions show how a particular variable responds to shocks to other variables in the system. In other words, an innovation in a given variable triggers a chain reaction over time in the remaining variables. The impulse response functions allow us to assess these chain reactions. Impulse- response function results can be seen in Appendix V. In these graphs, it is seen that response of series when representing one standard deviation shock of each other. Action and reaction analysis can be seen in graphs. Following a one standard deviation shock to the Greek ATHEX, BELEX and BIRS indicate an increase. They increase in short-run period. BIFX and MBI indices respond by a weak increase in short-run period. SBI TOP responds with immediate decrease, the same is the reaction of the Romanian BET. The Bulgarian SOFIX reacts by a weak increase that is followed by a sudden and strong decrease. Following a one standard deviation shock to the Croatian CROBEX, the explored developing capital markets react with a similar dynamic – sudden strong decrease in their values with a following slow increase. The exception of the aforementioned dynamic is the response of SBITOP. The Slovenian capital market reacts with a slow and smooth decrease. We should emphasize that all of the explored developing capital markets from SEE have similar reactions to the shocks and amendments in the Croatian market. Following a one standard deviation shock to the Turkish BIST, BIRS and MONEX respond with a sudden decrease followed by short-run increase. We should emphasize that Bulgarian and Romanian capital market respond very weakly to the shocks of Turkish capital market. The reaction of

BELEX, BIFX, MBI and SBI TOP is revealed by quick increase followed by a decrease in short- run period.

To conclude the results from VAR model, variance decomposition and impulse response function, we prove significant interactions between capital markets' dynamic from SEE group in two lag period. We prove a high degree of integration of the Bulgarian, Romanian and Serbian capital markets among the reference capital markets of this group of countries. It is proved fast degree of information incorporation for reference and developing capital markets from the other members of the group. We should mention that we observe less significant interactions between reference capital markets than the ones between developing. These results confirm the ones from the correlation analysis. The developing capital markets of the explored group are strongly determined by country-specific factors, but five of them are strongly influenced by the Greek innovations. However, the market integration is anticipated to strengthen, as a result of EU expansion, as the implementation of Strategy 2020. These results lead to the argument that investor can benefit, at least in the short run, from diversifying into the SEE equity markets.

5. Future research directions

In this research, we examine the interactions between the capital markets of Southeast Europe (SEE). Meaningful future directions include:

1) Applying econometric models of the ARCH and GARCH family to examine the interdependencies, volatility and spillover of the SEE capital markets (Tsenkov and Stoitsova-Stoykova, 2017; Cifarelli and Paladino, 2005; Fujis, 2005; Baur and Jung, 2006).
2) Using non-linear Granger causality test to examine the dynamic relationships between the analysed stock markets (Syriopoulos, 2007; Chong et al., 2008; Lim, 2009).
3) Estimating minimum variance portfolio for SEE emerging markets (Kohers et al, 2006).

6. Conclusion

Summing up the results of the correlation analysis, it can be concluded that SEE capital markets are highly related, which also shows co-movement in their market dynamics. The degree of development of the capital markets also determines the linkages between them, showing that the reference ones demonstrate a lower positive correlation than the developing ones. The Serbian market is most highly correlated in the group, and the least correlated – Banja Luka. One of the possible reasons for the weak connection between Banja Luka and the other examined countries is the fact that the Banja Luka market is small and illiquid and the access of foreign investors to it is very limited. The Bulgarian capital market is synchronized with the other SEE markets because of the high or average positive values of registered correlation coefficients and the stronger influence of the Greek innovations. These results are proved by the VAR analysis. It is revealed a high degree of interaction of the Bulgarian, Romanian and Serbian capital markets with the reference

capital markets of this group of countries. We prove a high degree of integration of the Bulgarian, Romanian and Serbian capital markets among the reference capital markets of this group of countries. It is proved fast degree of information incorporation for reference and developing capital markets from the other members of the group. We should mention that we observe less significant interactions between reference capital markets than the ones between developing. These results confirm the ones from the correlation analysis. The developing capital markets of the explored group are strongly determined by country-specific factors, but five of them are strongly influenced by the Greek innovations. However, the market integration is anticipated to strengthen, as a result of EU expansion, as the implementation of Strategy 2020. These results lead to the argument that investor can benefit, at least in the short run, from diversifying into the SEE equity markets. All things consider, we can assume that the Southeast European capital markets are characterized with synchronicity and co-movement of stock market dynamics, which is the first step towards achieving market integration. We should be careful with the fact that the deeper financial integration corresponds to a greater cost of financial contagion, implying a concession between them. Following these conclusions: due to the revealed interdependences between the explored capital markets, foreign investors may benefit by including stocks of these countries in their investing portfolios. These countries will take profit if their capital markets are more accessible to foreign investors, reorganizing them in conditions to international law in order to defend foreign investors.

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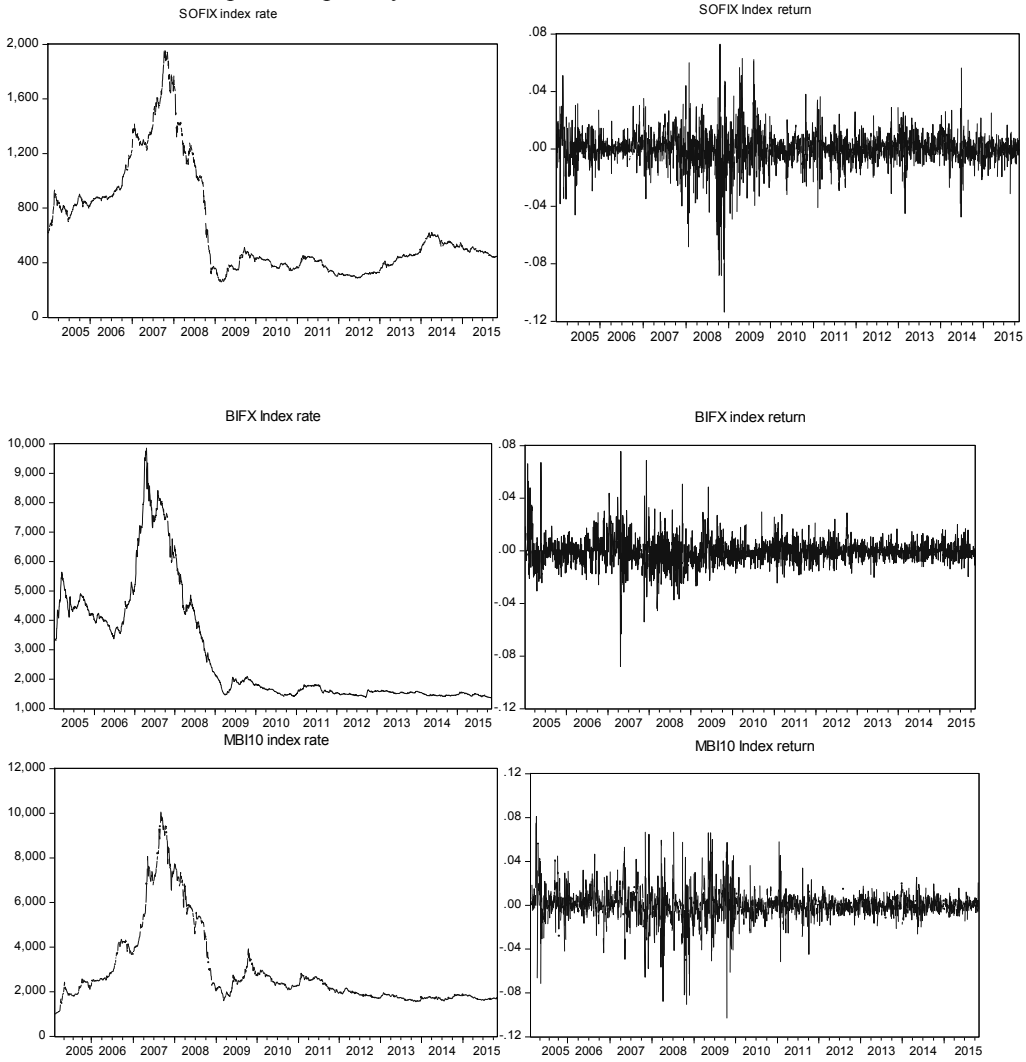
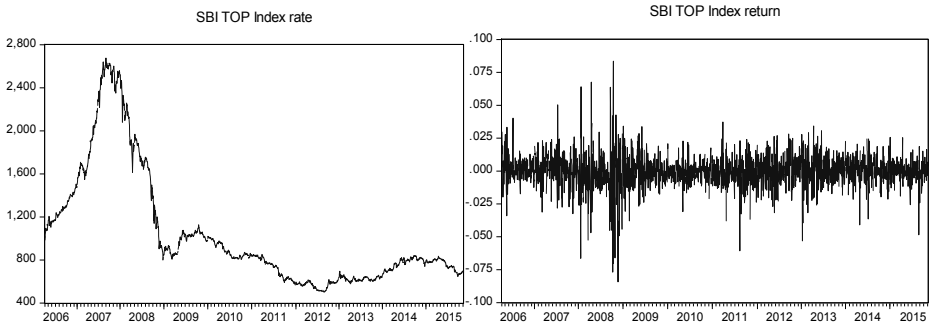
Appendixes

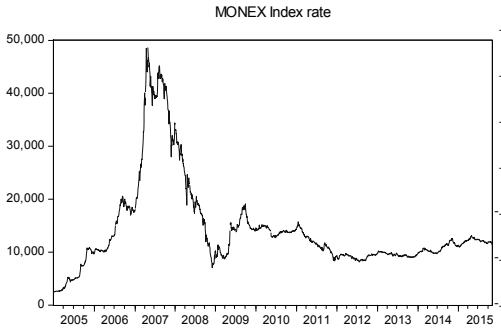
Appendix I

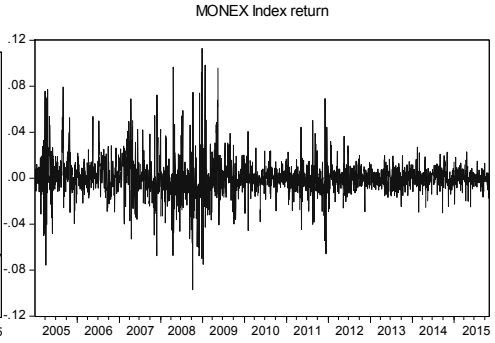
Graphs of capital dynamics and returns of the SEE indices

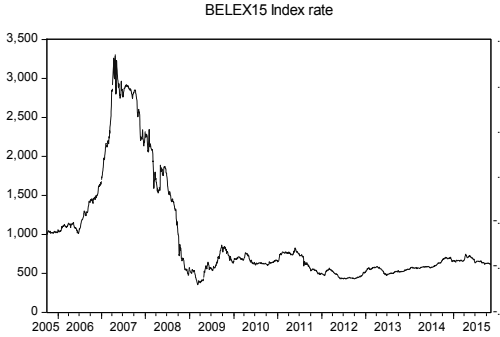


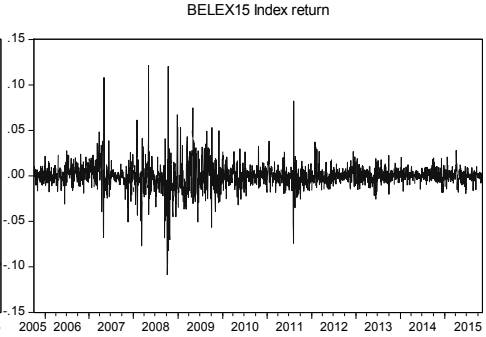

SBI TOP Index rate
2,800
2,400
2,000
1,600
1,200
800
400
2006 2007 2008 2009 2010 2011 2012 2013 2014 2015

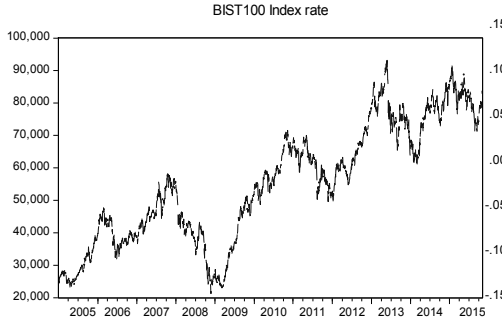
SBI TOP Index return
.100
.075
.050
.025
.000
-.025
-.050
-.075
-.100
2006 2007 2008 2009 2010 2011 2012 2013 2014 2015

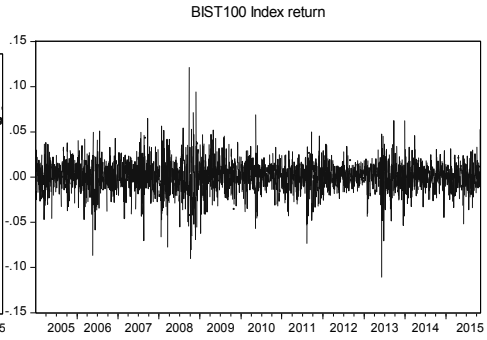

MONEX Index rate
50,000
40,000
30,000
20,000
10,000
0
2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015

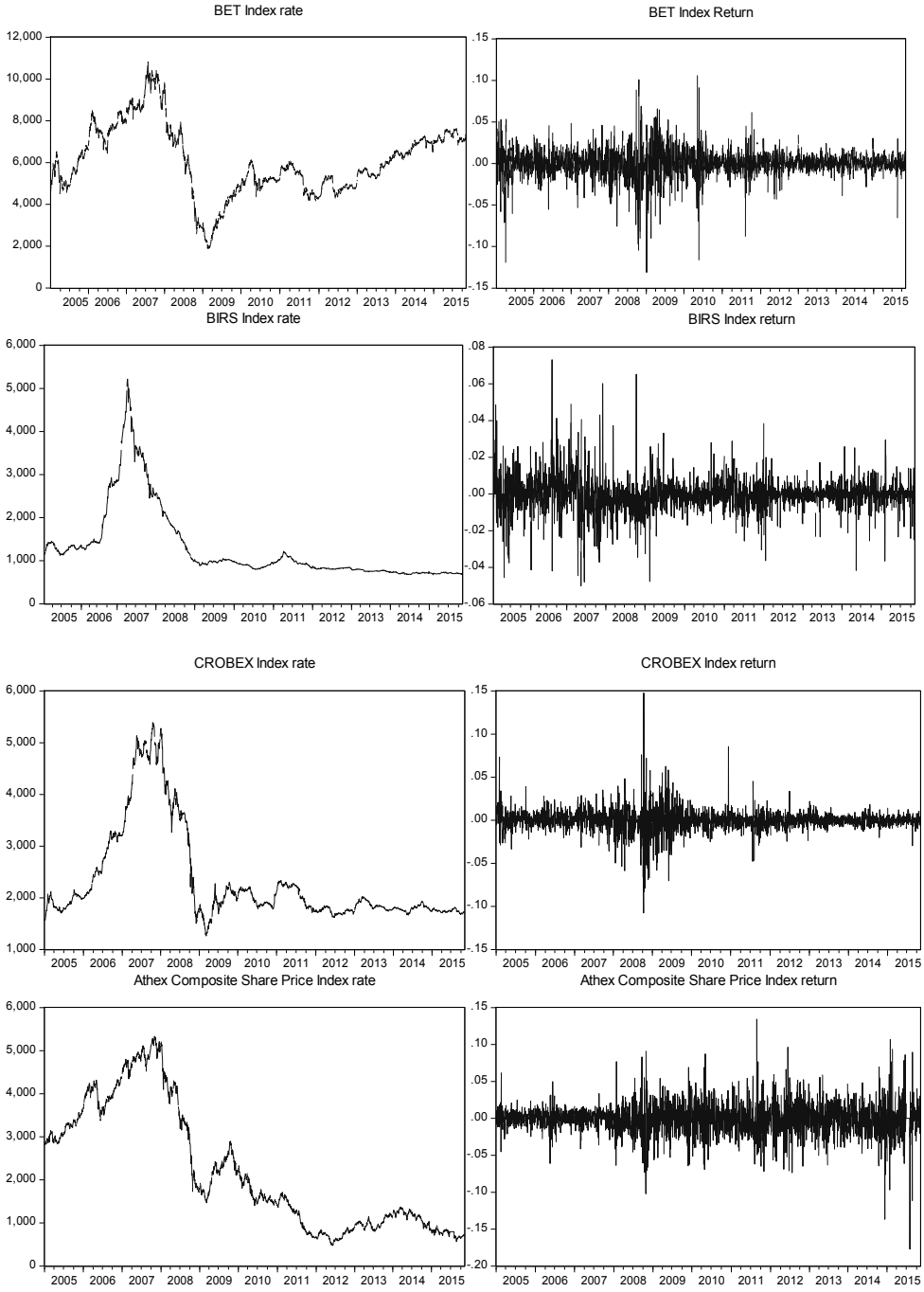

MONEX Index return
.12
.08
.04
.00
-.04
-.08
-.12
2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015


BELEX15 Index rate
3,500
3,000
2,500
2,000
1,500
1,000
500
0
2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015


BELEX15 Index return
.15
.10
.05
.00
-.05
-.10
-.15
2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015


BIST100 Index rate
100,000
90,000
80,000
70,000
60,000
50,000
40,000
30,000
20,000
2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015


BIST100 Index return
.15
.10
.05
.00
-.05
-.10
-.15
2005 2006 2007 2008 2009 2010 2011 2012 2013 2014 2015


BET Index rate
BET Index Return
BIRS Index rate
BIRS Index return
CROBEX Index rate
CROBEX Index return
Athex Composite Share Price Index rate
Athex Composite Share Price Index return

Appendix II

VAR Residual Heteroskedasticity Test

VAR Residual Heteroskedasticity Tests: No Cross Terms
(only levels and squares)

Sample: 1 131
Included observations: 112

Joint test:

Chi-sq	df	Prob.
3238.960	2904	0.0000

Individual components:

Dependent	R-squared	F(44,67)	Prob.	Chi-sq(44)	Prob.
res1*res1	0.479496	1.402761	0.1042	53.70358	0.1499
res2*res2	0.612141	2.403251	0.0006	68.55976	0.0103
res3*res3	0.655472	2.897028	0.0000	73.41291	0.0035
res4*res4	0.520888	1.655504	0.0307	58.33950	0.0725
res5*res5	0.301398	0.656951	0.9303	33.75661	0.8682
res6*res6	0.615517	2.437726	0.0005	68.93790	0.0095
res7*res7	0.535280	1.753926	0.0186	59.95133	0.0549
res8*res8	0.593297	2.221351	0.0016	66.44928	0.0160
res9*res9	0.582667	2.125981	0.0026	65.25867	0.0203
res10*res10	0.341932	0.791208	0.7947	38.29636	0.7138
res11*res11	0.598496	2.269833	0.0012	67.03157	0.0142
res2*res1	0.479134	1.400726	0.1051	53.66302	0.1508
res3*res1	0.548678	1.851197	0.0112	61.45190	0.0420
res3*res2	0.663635	3.004288	0.0000	74.32717	0.0029
res4*res1	0.338355	0.778700	0.8104	37.89578	0.7296
res4*res2	0.555379	1.902050	0.0086	62.20246	0.0366
res4*res3	0.456578	1.279382	0.1790	51.13675	0.2138
res5*res1	0.444343	1.217681	0.2303	49.76640	0.2546
res5*res2	0.522049	1.663219	0.0296	58.46946	0.0709
res5*res3	0.519775	1.648136	0.0319	58.21482	0.0740
res5*res4	0.659973	2.955531	0.0000	73.91701	0.0032
res6*res1	0.578361	2.088717	0.0032	64.77638	0.0223
res6*res2	0.553320	1.886260	0.0093	61.97181	0.0381
res6*res3	0.651282	2.843911	0.0001	72.94354	0.0039
res6*res4	0.412031	1.067079	0.3994	46.14742	0.3836
res6*res5	0.473062	1.367037	0.1224	52.98292	0.1662

res7*res1	0.477210	1.389968	0.1104	53.44754	0.1556
res7*res2	0.628323	2.574179	0.0002	70.37214	0.0070
res7*res3	0.614910	2.431488	0.0005	68.86996	0.0097
res7*res4	0.556625	1.911671	0.0081	62.34197	0.0356
res7*res5	0.482682	1.420774	0.0959	54.06035	0.1423
res7*res6	0.596953	2.255316	0.0013	66.85879	0.0147
res8*res1	0.456150	1.277174	0.1806	51.08876	0.2151
res8*res2	0.539420	1.783378	0.0160	60.41500	0.0506
res8*res3	0.559251	1.932138	0.0073	62.63614	0.0337
res8*res4	0.603332	2.316073	0.0009	67.57324	0.0127
res8*res5	0.480149	1.406434	0.1024	53.77669	0.1483
res8*res6	0.419860	1.102029	0.3547	47.02427	0.3497
res8*res7	0.583528	2.133528	0.0025	65.35516	0.0199
res9*res1	0.480991	1.411183	0.1002	53.87095	0.1463
res9*res2	0.582047	2.120573	0.0027	65.18930	0.0206
res9*res3	0.538872	1.779448	0.0163	60.35361	0.0511
res9*res4	0.636896	2.670917	0.0001	71.33240	0.0057
res9*res5	0.368138	0.887178	0.6603	41.23148	0.5910
res9*res6	0.502077	1.535431	0.0557	56.23263	0.1022
res9*res7	0.609830	2.379996	0.0007	68.30091	0.0109
res9*res8	0.565154	1.979037	0.0057	63.29728	0.0297
res10*res1	0.379975	0.933185	0.5914	42.55718	0.5335
res10*res2	0.609346	2.375163	0.0007	68.24673	0.0110
res10*res3	0.648180	2.805420	0.0001	72.59620	0.0043
res10*res4	0.463047	1.313140	0.1550	51.86126	0.1941
res10*res5	0.729403	4.104554	0.0000	81.69310	0.0005
res10*res6	0.551965	1.875950	0.0098	61.82005	0.0392
res10*res7	0.604597	2.328346	0.0009	67.71482	0.0123
res10*res8	0.565603	1.982656	0.0056	63.34756	0.0295
res10*res9	0.534403	1.747755	0.0192	59.85311	0.0559
res11*res1	0.643323	2.746474	0.0001	72.05214	0.0048
res11*res2	0.608855	2.370271	0.0007	68.19175	0.0112
res11*res3	0.687451	3.349228	0.0000	76.99446	0.0015
res11*res4	0.496576	1.502016	0.0654	55.61655	0.1125
res11*res5	0.414186	1.076610	0.3869	46.38886	0.3741
res11*res6	0.636431	2.665544	0.0001	71.28023	0.0057
res11*res7	0.665806	3.033688	0.0000	74.57025	0.0027
res11*res8	0.604174	2.324233	0.0009	67.66747	0.0124
res11*res9	0.635489	2.654726	0.0002	71.17478	0.0059
res11*res10	0.588700	2.179505	0.0019	65.93443	0.0177

Appendix III

VAR Residual Normality Test

VAR Residual Normality Tests
Orthogonalization: Cholesky (Lutkepohl)
Null Hypothesis: residuals are multivariate normal
Date: 07/12/18 Time: 23:41
Sample: 1 131
Included observations: 112

Component	Skewness	Chi-sq	df	Prob.
1	0.020208	0.007623	1	0.9304
2	-0.061893	0.071508	1	0.7892
3	0.294321	1.616992	1	0.2035
4	0.630592	7.422720	1	0.0064
5	1.182736	26.11215	1	0.0000
6	0.019470	0.007076	1	0.9330
7	0.092314	0.159076	1	0.6900
8	0.231360	0.999176	1	0.3175
9	-0.087757	0.143758	1	0.7046
10	0.229111	0.979852	1	0.3222
11	-0.021781	0.008856	1	0.9250
Joint		37.52879	11	0.0001

Component	Kurtosis	Chi-sq	df	Prob.
1	3.180178	0.151500	1	0.6971
2	2.881839	0.065156	1	0.7985
3	3.495285	1.144769	1	0.2846
4	3.762147	2.710718	1	0.0997
5	8.273629	129.7854	1	0.0000
6	3.161110	0.121130	1	0.7278
7	3.800355	2.989316	1	0.0838
8	2.874548	0.073445	1	0.7864
9	2.682419	0.470670	1	0.4927
10	3.483259	1.089852	1	0.2965
11	3.079431	0.029443	1	0.8638
Joint		138.6314	11	0.0000

Component	Jarque-Bera	df	Prob.
1	0.159122	2	0.9235
2	0.136664	2	0.9340
3	2.761760	2	0.2514
4	10.13344	2	0.0063
5	155.8976	2	0.0000
6	0.128207	2	0.9379
7	3.148392	2	0.2072
8	1.072620	2	0.5849
9	0.614428	2	0.7355
10	2.069704	2	0.3553
11	0.038299	2	0.9810
Joint	176.1602	22	0.0000

Appendix IV

Vector Autoregression Estimates

Vector Autoregression Estimates											
Sample (adjusted): 20 131											
Included observations: 112 after adjustments											
Standard errors in ( ) & t-statistics in [ ]											
	RATHEX	RBELEX	RBET	RBIFX	RBIRS	RBIST	RCROBEX	RMBI	RMONEX	RSBITO	RSOFIX
RATHEX(-1)	-0.026322	0.052253	0.002605	0.032780	0.071303	0.184095	-0.030899	0.108695	0.008568	0.028627	0.069945
	(0.13990)	(0.09758)	(0.11816)	(0.08060)	(0.07942)	(0.10316)	(0.09360)	(0.11158)	(0.12891)	(0.07496)	(0.11474)
	[-0.18815]	[0.53548]	[0.02204]	[0.40668]	[-0.89776]	[-1.78456]	[-0.33012]	[-0.97415]	[-0.06647]	[-0.38179]	[0.60954]
RATHEX(-2)	-0.021280	0.034384	-0.075185	0.009941	0.047860	0.006505	-0.032893	0.185341	0.145096	0.001295	0.042015
	(0.13928)	(0.09715)	(0.11764)	(0.08025)	(0.07907)	(0.10271)	(0.09319)	(0.11109)	(0.12835)	(0.07464)	(0.11424)
	[-0.15278]	[-0.35391]	[-0.63913]	[-0.12388]	[0.60525]	[-0.06333]	[-0.35298]	[-1.66841]	[-1.13049]	[-0.01730]	[-0.36775]
RBELEX(-1)	0.323684	0.086425	0.116405	0.052590	0.148307	**0.407745**	**0.334771**	**0.518935**	0.263905	0.084303	0.150272
	(0.23793)	(0.16596)	(0.20095)	(0.13709)	(0.13508)	**(0.17545)**	**(0.15919)**	**(0.18977)**	(0.21925)	(0.12750)	(0.19515)
	[1.36041]	[0.52075]	[0.57926]	[-0.38369]	[1.09793]	**[2.32395]**	**[2.10301]**	**[2.73459]**	[1.20367]	[0.66122]	[0.77002]
RBELEX(-2)	-0.100587	0.250883	0.041658	0.170564	-0.038433	0.129351	-0.063175	0.013844	-0.166665	0.032577	0.126927
	(0.20233)	(0.14113)	(0.17088)	(0.11657)	(0.11487)	(0.14920)	(0.13537)	(0.16137)	(0.18644)	(0.10842)	(0.16595)
	[-0.49715]	[-1.77773]	[0.24378]	[-1.46315]	[-0.33458]	[0.86701]	[-0.46670]	[0.08579]	[-0.89390]	[0.30042]	[-0.76485]
RBET(-1)	-0.053545	**0.473961**	0.285687	0.218053	**0.302230**	**0.453586**	**0.326690**	0.071138	**0.386703**	0.084117	0.266135
	(0.19744)	**(0.13772)**	(0.16675)	(0.11376)	**(0.11209)**	**(0.14559)**	**(0.13210)**	(0.15747)	**(0.18194)**	(0.10580)	(0.16194)
	[-0.27119]	**[3.44153]**	[1.71323]	[1.91685]	**[2.69630]**	**[3.11536]**	**[2.47312]**	[0.45175]	**[2.12547]**	[0.79507]	[1.64341]
RBET(-2)	-0.122022	0.124473	0.065684	-0.107643	0.104114	0.090804	0.023173	0.085291	0.365236	0.068477	0.039372
	(0.21636)	(0.15092)	(0.18273)	(0.12466)	(0.12283)	(0.15955)	(0.14475)	(0.17256)	(0.19937)	(0.11594)	(0.17746)
	[-0.56398]	[0.82479]	[-0.35945]	[0.86352]	[-0.84761]	[-0.56912]	[0.16008]	[0.49427]	[1.83192]	[0.59063]	[-0.22186]
RBIFX(-1)	-0.380006	0.171469	0.077542	0.161260	0.135691	**0.426431**	**-0.325735**	0.146720	0.086845	0.142850	0.158005
	(0.21563)	(0.15041)	(0.18212)	(0.12424)	(0.12242)	**(0.15901)**	**(0.14427)**	(0.17198)	(0.19870)	(0.11555)	(0.17686)
	[-1.76229]	[1.14004]	[0.42578]	[-1.29802]	[1.10847]	**[-2.68181]**	**[-2.25786]**	[0.85312]	[-0.43706]	[-1.23638]	[-0.89338]
RBIFX(-2)	-0.054996	0.134015	-0.295301	0.161223	0.215051	0.216766	-0.034456	0.230154	0.102492	0.034243	0.060267
	(0.21848)	(0.15239)	(0.18452)	(0.12588)	(0.12403)	(0.16111)	(0.14617)	(0.17425)	(0.20132)	(0.11707)	(0.17920)
	[-0.25172]	[0.87941]	[-1.60035]	[1.28082]	[-1.73385]	[-1.34543]	[-0.23572]	[-1.32082]	[0.50909]	[-0.29254]	[-0.33632]
RBIRS(-1)	0.200357	**0.388722**	0.239272	**0.667351**	**0.409500**	0.210291	0.355139	0.169156	**0.396961**	0.154585	0.168595
	(0.19538)	**(0.13628)**	(0.16502)	**(0.11257)**	**(0.11092)**	(0.14408)	(0.13072)	(0.15583)	**(0.18004)**	(0.10470)	(0.16025)
	[1.02545]	**[2.85228]**	[1.44998]	**[5.92818]**	**[3.69173]**	[1.45957]	[2.71677]	[1.08549]	**[2.20480]**	[1.47645]	[1.05204]
RBIRS(-2)	0.229395	0.067426	0.052092	0.048110	0.046033	0.054231	0.056236	0.220130	0.049894	0.007567	0.167058
	(0.21555)	(0.15035)	(0.18205)	(0.12419)	(0.12237)	(0.15895)	(0.14421)	(0.17192)	(0.19863)	(0.11550)	(0.17679)
	[1.06423]	[0.44846]	[-0.28614]	[-0.38739]	[0.37617]	[0.34122]	[0.38995]	[-1.28045]	[-0.25120]	[0.06551]	[0.94492]
RBIST(-1)	0.217779	0.127383	0.110761	0.047061	0.083191	0.014198	0.137651	0.099101	0.054267	0.101174	0.117126
	(0.16272)	(0.11350)	(0.13743)	(0.09375)	(0.09238)	(0.11999)	(0.10887)	(0.12978)	(0.14995)	(0.08720)	(0.13347)
	[1.33835]	[1.12230]	[0.80593]	[0.50198]	[-0.90052]	[0.11832]	[1.26438]	[0.76364]	[-0.36191]	[1.16031]	[0.87757]
RBIST(-2)	-0.221164	**0.233826**	0.049555	0.090541	0.111186	0.073451	-0.091627	0.192151	0.227541	0.047190	0.116047
	(0.15416)	**(0.10753)**	(0.13020)	(0.08882)	(0.08752)	(0.11368)	(0.10314)	(0.12296)	(0.14206)	(0.08261)	(0.12644)
	[-1.43461]	**[-2.17449]**	[-0.38059]	[-1.01939]	[-1.27038]	[-0.64612]	[-0.88835]	[-1.56278]	[-1.60174]	[-0.57125]	[-0.91777]
RCROBEX(-1)	-0.464018	0.152658	**0.549878**	0.015950	0.210142	**0.702264**	**-0.616882**	0.149955	0.352375	0.174130	**0.422920**
	(0.23300)	(0.16252)	**(0.19679)**	(0.13425)	(0.13228)	**(0.17182)**	**(0.15589)**	(0.18584)	(0.21471)	(0.12485)	**(0.19111)**
	[-1.99148]	[-0.93930]	**[-2.79426]**	[0.11886]	[1.58862]	**[4.08727]**	**[-3.95721]**	[-0.80690]	[1.64119]	[1.39470]	**[-2.21299]**
RCROBEX(-2)	0.069457	0.143975	0.106570	0.141298	0.186963	0.155750	0.016695	0.055390	0.075433	0.047360	0.014112
	(0.23194)	(0.16178)	(0.19589)	(0.13364)	(0.13168)	(0.17104)	(0.15518)	(0.18499)	(0.21373)	(0.12429)	(0.19024)
	[0.29946]	[0.88992]	[-0.54402]	[1.05734]	[1.41987]	[-0.91063]	[0.10759]	[0.29942]	[0.35293]	[-0.38112]	[-0.07418]
RMBI(-1)	-0.004463	**0.271097**	0.045521	0.162120	0.140376	0.214450	-0.099831	**0.282790**	0.290358	0.114594	0.141078
	(0.17337)	**(0.12093)**	(0.14643)	(0.09989)	(0.09843)	(0.12785)	(0.11599)	**(0.13828)**	(0.15976)	(0.09290)	(0.14220)
	[-0.02574]	**[-2.24175]**	[-0.31092]	[-1.62299]	[-1.42621]	[-1.67741]	[-0.86066]	**[-2.04510]**	[-1.81746]	[-1.23348]	[0.99210]
RMBI(-2)	0.086289	0.094208	0.196319	0.048924	0.090515	0.205555	0.107874	0.053421	0.115995	0.056119	0.106386
	(0.17177)	(0.11981)	(0.14507)	(0.09897)	(0.09752)	(0.12666)	(0.11492)	(0.13700)	(0.15828)	(0.09204)	(0.14088)
	[0.50236]	[-0.78630]	[1.35325]	[-0.49437]	[-0.92820]	[1.62286]	[0.93868]	[-0.38999]	[-0.73284]	[0.60970]	[0.75513]
RMONEX(-1)	0.143509	0.164547	0.050967	0.027900	0.133039	0.233095	0.085084	0.149520	**0.311316**	0.172478	0.103074
	(0.16697)	(0.11646)	(0.14102)	(0.09620)	(0.09479)	(0.12313)	(0.11171)	(0.13317)	**(0.15386)**	(0.08947)	(0.13695)
	[0.85949]	[1.41285]	[-0.36142]	[-0.29004]	[1.40349]	[1.89318]	[0.76166]	[1.12282]	**[2.02337]**	[1.92775]	[-0.75265]
RMONEX(-2)	-0.162402	0.021784	-0.122029	0.080473	0.004713	0.089294	-0.076470	0.100109	0.111453	0.011100	0.008514

	(0.17427)	(0.12155	(0.14718	(0.10041	(0.09893	(0.12851	(0.11659	(0.13899	(0.16058	(0.09338	(0.14293
	[-0.93192]	-0.17921	0.82910	-0.80150	0.04764	-0.69488	-0.65588	0.72026	-0.69404	-0.11887	-0.05957
RSBITOP(-1)	0.110616	0.006689	0.151752	0.014310	0.029075	0.007539	0.129033	0.153262	0.071960	0.112005	0.382414
	(0.25029)	(0.17458	(0.21139	(0.14421	(0.14209	(0.18456	(0.16745	(0.19962	(0.23064	(0.13412	(0.20529
	[0.44196]	0.03832	0.71789	-0.09923	-0.20462	0.04085	0.77056	0.76776	0.31201	0.83513	1.86284
RSBITOP(-2)	0.163312	**0.391150**	0.145808	0.110917	0.169039	0.225895	0.152867	**0.466434**	**0.643550**	0.082414	0.225324
	(0.24613)	**(0.17168**	(0.20788	(0.14181	(0.13974	(0.18150	(0.16467	**0.19631**	**(0.22681**	(0.13189	(0.20188
	[0.66351]	**2.27832**	0.70140	0.78213	1.20971	1.24459	0.92829	**2.37601**	**2.83741**	0.62486	1.11613
RSOFIX(-1)	0.329405	0.055312	0.121357	0.046627	0.021675	0.021311	**0.337739**	0.173006	0.087185	0.116827	0.134873
	(0.17677)	(0.12330	(0.14930	(0.10185	(0.10036	(0.13035	**(0.11827)**	(0.14099	(0.16289	(0.09472	(0.14499
	[1.86346]	0.44859	0.81286	0.45781	0.21598	-0.16351	**2.85573**	1.22711	0.53524	1.23335	0.93024
RSOFIX(-2)	0.070987	0.077482	0.094587	0.199185	0.079197	**0.314835**	-0.109989	0.105315	0.296682	0.080113	0.056546
	(0.17650)	(0.12311	(0.14907	(0.10169	(0.10020	**0.13016**	(0.11809	(0.14077	(0.16264	(0.09458	(0.14477
	[0.40219]	-0.62935	0.63451	1.95867	0.79036	**2.41895**	-0.93141	-0.74815	-1.82411	0.84704	0.39060
C	-0.012797	0.000845	-0.000819	0.003234	0.002888	0.003585	-0.003756	0.006091	0.000354	0.004304	0.002174
	(0.01032)	(0.00720	(0.00872	(0.00595	(0.00586	(0.00761	(0.00690)	(0.00823	(0.00951	(0.00553	(0.00846
	[-1.24007]	0.11737	-0.09391	-0.54329	-0.49302	0.47154	-0.54406	-0.74004	0.03726	-0.77833	-0.25679
R-squared	0.222431	0.598312	0.283591	0.529276	0.464348	0.365865	0.520079	0.462358	0.439513	0.362875	0.385082
Adj. R-squared	0.030223	0.499018	0.106502	0.412918	0.331940	0.209116	0.401447	0.329458	0.300966	0.205384	0.233080
Sum sq. resids	0.883361	0.429783	0.630115	0.293240	0.284712	0.480350	0.395410	0.561924	0.750091	0.253648	0.594264
S.E. equation	0.099626	0.069491	0.084142	0.057402	0.056560	0.073466	0.066654	0.079459	0.091804	0.053385	0.081714
F-statistic	1.157241	6.025682	2.601400	4.548663	3.506940	2.334061	4.383961	3.478983	3.172298	2.304095	2.533397
Log likelihood	112.2600	152.6054	131.1785	174.0133	175.6662	146.3762	157.2734	137.5920	121.4182	182.1360	134.4590
Akaike AIC	-1.593928	2.314381	1.931760	2.696674	2.726182	2.203141	-2.397739	2.046296	1.757468	2.841713	1.990339
Schwarz SC	-1.035665	1.756118	1.373492	2.138402	2.167920	1.644884	-1.839476	1.488031	1.199202	2.283451	1.432075
Mean dependent	-0.014563	0.004678	7.00E-06	0.008293	0.006420	0.007668	-0.003931	0.004601	0.001069	0.004749	0.006151
S.D. dependent	0.101167	0.098179	0.089016	0.074913	0.069199	0.082609	0.086154	0.097036	0.109803	0.059888	0.093308

Determinant resid covariance (dof adj.	5.50E-28
Determinant resid covariance	4.38E-29
Log likelihood	1908.492
Akaike information criterion	29.56236
Schwarz criterion	23.42146

RATHEX = - 0.0263216621453*RATHEX(-1) - 0.0212797696839*RATHEX(-2) + 0.323684138118*RBELEX(-1) - 0.100587390452*RBELEX(-2) - 0.0535446989417*RBET(-1) - 0.122022494308*RBET(-2) - 0.380005854374*RBIFX(-1) - 0.0549958348217*RBIFX(-2) + 0.200356955916*RBIRS(-1) + 0.229394973451*RBIRS(-2) + 0.217779349583*RBIST(-1) - 0.22116428629*RBIST(-2) - 0.464017910874*RCROBEX(-1) + 0.0694567540322*RCROBEX(-2) - 0.00446261610532*RMBI(-1) + 0.0862888417865*RMBI(-2) + 0.143508593222*RMONEX(-1) - 0.162401950271*RMONEX(-2) + 0.110616269893*RSBITOP(-1) + 0.163311931272*RSBITOP(-2) + 0.329404925303*RSOFIX(-1) + 0.0709869967509*RSOFIX(-2) - 0.0127971185295

RBELEX = 0.0522525334972*RATHEX(-1) - 0.0343837287846*RATHEX(-2) + 0.0864254634225*RBELEX(-1) - 0.25088691389*RBELEX(-2) + 0.473960812779*RBET(-1) + 0.124473115471*RBET(-2) + 0.171469186748*RBIFX(-1) + 0.134015181177*RBIFX(-2) + 0.388721722109*RBIRS(-1) + 0.0674263031318*RBIRS(-2) + 0.127382936239*RBIST(-1) - 0.233826040939*RBIST(-2) - 0.152657764943*RCROBEX(-1) + 0.143974766801*RCROBEX(-2) - 0.271097207214*RMBI(-1) - 0.0942081048915*RMBI(-2) + 0.164547075258*RMONEX(-1) - 0.0217840655767*RMONEX(-2) + 0.00668949327623*RSBITOP(-1) + 0.39115004995*RSBITOP(-2) + 0.0553115169533*RSOFIX(-1) - 0.0774820658714*RSOFIX(-2) + 0.000844830955063

RBET = 0.00260462443865*RATHEX(-1) - 0.0751848988034*RATHEX(-2) + 0.116404606536*RBELEX(-1) + 0.0416584583062*RBELEX(-2) + 0.285687324341*RBET(-1) - 0.0656842546342*RBET(-2) + 0.0775415068477*RBIFX(-1) - 0.295300635024*RBIFX(-2) + 0.23927231827*RBIRS(-1) - 0.0520915811739*RBIRS(-2) + 0.110760954192*RBIST(-1) - 0.0495546249046*RBIST(-2) - 0.549878016082*RCROBEX(-1) - 0.106569702718*RCROBEX(-2) - 0.0455267989019*RMBI(-1) + 0.19631910125*RMBI(-2) - 0.0509667474335*RMONEX(-1) + 0.122029134192*RMONEX(-2) + 0.151752415902*RSBITOP(-1) + 0.145807821012*RSBITOP(-2) + 0.121357135397*RSOFIX(-1) + 0.0945868696887*RSOFIX(-2) - 0.000818513461578

RBIFX = 0.032780230549*RATHEX(-1) - 0.00994129857728*RATHEX(-2) - 0.0525992871923*RBELEX(-1) - 0.170564220576*RBELEX(-2) + 0.218055120064*RBET(-1) + 0.107645041294*RBET(-2) - 0.161263015027*RBIFX(-

1) + 0.161227528*RBIFX(-2) + 0.667350862928*RBIRS(-1) - 0.048110745484*RBIRS(-2) + 0.047062917947*RBIST(-1) - 0.0905448263111*RBIST(-2) + 0.0159558758262*RCROBEX(-1) + 0.141298008946*RCROBEX(-2) - 0.162121132718*RMBI(-1) - 0.0489255226255*RMBI(-2) - 0.0279021991801*RMONEX(-1) - 0.0804748313922*RMONEX(-2) - 0.0143097610062*RSBITOP(-1) + 0.110916510891*RSBITOP(-2) + 0.0466273842578*RSOFIX(-1) + 0.199184502108*RSOFIX(-2) - 0.00323026622536

RBIRS = - 0.0713023056057*RATHEX(-1) + 0.0478599554128*RATHEX(-2) + 0.148307269381*RBELEX(-1) - 0.0384312261356*RBELEX(-2) + 0.302230395196*RBET(-1) - 0.104114316729*RBET(-2) + 0.135696682903*RBIFX(-1) - 0.215057119463*RBIFX(-2) + 0.409499926761*RBIRS(-1) + 0.0460327977999*RBIRS(-2) - 0.0831906488178*RBIST(-1) - 0.111185895547*RBIST(-2) - 0.210141526869*RCROBEX(-1) + 0.186964844517*RCROBEX(-2) - 0.140377687097*RMBI(-1) - 0.090515079679*RMBI(-2) + 0.133039476339*RMONEX(-1) + 0.00471311540126*RMONEX(-2) - 0.0290747044313*RSBITOP(-1) + 0.169039129944*RSBITOP(-2) + 0.0216750278955*RSOFIX(-1) + 0.0791968510245*RSOFIX(-2) - 0.00288845487464

RBIST = - 0.184099317175*RATHEX(-1) - 0.00650469916287*RATHEX(-2) + 0.407745403603*RBELEX(-1) + 0.129356793573*RBELEX(-2) + 0.453579606326*RBET(-1) - 0.0908008631332*RBET(-2) - 0.426432472694*RBIFX(-1) - 0.216760566923*RBIFX(-2) + 0.21029311594*RBIRS(-1) + 0.0542366988783*RBIRS(-2) + 0.0141976890834*RBIST(-1) - 0.073452167214*RBIST(-2) - 0.702266127131*RCROBEX(-1) - 0.155750738052*RCROBEX(-2) - 0.214452798217*RMBI(-1) + 0.205557773608*RMBI(-2) + 0.233098162562*RMONEX(-1) - 0.0892960350371*RMONEX(-2) + 0.0075387173335*RSBITOP(-1) + 0.225895185144*RSBITOP(-2) - 0.0213145696017*RSOFIX(-1) + 0.314838786493*RSOFIX(-2) + 0.00358836259155

RCROBEX = - 0.0308989378931*RATHEX(-1) - 0.0328931287767*RATHEX(-2) + 0.334771462178*RBELEX(-1) - 0.0631751650499*RBELEX(-2) + 0.326689780069*RBET(-1) + 0.0231729593935*RBET(-2) - 0.325734775979*RBIFX(-1) - 0.0344561818205*RBIFX(-2) + 0.355138591845*RBIRS(-1) + 0.0562362986438*RBIRS(-2) + 0.137650762101*RBIST(-1) - 0.0916266893262*RBIST(-2) - 0.61688246088*RCROBEX(-1) + 0.0166949604*RCROBEX(-2) - 0.0998312345802*RMBI(-1) + 0.107874119291*RMBI(-2) + 0.0850844311691*RMONEX(-1) - 0.0764701223229*RMONEX(-2) + 0.129033260663*RSBITOP(-1) + 0.152866714429*RSBITOP(-2) + 0.337738881253*RSOFIX(-1) - 0.10998864498*RSOFIX(-2) - 0.00375633414038

RMBI = - 0.108694730534*RATHEX(-1) - 0.18534222961*RATHEX(-2) + 0.518936899068*RBELEX(-1) + 0.0138436293611*RBELEX(-2) + 0.0711384292522*RBET(-1) + 0.0852925289345*RBET(-2) + 0.146720045432*RBIFX(-1) - 0.230155826968*RBIFX(-2) + 0.16915554714*RBIRS(-1) - 0.220130675661*RBIRS(-2) + 0.0991072105512*RBIST(-1) - 0.192153338206*RBIST(-2) - 0.14995129421*RCROBEX(-1) + 0.0553896402624*RCROBEX(-2) - 0.282791799102*RMBI(-1) - 0.0534274463213*RMBI(-2) + 0.149525457131*RMONEX(-1) + 0.100109210997*RMONEX(-2) + 0.15326168324*RSBITOP(-1) + 0.466434104467*RSBITOP(-2) + 0.173006295139*RSOFIX(-1) - 0.105319266105*RSOFIX(-2) - 0.00609106260579

RMONEX = - 0.00856836742722*RATHEX(-1) - 0.145096066683*RATHEX(-2) + 0.263904857057*RBELEX(-1) - 0.166660768014*RBELEX(-2) + 0.386703074895*RBET(-1) + 0.365236394876*RBET(-2) - 0.0868449872346*RBIFX(-1) + 0.102492332608*RBIFX(-2) + 0.396960581016*RBIRS(-1) - 0.049894159461*RBIRS(-2) - 0.0542671953618*RBIST(-1) - 0.227541138383*RBIST(-2) - 0.352375131947*RCROBEX(-1) + 0.0754328674747*RCROBEX(-2) - 0.290358460293*RMBI(-1) - 0.115995011487*RMBI(-2) + 0.311315835154*RMONEX(-1) - 0.111450936935*RMONEX(-2) + 0.0719606872781*RSBITOP(-1) + 0.643550150922*RSBITOP(-2) + 0.0871854633383*RSOFIX(-1) - 0.296681954515*RSOFIX(-2) + 0.000354328969038

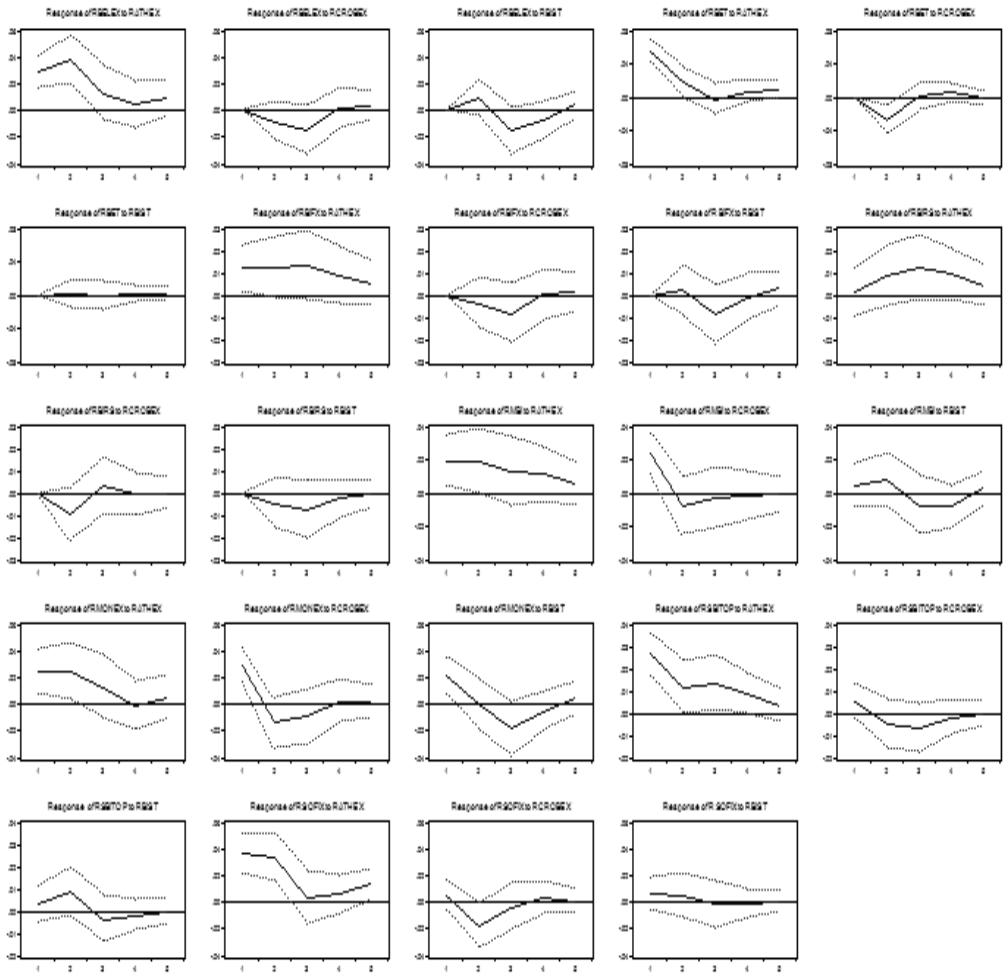
RSBITOP = - 0.0286211013562*RATHEX(-1) - 0.00129143267591*RATHEX(-2) + 0.0843028666888*RBELEX(-1) + 0.0325713851903*RBELEX(-2) + 0.0841173526929*RBET(-1) + 0.0684765381217*RBET(-2) - 0.14285931896*RBIFX(-1) - 0.0342482903283*RBIFX(-2) + 0.154581078047*RBIRS(-1) + 0.00756680511657*RBIRS(-2) + 0.101173645445*RBIST(-1) - 0.0471902302294*RBIST(-2) - 0.174134592252*RCROBEX(-1) - 0.0473679890014*RCROBEX(-2) - 0.114593718485*RMBI(-1) + 0.0561189654928*RMBI(-2) + 0.172477956391*RMONEX(-1) - 0.0110998702278*RMONEX(-2) + 0.11200489328*RSBITOP(-1) + 0.0824138890657*RSBITOP(-2) + 0.116827243527*RSOFIX(-1) + 0.0801126499481*RSOFIX(-2) - 0.00430406709793

RSOFIX = 0.0699417779094*RATHEX(-1) - 0.042012468341*RATHEX(-2) + 0.150270797152*RBELEX(-1) - 0.126927137503*RBELEX(-2) + 0.2661350387*RBET(-1) - 0.0393713205467*RBET(-2) - 0.158004899514*RBIFX(-1) - 0.0602673526211*RBIFX(-2) + 0.168595111597*RBIRS(-1) + 0.167057500673*RBIRS(-2) +

0.117125588886*RBIST(-1) - 0.116047351909*RBIST(-2) - 0.422919608065*RCROBEX(-1) - 0.0141116659714*RCROBEX(-2) + 0.141078120951*RMBI(-1) + 0.106386012568*RMBI(-2) - 0.103073981435*RMONEX(-1) - 0.00851439681808*RMONEX(-2) + 0.382414115988*RSBITOP(-1) + 0.22532445293*RSBITOP(-2) + 0.134873310843*RSOFIX(-1) + 0.0565464762179*RSOFIX(-2) - 0.002173510032

Appendix V

Impulse Response Function Results



ИКОНОМИЧЕСКИ ИЗСЛЕДВАНИЯ
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THE IMPACT OF ACQUISITIONS ON PROFITABILITY: EVIDENCE FROM THE BANKING SECTOR IN SERBIA

The aim of the paper is to look at the impact of takeover processes on the profitability of banks by analyzing periods prior to and after the takeover, as well as the factors that influenced the movement of banks' profitability. In 2001 there were 86 banks operating in the Serbian market, in 2003 that number was 49, whereas today there are 30 banks operating on the Serbian market and 23 thereof are foreign-owned. The study sample encompasses all banks taken over in the Serbian market in the period from 2001-2012. Methods applied in this study are: discriminant analysis and linear regression. Profitability of taken over banks was lower in comparison with the banking sector average. However, comparison of banks' profitability prior to and after the takeover, by introducing the dummy variable in the regression model, showed a substantial positive effect of the takeover on bank profitability. The increase of assets and the decrease of operating expenses had a positive influence on bank profitability movement and on medium-term gain in banks' market share. The contribution is in the prediction of potential targets and evaluate the market attractiveness of Serbia for further acquisition processes.
JEL: F36; F37; G24; G34

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Introduction

Restructuring process of Serbian banking system started in 2001. At the beginning of 2001 banking system included 86 banks, their number was 49 at the end of 2001, whereas today it is 30. Transformation of the banking system of Serbia encompassed restructuring bank ownership through privatization process that referred to buying shares of the banks with majority state capital by foreign banks. Transforming state-owned and socially-owned property into private property created the first prerequisite for the continuance of the bank restructuring process through mergers and acquisitions. According to the report of the National Bank of Serbia for year 2002 the most significant activities regarding ownership restructuring of the banking sector referred to putting into effect law regulations that solved long-standing problem of banking sector – immobilization of over 50% of balance sum of the most significant banks on the basis of old foreign currency savings of citizens and deferral of long-term foreign currency loans. During this period a large number of banks was closed down including the biggest financial institutions in the country, and several new banks were founded, mostly owned by foreign banks and ownership reform of the banking sector began through debt-for-equity conversion of Paris and London Club debt and old foreign currency savings debt. During 2003 reform continued in several directions. One of them was continuance of a policy that directs foreign investors to buy domestic banks till the end of privatization process of banks with majority state capital. According to the report of the National Bank of Serbia for the third quarter of 2012, there are 33 banks operating in the Serbian banking sector, of which: 21 banks in foreign ownership and 12 banks in domestic ownership (9 thereof have the state as a majority owner or largest individual shareholder and 3 banks are owned by private individuals).

Foreign-owned banks dominate and account for 74% of total assets in the banking sector, 74% of capital, 70% of employees and earned a profit of 6.6 billion RSD (70% of earned profit in the banking sector). Foreign-owned banks come from banking groups from 11 countries. In terms of their share in total assets of the banking sector, the most significant come from Italy with 22% of overall share, followed by Austria and Greece with 15% each, France 10% and all other countries with 12% of share.

Today, according to the report of the National Bank of Serbia for the first quarter of 2016, there are 30 banks operating in the Serbian banking sector, of which: 23 banks in foreign ownership and 7 banks in domestic ownership.

The aim of the study is to examine:

- Profitability of banks prior to the takeover and possibility of predicting future targets. Namely, a large number of empirical studies confirmed that immediately prior to takeover, after the announcement of the intention for takeover, there is a decline in profitability compared to the industry average.
- Profitability of banks in the post-takeover period. In literature there isn't much agreement on profitability movement after the takeover. Some authors confirm decline, whereas others confirm an increase in profitability shortly after the takeover.

- Is there a difference between profitability prior to and after the takeover, and in which period was it greater?
- Are there any, and if so which, factors that influenced profitability movement in four years' time?
- Are there any factors whose effect on bank profitability was different in pre- and post-takeover period?
- Research contribution, in terms of evaluation of the Serbian market attractiveness, to explain the reasons for further consolidation of the banking sector as well as support for the domestic banks in terms of analysis of factors which are to be influenced in order to prevent banks from becoming targets of hostile attacks.

1. Theoretical background

1.1. The Characteristics of the Target Bank before the Acquisition

A large number of empirical studies in literature dealt with the study of characteristics of target companies (Aharony and Barniv (2004), Harford et al. (2012), Humphery and Powell (2014), Mesulis et al. (2007), Moeller et al. (2004). One of the first research studies done on market for corporate control in Great Britain in 1960s concluded that target companies were smaller in size, less profitable and had a lower growth rate compared to the industry average Singh (1997). According to Baker and Kennedy (2002), target companies are more often less profitable measured by indicators ROA and ROE compared to the industry average. This corresponds to the research of Palepu (1986) according to which companies with lower return rate are targets of hostile attacks. There is a high level of agreement in the literature on measuring profitability of target companies. Most studies confirm that target companies show a decline in profitability and performance indicators compared to the industry average. First empirical studies to confirm this were the aforementioned studies of the authors Singh (1997) and Meeks (1977). These authors also studied takeover likelihood and came to a conclusion that companies whose profitability was below the industry average were more often takeover targets.

1.2. Characteristics of Target Banks after Acquisitions

In regard to the results of research on the impact of takeover transactions on value, the most often used performance measurements are profitability indicators: ROE (return on equity) and ROA (return o assets).

The most comprehensive research is surely that of the authors Martynova and Renneboog (2008) on post-merger operative performances, which sums up 23 separate empirical studies on the impact of takeover activities on profitability. Mueller (1980) analyzed 247 acquisitions in the period from 1962-1972 in the USA and arrived at a conclusion that profitability declines in the first three years after the merger compared to the industry average. Indicator ROE deviated more significantly from the industry average, whereas

ROA showed a decline in profitability that was not substantial. In regard to leverage, it increased in the period of three years post-merger.

Having observed 62 public offers in the period from 1975-1977 in the USA, the authors Ravenscraft and Scherer (1987) arrived at a conclusion that there is a decline in profitability in the period of three years post-merger.

Authors Haley et al. (1992) considered only the largest acquisitions in the period from 1979-1984 in the USA and concluded that there was a significant improvement in profitability in a five-year period post-merger. Authors Clark and Ofek (1994) observed 25 mergers in the period from 1981-1988 and came to a conclusion that there was a significant decline in profitability two years post-merger. Ghosh (2001) observed all mergers and acquisitions in the period from 1981-1995 that made up a sample of 315 takeovers and reached a conclusion that there was a significant rise in profitability measured by net cash flow return on total assets. Author Meeks (1977), in his empirical study based on the sample of 161 acquisitions in the period from 1964-1972 in Great Britain, points to a decline in profitability in the period of up to five years post-takeover compared to the industry average. Contrary to this research, authors Powell and Stark (2005) and authors Carline et al. (2002), also analyzing the market of Great Britain, arrived at a conclusion that there was a significant improvement in profitability compared to the industry average. Authors Chaudary and Mirza (2017) investigating the market U.K. and acquisitions in the banking sector, concluded that the higher yields achieved domestic banks that were taken from domestic banks, but the banks that were taken from cross-border banks.

Authors Joash and Njangiru at al (2015) analyzed 14 banks which were taken over in the period from 2000-2014 in Kenya and found an increase in banks' profitability after the takeover. Analyzing Lithuanian market, authors MIlvydiene and Burksaitiene (2016) compared restructuring and bankruptcy on one hand, with mergers and acquisitions on the other, and determined that mergers and acquisitions are more often becoming models of restructuring. Economies of scale, economic growth and diversification represent the main merger drivers.

1.3. Factor Analysis of Banks' Profitability in the Period before and after Acquisition

Bank profitability reflects how banks operate and it should mirror the quality of management and competitive strategies, efficiency and risk management capabilities Herrero et al. (2009). Authors Golin (2001) and Rose et al (2005) defined return on assets (ROA) and return on equity (ROE) as two most relevant indicators in banking while other studies determined the importance of net interest margin (NET) of bank's profitability determinants (Demirguc and Huizinga, 1999; Ahmed, 2003).

There are many papers which analyzed factors affecting commercial banks performance according to profitability are classified into internal and external factors (Goodard et al., 2004; Albertazzi and Gambacorta, 2009; Pejić et al., 2009; Sufian and Habibullah, 2010; Ozili, 2015).

The most commonly studied external factors are a gross domestic product (Ali et al. 2011; Bikker and Hu, 2002), inflation (Staikouras and Wood, 2011) and real interest rate and monetary policy (Borio et al., 2015)

Authors Havrylchyk et al. (2006) found a positive relationship between capital and bank's profit whereby more efficient banks should have higher profits how could be able to maximize net interest income. Further, authors Iannotta et al. (2007), Athanasoglou et al. (2008) and Alexiou and Sofoklis (2009) manifested a positive effect of capital on bank profitability. Likewise, authors Busuioc and Luca (2016) argued that profitability may have a positive effect on bank level of capital if a bank increases capital through retained earnings rather than by equity issues.

In the study of 19 banks in Romania in the period from 2004-2008, authors Andries et al. (2013) found a positive correlation between bank profitability ROA and its size in regard to the bank efficiency. Moreover, the mentioned study confirmed that taken over banks have greater efficiency, i.e. M&A had a positive effect on efficiency.

In the study of 16 banks in Macedonia in the period from Q1 2007 to Q4 2013, authors Kjosevski and Petkovski (2017) found that credit risk management capital to total assets ratio and operating expense management are the most important internal factors of bank profitability.

Authors Nnadi and Tanna (2014), studied post-acquisition performances of taken over banks in the European Union and found that operative expenses, net interest margin, the equity-to-assets ratio had a negative impact on ROA. Adding to the study of banks in the European Union, Hernando (2009), found that taken over banks were bigger and more profitable than domestic banks.

There are many studies with a focus on Eastern Europe, and most of them highlight that foreign-owned banks perform better than other type of banks in terms of cost and profit efficiency.

Author Weill (2003) researched the performance of foreign-owned and domestic owned banks in the Czech Republic and Poland. He found that foreign-owned banks are more efficient than domestic owned banks in these countries. Empirical studies of authors Isik and Hassan (2002) as well as authors Grigorian and Manole (2002) confirmed that foreign banks in transition countries and developing countries succeeded in using their comparative advantages and manifest a higher level of efficiency compared to domestic owned banks. Similarly, authors Matoušek and Taci (2004) examined the cost efficiency of the banking system in the Czech Republic and concluded that foreign banks were on average more efficient than other banks. Likewise, they argued that privatization of state-owned commercial banks and more liberal policy towards foreign banks in the early stage of the transition process would have enhanced the banking system's efficiency.

On the other side, authors Havrylchyk and Jurzyk (2006) researched the efficiency of the banking system in Poland from 1997 to 2001 and found that banks' efficiency has not improved during the observed period. Authors Hasan and Marton (2003) analyzed the Hungarian banking sector during the transition process and found that foreign banks were more efficient than domestic banks. Their findings confirmed that foreign banks have used

comparative advantages of local market that is reflected in lower costs and consequently, a lower inefficiency.

In addition, authors Kraft et al. (2006) researched the bank's efficiency in Croatia from 1994 to 2000 and argued that privatization does not have an immediate effect on the higher efficiency of banks. But, they concluded that foreign banks were substantially efficient compared to domestic banks. Authors Jemric and Vujcic (2002) examined old and new bank efficiency, as well as their efficiency by size and ownership u Croatia, and their findings showed that foreign banks are the most efficient and the new banks are more efficient than old ones.

2. Methodology and Data

Study sample consists of all banks taken over in the Serbian market in the period from 2001-2012. The cut-off year is 2012 due to the consideration of post-acquisition performances of banks two and five years after the takeover and thus due to the availability of data until 2017. Of the total of 33 banks in the observed period 21 banks are foreign-owned, 13 thereof were taken over through acquisitions, 1 through merger and remaining 9 taken over banks entered the Serbian market through greenfield investments. Study sample encompasses all 13 banks taken over in the Serbian market, which represents the sample of 100% of taken over banks in the given period. Most of the takeover was carried out before beginning the global economic and financial crisis. The financial crisis in the best possible way, showed how much the market has become global (on the impact of globalization and the crisis on the economy see: Urbsiene (2013); Zivkov et al. (2016); Miklaszewska and Kil (2016). The economic and financial crisis has particularly affected the increase in risk investment and profitability of the banking sector (Treapat, 2016; Vunjak et al., 2015).

Utilized database consists of financial bank reports and annual reports on banking sector for calculating the average values of indicators for the banking sector, available at the website of the Serbian National Bank, and financial bank reports available at the website of the Serbian Business Registers Agency. Two periods are analyzed in the study: pre-takeover period (two years before takeover (T-2) and a year before takeover (T-1)) and post-takeover period (a year after takeover (T+1) and two years after takeover (T+2). The variables are parametric, the analysis will be done using parametric methods. Methods used in the study are a multivariate statistical method – discriminant analysis. Of univariate methods ANOVA and t-test are used. Purpose of using mathematical-statistical analysis is to determine the characteristics of both subsamples – chosen variables and the banking sector average, and homogeneity, in order to perform precise prediction and forecast with certain reliability. After having shown the results of the discriminant analysis, with the use of linear regression we will test the impact of factors, i.e. independent variables, on banks' profitability movement in observed periods.

Bank profitability is measured by two most often used indicators: ROA (return on assets) and ROE (return on equity). ROA ratio should be higher than 0.1, and ROE ratio should be higher than 0.15 (Jakšić et al. 2015). Other indicators for measuring profitability are:

ROE/ROA (leverage), NIMA (net interest income to total assets ratio), NI/OR (net interest income to operating expenses ratio), NIC/OR (net interest and commission income to operating expenses ratio).

Independent variables most often used in the model of linear regression are:: dummy (0 – period before takeover, 1 – period after takeover), operating expenses and log values of interest incomes, NIMA (net interest income to total assets ratio), ShEq/TLR (shareholders equity to total liabilities ratio), L/D (loan to deposit ratio) and bank size (size log assets) measured by the bank's assets size in log values.

3. Results and Discussion

The applied methods of discriminant analysis and linear regression had the following research results:

Table 1

Discriminant analysis (Wilks' Lambda)

Test of Function(s)	Wilks' Lambda	Chi-square	df	Sig.
T-2	.688	7.867	6	.248
T-1	.502	14.489	6	.025
T+1	.719	6.916	6	.329
T+2	.466	16.054	6	.013

Source: Authors.

Based on the above-shown table 1 it can be concluded that the result of the discriminant analysis method, p = .025 with T-1 and p=.013 with T+2 is below the significance threshold ($p<0.05$). That further implies that there is a statistically significant difference between analyzed determinants of studied banks and banking sector average.

Table 2

Canonical Correlation (Eigenvalues)

Period	Eigenvalue	% of Variance	Cumulative %	Canonical Correlation
T-2	.454	100.0	100.0	.559
T-1	.994	100.0	100.0	.706
T+1	.390	100.0	100.0	.530
T+2	1.148	100.0	100.0	.731

Source: Authors

The canonical correlation coefficient of **.**706 with T-1 and .731 with T+2 implies a very strong model and important significance and correlation of discriminant variables in the formation of differences. Both canonical coefficient and the Wilks' lambda result (sig=.025) and (sig=.013) confirm a good choice of banks determinants in the formation of differences (Table 2).

Table 3

Analysis of differences between chosen bank determinants and average values for chosen determinants a year before the takeover

	T-1		T+2	
	F	Sig.	F	Sig.
ROE	.484	.494	5.435	.028
ROA	.275	.605	6.459	.018
ROE/ROA	1.311	.264	.071	.793
NIMA	4.623	.042	1.128	.299
NI/OR	.005	.946	3.616	.069
NIC/OR	.022	.883	2.989	.097

Source: Authors

Since $p < 0.01$ is below the significance threshold with: NIMA (.042) with T-1; ROE (.028) and ROA (.018) with T+2; it can be concluded that these determinants differ substantially between the chosen banks sample and the banking sector average.

Since the discriminant analysis showed (p=.025 with T-1) and (p=.013 with T+2) that there is a significant difference, which further implies that there is a clearly defined border between chosen banks determinants, i.e. it is possible to determine the characteristics of all chosen determinants a two year after the takeover and one year before the takeover (Table 3).

Table 4

Characteristics and homogeneity of chosen company determinants and average values a year before the takeover

Dependent Variable		T+2			T-1		
		Mean	Higher/Lower	Dpr%	Mean	Higher/Lower	Dpr%
ROA	1	-.46	↓*	47.798	-1.78	↓	19.255
	2	6.73			-.38		
ROE	1	-.24	↓*	31.865	-9.46	↓	14.333
	2	1.44			-1.82		
ROA/ROE	1	4.77	↑	7.772	4.51	↓	18.058
	2	4.69			5.28		
NI/OR	1	3.98	↓	7.383	55.42	↓	10.642
	2	4.31			56.39		
NIC/OR	1	47.63	↓	3.497	89.44	↑	8.380
	2	93.58			86.09		
NIMA	1	71.52	↓	1.684	5.86	↑*	29.332
	2	130.01			4.62		

*p<0.05, note: *chosen banks determinants-1, average values for chosen determinants -2;*
Note: ↑ (higher); ↓ (lower).
Source: Authors.

Since years T-1 and T+2 differ significantly from the banking sector average, in the above-given table based on the comparison of the arithmetic means of two periods, values of chosen indicators are compared.

The given table 4 shows that banks' profitability measured by indicators ROE and ROA was lower compared to the banking sector average a year prior to takeover and two years after the takeover, in fact it differed greatly from the banking sector average in year T+2. What can be observed is the movement of ROA indicator (average value) for the whole banking sector from -.38 prior to takeover to 6.78 two years after the takeover. Leverage indicator (ROA/ROE) was lower that the banking sector average a year before takeover, but showed an increase in regard to the banking sector average two years post-takeover, which implies an increase in banks' leverage after the takeover. Also, net interest and commission income to operating expenses ratio changed, so there was a decrease of that indicator in the year T+2. With indicator NI/OR there wasn't a significant deviation in comparison to the banking sector average, but what can be observed based on the arithmetic means of years T-1 and T+2 is that there was a significant decrease of this indicator for studied banks (55.42 in year T-1 and 3.98 in year T+2). Indicator NIMA differed substantially and was higher than the banking sector average, while in year T+2 there is a decline of this indicator when compared to the banking sector average. However, comparing arithmetic means of years T-1 and T+2 shows a significant rise in indicator NIMA both for the chosen banks and the whole banking industry (5.86 in year T-1 for chosen banks and 4.62 for banking industry; 71.52 in year T+2 for chosen banks and 130.01 for banking industry).

Table 5

Classification Results[a,c] Predicted Group Membership

	T-2	T-1	T+1	T+2
n/m	10/13	11/13	8/13	11/13
%	76.9	84.6	61.5	84.6
original grouped cases correctly classified.	88.5	92.3	80.8	92.3
cross-validated grouped cases correctly classified	69.2	76.9	65.4	80.8

Source: Authors

The table 5 shows that 11 of 13 banks in both years T-1 and T+2 have the characteristics of chosen determinants (n/m) and thus homogeneity of the sample is 84.6%, leaving 2 banks with other characteristics and not those of the chosen sample. Since sample homogeneity is 84.6%, the forecast can be made with certain reliability. It can be concluded with certainty of 84.6% in year T-1, that banks whose characteristics are similar to those of the chosen banks determinants in the sample can become targets of hostile attack in the Serbian market Based on the homogeneity of 84.6% it can be concluded that, should takeover processes continue, the acquisitors may expect a deviation of ROE and ROA indicators compared to the banking sector average in two years' time after the takeover. Reliability of 92.3% represents a very good indicator of the original classification of groups and classification of groups through the coefficient of determination.

Further research sequence should explain factors which influenced the change in banks' profitability after their takeovers. Contribution in creating a model difference with

indicators ROE and ROA is 79%. Based on arithmetic means of indicators NI/OR and NIMA we see a significant change for these two indicators when comparing the period a year before takeover to the period two years after the takeover. Did net interest incomes, operating expenses and NIMA have an impact on the change in indicators ROA and ROE and in which period was banks' profitability higher?

Table 6

Correlations

		ROE	ROA
ROE	Pearson Correlation	1	.938**
	Sig. (2-tailed)		.000
	N	52	52
ROA	Pearson Correlation	.938**	1
	Sig. (2-tailed)	.000	
	N	52	52

** Correlation is significant at the 0.01 level (2-tailed)
Source: Authors.

After having shown the results of the discriminant analysis, with the use of linear regression we will test the impact of factors, i.e. independent variables, on banks' profitability movement in observed periods.

Since the correlation between indicators ROE and ROE is significant .000 and strong .938, the analysis of banks' profitability factors will follow with only one indicator ROA which had a greater contribution in creating the difference (47.798). At the beginning, tests were done to determine whether data is suitable for Panel regression model or Linear regression model (Table 6).

Test results the Breusch-Pagan: prob>chibar2 = 0.4512 is more than p=0.05 so the model is suitable for applying a linear regression model.

Table 7

ANOVA

Model		Sum of Squares	Df	Mean Square	F	Sig.
ROA	Regression	2170.524	7	310.075	16.517	.000[b]
	Residual	826.024	44	18.773		
	Total	2996.548	51			

Source: Authors.

The result of linear regression model: p=.000 is less than p=0.05 meaning there is a significant impact of independent variables on ROA movement. (Tabel 7). The following will examine the multicollinearity variables in the model (Durbin-Watson-test) and the analysis of the individual effect of the factors on the movement of ROA.

Table 8

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
ROA	.851[a]	.724	.680	4.33281	1.729

Source: Authors.

Result of Durbin-Watson test on multicollinearity of 1.729 (it should be near two) confirms model validity. RSquare is .724 meaning that 73% of dependent variable ROA is explained by stated factors, pointing to a good choice of independent variables (Table 8).

Table 9

Coefficient

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
ROA	(Constant)	-46.883	20.760		-2.258	.029
	dummy	4.338	1.749	.286	2.481	.017
	log operating expenses	-3.133	1.308	-.403	-2.396	.021
	log interest income	-19.608	4.726	-2.733	-4.149	.000
	NIMA	4.024	.612	.978	6.573	.000
	size log assets	21.069	4.934	3.054	4.270	.000
	ShEq/TLR*100	-.380	.064	-.628	-5.981	.000
	L/D*100	.007	.016	.039	.450	.655

Source: Authors.

Considering the individual impact of independent variables on banks' profitability it can be concluded that all variables, with the exception of variable L/D, had a significant impact on indicator ROA.

Dummy variable p=.017 (coeff 4.338) implies positive effect of takeovers on banks' profitability. Log operating expenses p=.0.21 and log interest income p=.000, ShEq/TLR had a significant impact on the movement of ROA, where their impact was inversely proportional to movement of ROA, while NIMA p=.000 and size log assets p=.000 also had a significant impact on ROA, where their impact was directly proportional to the movement of banks' profitability.

Stated results indicate that bigger bank (measured by the size of its assets) with lower shareholder capital leads to an increase in bank's profitability. Lowering operating expenses

and increasing net interest margin lead to an increase in banks' profitability, whereas lowering interest income leads to an increase in banks' profitability. This result of lowering net interest income is derived from abolishing the policy of soft budget crediting which was applied in the Republic of Serbia until the beginning of 2000. After 2001 with the passing of new laws, policy of soft budget crediting is abolished and there was a decrease in growth based on domestic consumption, and in that very period there was the greatest number of

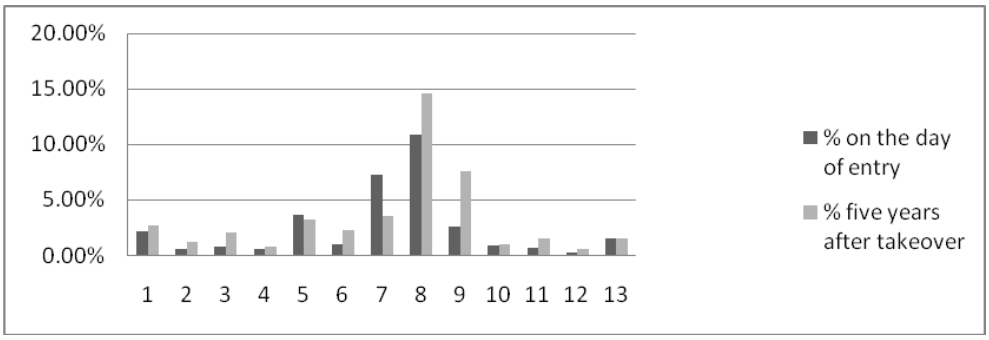
inflow of foreign banks into the Serbian market. Since foreign banks did not apply the policy of soft budget crediting there was a decline in loans compared to domestic banks, and thus a decline in net interest income.

Summing the results of discriminant analysis and results of linear regression leads to a conclusion that in year T+2 there was a significant deviation of banks' profitability compared to the banking sector average measured by ROA and ROE. Consolidation of the banking sector and taking over of banks had a positive impact on profitability movement for the whole banking sector. In year T-1 ROA was .-38 while in year T+2 it was 6.73, whereas indicator ROE in year T-1 was -1.82, and in year T+2 it was 1.44. Dummy variable in the regression model confirmed a substantial positive effect of takeover processes on banks' profitability. Since ROE and ROA have the same dominator, we conclude that significant change of indicator ROA is the result of an increase in banks' assets after the takeover, which was confirmed by the result of linear regression. Increase in banks' assets after takeover leads to a significant change in indicator NIMA (net interest income to total assets ratio); since the result of linear regression confirmed that net interest incomes were inversely proportional to the movement of banks' profitability. Significant change in NI/OR measured by the ratio of arithmetic means for the two periods, along with the result of linear regression on the impact of net interest incomes and operating expenses on the movement of ROA point to a decrease in both indicators, and the decrease had a significant impact on banks' profitability movement. Increase in assets and decrease in operating expenses should lead to an increase in banks' market share. Studying European market authors Bonin and Abel (2000) concluded that privatization is a key to an increase in market share of foreign banks. Likewise, authors Knežević and Dobromirov (2016) point out increasing number of foreign banks in transition countries and rapid progress in bank privatization. Accordingly, authors Claessens et al. (2001) investigated the profitability of banks from 80 countries from 1988 to 1995 and confirmed that foreign banks are more profitable than domestic banks in developing countries but the opposite results were found in developed countries. Similarly, author Goldberg (2004) argued that foreign banks operating in developing countries appear to be more efficient than domestic banks. The entry of foreign banks has affected domestic banks to achieve as much efficiency as possible. Also, the higher level of efficiency of the banking sector is induced by changes in industry competitive structure which means that entry of foreign banks and mergers and acquisitions have changed local competitive conditions. "I argue that foreign banks will promote financial development directly by providing high-quality banking services and indirectly as well, by three means. First, they can spur domestic banks to improve quality and cut costs; second, they can encourage the upgrading of accounting, auditing and rating institutions; and third, they can intensify pressures on governments to enhance the legal, regulatory, and supervisory systems underlying financial activities" (Levine, 1996. p.225). Contrary, author Stiglitz (1993) point out that entry of foreign banks can affect on costs of domestic banks because they have to compete with large international banks with a better reputation. Moreover, foreign banks can reduce access to finance for main domestic companies and have stabilizing or destabilizing impact on the domestic banking sector. In the situation of domestic shocks, foreign banks can have a significant stabilizing role because of their liquidity and capital as well as diversification. Authors Ani et al., (2012) concluded that a profitable banking sector is better able to stand negative shocks and

contribute to the stability. De Haas et al. (2015) analyzed 350 banks in emerging Europe from aspect how bank ownership and the Vienna Initiative impacted credit growth during the Great Recession. Their findings show that while both domestic and foreign banks strongly reduced credit during the financial crisis, foreign banks that participated in the Vienna Initiative were relatively stable lenders. Likewise, authors Barba Navarreti et al. (2010) argue that multinational banks were a stabilizing factor in Europe where they reflected a relatively stable loan-to-deposit ratio. On the other side, authors Cull and Martínez Pería (2013) confirmed that foreign banks in Eastern Europe declined lending more than domestic private banks.

Figure 1

Market share of foreign banks



Source: Authors.

Majority of taken over banks realized a gain in market share in the medium term. Only two banks reported a decrease in market share after takeover. Increase in market share is most often the result of economies of scale which is realised through a decrease in expenses and an increase in banks' assets as confirmed by the model of linear regression (Figure 1).

4. Future research directions

After the study has showed that takeover has a significant and positive impact on bank profitability in Serbia, future research will focus on two directions where one strand of research will examine of the efficiency of foreign-owned banks and domestic banks by analysis of the competitive pressure, spread level and cost structure. The second strand of research will include the analysis of profitability among the banks in Serbia from the aspect of banks acquired through takeover, merger, greenfield investments and domestic banks without foreign capital. Also, the analysis may include countries in the region and member of EU.

5. Conclusions

Results of the study fulfilled the aims of the study:

- Two years prior to the takeover there was no difference between profitability indicators of the banks which were takeover targets and the banking sector average, whereas a year prior to the takeover, due to the very announcement and certain probability of the takeover, there was a significant difference between profitability indicators of banks and the banking sector average. The prognosis is made with a certain reliability based on the sample homogeneity of 84.6%. Namely, banks operating in the Serbian market, which are not taken over, and have the same or similar characteristics to those that have already been taken over, may become targets of acquisitors.
- Post-acquisition analysis of profitability and other indicators relative to profitability showed no significant difference between profitability indicators of taken over banks and banking sector average a year after the takeover, however, two years after the takeover a substantial difference is observed in profitability indicators of taken over banks compared to the banking sector average. Profitability of taken over banks was lower in comparison with the banking sector average.
- Result of dummy variable confirmed that takeover had a positive effect on banks' profitability. Although discriminant analysis showed lower bank profitability of taken over banks compared to the banking sector average, the result of linear regression encompassing both takeover periods confirmed an increase in profitability post-takeover.
- Increase in bank's size, decrease in shareholders' capital, decrease in operating expenses, increase in net interest margin and decrease in net interest income had a significant impact on increasing bank's profitability.
- Operating expenses, net interest margin and net interest income showed a great change in arithmetic means in years T-1 and T+2.
- Based on given results a conclusion can be drawn that domestic banks are not managed in an optimal manner and that after the takeover of domestic banks by foreign banks there is an increase in banks' profitability and their market share due to the economies of scale. The takeover of banks had an overall positive effect on the profitability movement of the whole banking sector. That makes Serbian market attractive, since in short and medium term taken over banks report higher profitability, thus giving a positive signal to foreign investors to perform a takeover.
- This paper provides a contribution to the prediction of potential targets and evaluates the market attractiveness of Serbia for further acquisition process which was confirmed by the results of research.

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ИКОНОМИЧЕСКИ ИЗСЛЕДВАНИЯ
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FUZZY MODELING OF THE CREDITWORTHINESS ASSESSMENTS OF BANK'S POTENTIAL BORROWERS IN UKRAINE

The work is aimed at defining the directions of credit activity intensification of the economic entities through critical analysis of banks as a powerful leverage of raising additional resources and ensuring sufficient conditions for the development of entrepreneurship. The system of management of quality credit portfolio has considered as the basis for increasing the capacity of the banking system and development the credit relations in a country. It is proved that the issue of complex automation of processing indicators in the face of rising systemic risk, forecasting the results based on the analysis of their dynamics is an increasingly urgent task for the modern banking system. Authors have proposed modern analytical tools to provide the necessary quality of credit activity of the structural units of banks by grounded assessment of the creditworthiness of potential borrowers. The paper presents the model of assessing the creditworthiness of potential borrowers of the bank based on fuzzy logic regarding selected qualitative and quantitative indicators that are fully characterizing the client.
JEL: G21; C61; C45

1. Introduction

In conditions of transformations of the world economy, one of the main tasks of the banking system is the creation of favorable conditions for the stable reproduction process and entrepreneurial activity development because the prospects for further growth of economic entities largely depend on the ability of banks to meet their needs by necessary financial resources. Research the directions of activation of economic entities credit activity and bank's activity as a powerful lever of influence and ensuring the development of

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entrepreneurship are actualized in terms of lack of own funds to finance the production. In its turn, the complex system of management of credit portfolio on the basis of grounded analysis and assessment of its quality is essential for increasing the capacity of the banking system and development the credit relations.

Today banks as one of the main parts of the economic system of the state are often faced with borrowers who cannot repay the loan. And a lot of bad loans in the total bank assets is the cause of the banking system losses.

The credit activity of banks is complicated by the absence of grounded methods of assessing the creditworthiness of the borrower, lack of information base for a full analysis of the financial standing of customers. Also, the modern economic conditions require the use of new information technologies and computerized tools for collecting, processing and providing information. Therefore, solving the problem of assessing the creditworthiness of customers is one of priority for the bank. That is why it is reasonable to determine the ways of improving the assessment of the creditworthiness of borrowers by the justification the appropriate methodical approach and forming the model of assessment of the creditworthiness of potential borrowers of the bank.

2. Analysis of recent research and publications

It should be noted that in the scientific literature researchers pay much attention to the investigation of the mechanism of bank's participation in the monetary relations both at the macro level (Levine, 2003; Huerta-de-Soto, 2009; Herrmann & Jochem, 2003; Mersch, 2015; Draghi, 2013; Barth, Caprio & Levine, 2013; Blundell-Wignall & Atkinson, 2010; Claessens & Horen, 2014; Pacces & Heremans, 2012; Severe, 2016; Rad, 2016) and micro level (Danila, 2007; Eremia & Stancu, 2006; Thompson & Strickland, 2009; Cucinelli, 2016; Mukherjee, 2014).

However, the analysis of existing viewpoints showed that depending on economic conditions and goals of research, approaches to management of the bank credit portfolio quality based on the assessment of the creditworthiness of potential borrowers are formulated by scientists controversial. The assessing the creditworthiness of potential borrowers of the bank is the subject of many scientists' research. Despite the significant contribution of scientists to study the ways of effective formation and evaluation of the credit portfolio this issue is still important today and needs further study in both theoretical and in practical terms.

It should be noted that most scientific works devoted to the research of separate aspects of credit activity of banks. Thus, according to the work of Severe (2016) the impact of the monetary policy of banks is essential to the development of production, is especially noticeable with changes in interest rates on loans, which reduction increases the industrial growth in the country.

Ali-Shawtari, Ariff, and Abdul-Razak (2015) assessed the viability of the banking sector and proposed policy concerning the restructuring the industry in order to increase its

effectiveness. In other words, there were identified common directions of intensification of bank's work.

Carvajal (2015) investigated the impact of the credit restriction on macroeconomic instability and emphasized the importance of credit facilities for business entities. Rad (2016) studied the link between risk management and system of management in banks, in particular, studied the management intent underlying the forming of bank's activity control system.

Mertzanis (2015) emphasized the importance of developing a risk management system and grounded analysis in the process of regulating the bank's activity. Osei-Assibey and Asenso (2014) presented the results of modeling interconnection between indicators of bank's activity, industrial and macroeconomic changes, examined in detail the regulatory capital and its impact on credit expansion, the role of credit and credit debt impact on the efficiency of the bank. Gaillard (2014) investigated the lack of clear and reliable information about potential borrowers and the impact of limited information on the activity of banks.

Hsu-Che, Ya-Han, and Yen-Hao (2014) analyzed credit ratings for assessing credit risk. Ordinary credit rating approaches mainly focus on two classes classification (good or bad credit), which leads to a lack of adequate accuracy for the assessment of credit risk in practice. Scientists had proved that most previous studies focused on the use of different methods of data analysis, but the issue of selection and data processing are still remained scarcely explored.

Acknowledging the importance and practical significance of these results, we emphasize that the overall there is a lack of deep theoretical research and practical recommendations for solving the problem of improving and managing exactly the process of assessing the creditworthiness of the borrowers based on advanced information technologies.

3. Formulation of the purpose of the article

The purpose of this article is the examining of existing approaches to determine the creditworthiness of the borrower, analyzing characteristics of such approaches and justification the methodology of evaluating the creditworthiness of the borrower – individual, that let's decide most effectively in the specific conditions of activity of banks.

4. Approaches for assessing the borrower creditworthiness

Each bank uses its own procedures and criteria for assessing the creditworthiness and financial position of the borrower based on the analysis of financial statements, following the recommendations of the central bank. For this purpose, there are used advanced applications of express-analysis of the financial standing of companies and dynamic of cash flow. However, there is a lack of recommendations for determining the validity and

normative values of some parameters. In the absence of powerful analytical tools in most banks, this problem remains unresolved or solved subjectively in practice.

The main problem of assessing the creditworthiness of borrowers, both individuals and legal entities in banks, there is a great complexity of this work. The process of assessing the creditworthiness are mostly not automated, so there are plenty of busy workers. In addition to the above, search for the required information about the client and its documents is often difficult, because several departments and workers are engaged simultaneously in the assessment of the creditworthiness of the borrower. The main problem with the bank credit process is the inherent uncertainty of it. Not having full information about potential borrowers and changes in the environment, banks have to deal with credit risk almost every day. The development of information technology and information systems allows solving almost no limited number of tasks related to decision-making under uncertainty.

Most frequently to assess the creditworthiness of the borrower used: statistical methods; decision tree; genetic algorithms; neural networks.

Statistical methods based on discriminant analysis are used in solving problems of classification. Thus, the famous Altman model using for analyzing the creditworthiness of entities is based on multiple discriminant analysis. Linear or logistic regression is used to analyze the creditworthiness of individuals. All regression methods are sensitive to the correlation between characteristics, so there should not be strongly correlated characteristics of the borrower in the model.

Statistical methods are based on averaging indicators, but during the study of real difficult phenomena of life, these characteristics may be inapplicable. Assessment of creditworthiness of the borrower through these methods requires a lot of data about the credit history, that is not always possible. Also typical is the problem of lack of examples of borrowers that were unable to repay their debts. A significant drawback of statistical methods is the requirements for special training of the user.

The method of decision trees is high-speed processing and training while maintaining the properties of fuzzy inference. When using the method of decision trees for classification of loan applications a set of rules is used that formed in the construction of the tree based on the training set. The tree includes interrelated initial (root), intermediate and end nodes. Each node meets the condition (rule) of the classification of objects. To build a tree at each internal node you need to find a condition that would break the set associated with this node in the subset.

With selected characteristic, the set is divided. As a result, the obtained subset is consisted of objects belonging to the same class, or are as close as possible to this. The number of objects from other classes in each of these sets should be as less as possible.

But the method of decision trees has significant drawbacks. It is not suitable for tasks with a large number of possible links and when the condition (rule) can be formulated only in terms of "more / less". That hinders its application to tasks where the class is determined by a complex combination of variables.

Genetic algorithms are based on a stochastic search of a global optimum objective function. The idea of genetic algorithms is borrowed from nature and means an organization the process of evolution, the ultimate objective of which is the optimal solution. Such algorithms have a lot of drawbacks. The criterion of selection the indicators does not guarantee finding the "best" solution. You must also have available a fairly large amount of input data to complete the procedure.

Neural networks are the computational structures that model simple biological processes commonly associated with processes in the human brain. According to Michie et al. (1994), neural networks are a set of elements (artificial neurons) connected by synoptic links. The disadvantage of using neural networks is that they are a "black box". It means that they work on the principle of transferring information from one level of neurons to others, certain input signal corresponds to a certain output and the mechanism of such work is still unknown. Knowledge recorded as the weight of several hundred interneuronal relationships and it is difficult for a person to analyze and interpret them. Also, there is a lack of hard rules of the choice of network speed training for solving specific problems.

There are many architectures of neural networks. For example, to classify clients of German and Australian banks use the following networks: network of Kohonen, Back Propagation network, radial basis network, cascading network.

General disadvantages for practical application of the above methods are requirements to the volume of input and stringent requirements for characteristics and selection criteria for the borrower. In real life borrower's environment is constantly changing, as a result his marital and financial status is changing too. This brings uncertainty to the information about the client. Incorrect assessment of the borrower in these conditions can increase the risk of bank or loss potentially reliable customers.

Turtle, Bector and Gill (1994), Friedlob and Schleifer (1999), Allen, Bhattacharya and Smarandache (2003), Chi-Man-Hui, Muk-Fai-Lau and Kak-Keung-Lo (2009), Kahraman (2011) and others show that the most effective methods are the combined methods of intelligence that combines the benefits of natural and artificial intelligence (for example, methods of fuzzy sets theory).

Based on this theory, methods of building information models significantly expand the traditional areas of application computer and create an independent direction of scientific and applied research. Recently, fuzzy modeling is one of the most active and perspective directions of modeling in management and decision-making. In the management of technical facilities, fuzzy modeling allows obtaining more adequate results, compared with the results based on the use of traditional analytical models and control algorithms.

Fuzzy modeling process can be represented in the form of interconnected stages, at each stage, there are carried out specific actions directed to building and further using of information and logical models of systems. In addition, each stage is performed in order to build and use the fuzzy model system to solve the initial problem.

Separate stages of the process fuzzy modeling are: analysis of the problem situation; structuring of the subject area and building a fuzzy model; execution of computing

experiments with the fuzzy model; application of the results of computational experiments; correction or completion fuzzy model.

Thus, a fuzzy model of the original or a fuzzy system is first of all characterized by uncertainties type of ambiguity (fuzziness) of the system's limits and its individual states, input and output impacts.

The task of assessing the creditworthiness can be formulated as follows. Every credit application is given by the vector, another word by formalized in a certain way data from the borrower's questionnaire and chosen loan parameters. Then according to the chosen vector, it is necessary to make a decision on the loan, the borrower should be classified as "reliable" or as "not reliable."

In world practice, still there is no single standardized system of assessing the creditworthiness of borrowers, that's why banks use different methods that are complemented each other. At present sector of loans to individuals is the most sensitive to changes in the socio-economic sphere, and many existing methods for assessing the creditworthiness of clients has appeared inefficient. Because of growing competition in the market of credit services and unsatisfied demand for different banking products, credit institutions have to look for ways to attract credit-worthy customers with saving the possibility of control losses. So there is a need for better selection of borrowers.

Assessment of the creditworthiness of the borrower – individual based on the ratio of the requested loan and its personal income, overall assessment of the financial situation of the borrower and the cost of its property, on the results of studying personal characteristics and credit history. Lending to borrowers – individuals allows banks, on the one hand, to increase their income in a short period of time, and on the other hand, it is always associated with the risk of late payment or no repayment of the loan in full. Accurate assessment of the ability of borrowers to meet their loan obligations allows reducing possible losses. Therefore, a competent organization of assessing the creditworthiness of borrowers very is important.

Permanent improvement of the lending system in the face of rising interbank competition is a necessary condition for the bank for forming its public image as a universal credit institution and serves as an additional source of income of credit operations with individuals. Despite intense development in recent years this area of banking business still has huge reserves of growth. Assessment of the creditworthiness of a potential borrower is carried out to determine its class of reliability and financial ability to timely and fully implement repayment in terms and conditions established by the credit agreement.

The periodicity of assessment of the financial condition of the individual borrowers is defined by the bank based on the state of debt servicing and maturity of the loan. If the credit debt service is characterized by delay or prolongation, then an assessment of the financial condition of the individual borrowers should be constant for a period of delayed repayment of debt, except when it is related to valid reasons. The world banking practice distinguishes a number of components that together allow determining the level of creditworthiness of the borrower. In order to create an effective methodology of the complex system of assessment the creditworthiness of borrowers in indicators of

creditworthiness should be included not only the value that is relatively easily calculated using quantitative data but also those that may be described by the evaluative judgments.

Yue Jiao, Yu-Ru Syau, and E. Stanley Lee (2007) in their work presented a model for assessing the credit rating of small financial enterprises based on the fuzzy adaptive network. There are deep mathematical calculations and a lot of specification of the neural network. The authors use a set of specific indicators taking into account the object of their research.

Based on the research work of scientists there were generalized main qualitative and quantitative characteristics of the borrower, that should be taken into account in assessing the creditworthiness of the borrower – individual. Particular attention is paid on considering the quality indicators of the creditworthiness of borrowers in the regulation of credit activity of the banks. This question was so emphasized by Tammi (2013) in his works. Also, questions of security of credit were investigated by Ghosh (2016) by the example of specialized banks.

For the proposed model of the creditworthiness assessments of bank's potential borrowers (individuals) on the basis of fuzzy logic the input indicators were selected taking into account the recommendations of the central bank, internal instructions of Ukrainian banks, the experience of using the system of indicators in domestic banking practice by an expert survey of employees of the largest banks in Ukraine.

5. Description of the proposed model

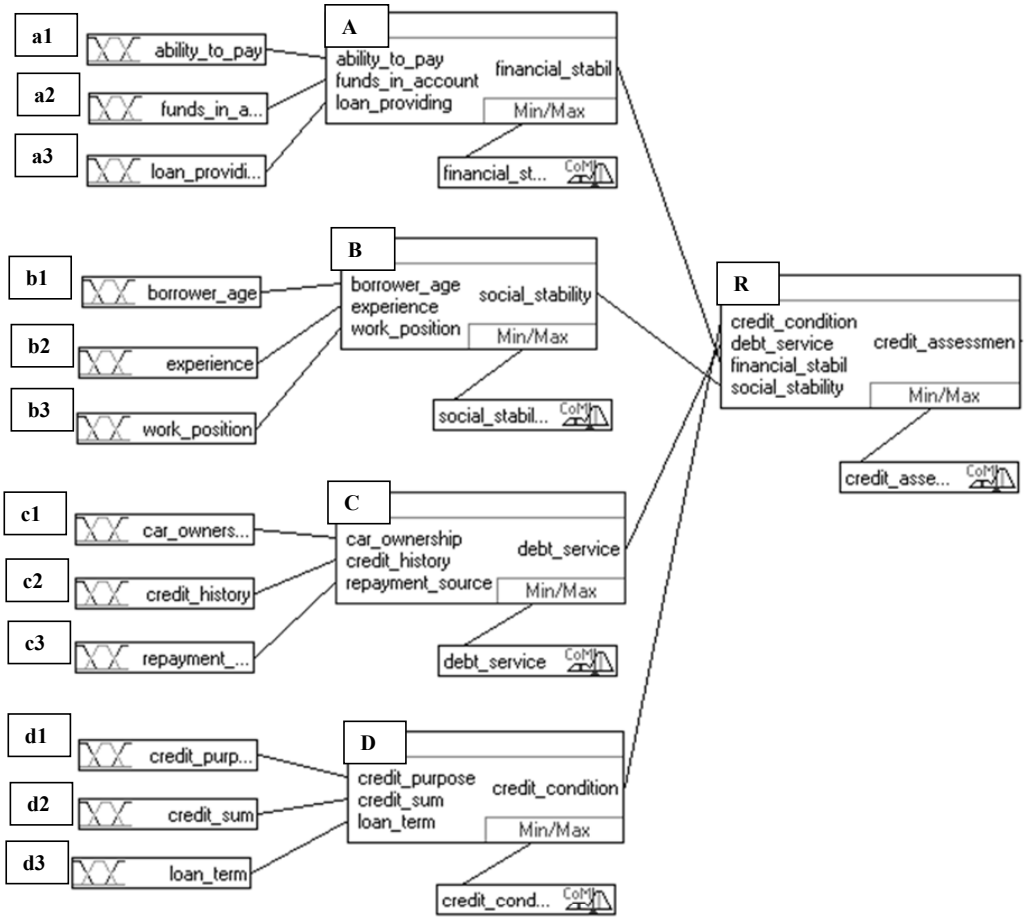
The authors constructed a model assessing the creditworthiness of the borrower based on fuzzy logic taking into account selected indicators with further the possibility of expanding the list of assessment criteria. According to these indicators, we make a linguistic score for generalizing indicator of creditworthiness.

General indicator (R) is a three-level convolution where partial indicators (a1, a2, a3, b1, b2, b3, c1, c2, c3, d1, d2, d3) combined in the components of evaluation (A, B, C, D), and the components in their turn – in the resulting indicator. Model of assessment of the creditworthiness of the individual borrower is based on predefined parameters and the chosen method (Figure 1).

Thus, input and output options were identified and each of them is characterized by a set of linguistic terms of linear (triangular and trapezoidal) membership function.

Figure 1

The structure of the model of assessing the creditworthiness of potential borrower-individual (realization in FuzzyTech program tool)



Intervals of changes of such components as the financial stability of the borrower, debt service of the borrower, credit conditions are based on the "golden ratio" or Fibonacci numbers as the basis of harmonious division.

On the upper level, the input parameters are the borrower's financial stability, social stability, debt service, credit conditions. They are also output parameters of the lower level. For each input parameter has constructed membership function depending on the deviation from the schedule of passing control points (Table. 1).

Table 1

The components (characteristics of membership functions) for assessing creditworthiness of borrower (R)

Symbol	Name	Symbol	Linguistic assessment	The trapezoidal numbers for the values of linguistic variable				Interval
A	Financial stability of the borrower	A1	weak	0.000	0.118	0.382		0.000-0.382
		A2	enough	0.375	0.499	0.558	0.618	0.382-0.618
		A3	strong	0.600	0.735	0.853	1.000	0.618-1.000
B	Social stability of the borrower	B1	weak	0.000	0.120	0.250		0.000-0.250
		B2	enough	0.200	0.350	0.500	0.750	0.250-0.750
		B3	strong	0.650	0.850	0.950	1.000	0.750-1.000
C	Debt service	C1	satisfactory	0.000	0.236	0.382		0.000-0.382
		C2	good	0.370	0.499	0.618		0.382-0.618
		C3	excellent	0.550	0.735	1.000		0.618-1.000
D	Credit conditions	D1	low risky	0.000	0.127	0.254	0.382	0.000-0.382
		D2	risky	0.375	0.508	0.618		0.382-0.618
		D3	very risky	0.500	0.744	1.000		0.618-1.000

As already noted, general indicator of assessment of the creditworthiness of the borrower – individual (R), consists of four components, which have three terms in accordance with the range of variation: financial stability of the borrower, social stability of the borrower, debt service and credit conditions.

In Table 2 terms and intervals of an overall assessment of the creditworthiness of the borrower for the model are given. Intervals of changes in the assessment of the creditworthiness of the borrower and its linguistic assessment are based on Harrington's Desirability Function (Harrington, 1965).

Table 2

Overall assessment of creditworthiness of the borrower for the model

Indicator	Intervals	Linguistic assessment
R1	0.00-0.37	Low
R2	0.30-0.65	Satisfactory
R3	0.55-0.80	Good
R4	0.70-1.00	very good

Each of the components of an overall assessment of the creditworthiness of the borrower combines a number of partial indicators. In annex 1-4 the structure of each component in the context of the partial indicators is given. The intervals of changing of the indicator of the current ability to pay are selected in accordance with the generally accepted practice of its use in the bank's work, as well as the intervals for the indicator of ensuring the credit, the loan term, lending amount.

For indicators funds on accounts in banks, sources of debt repayment and purpose of lending intervals are based on the results of a survey of experts of the banking sector. The

"age of the borrower" and "work experience" are broken at intervals, taking into account the logic and objective trends of the labor market in Ukraine.

Intervals for the indicator “place of work (position)” correspond to the logic of construction of the Unified Tariff Grid in Ukraine. The intervals of the indicator "Automobile ownership" (the cost of cars) are due to the general tendency of prices in the car market and the purchasing power of Ukrainian citizens.

Depending on the input variables and possible options of its combination (rules for assessing the creditworthiness of the borrower) we received general characteristics R (Table 3). The full set of rules is given in annex 5-9.

Table 3

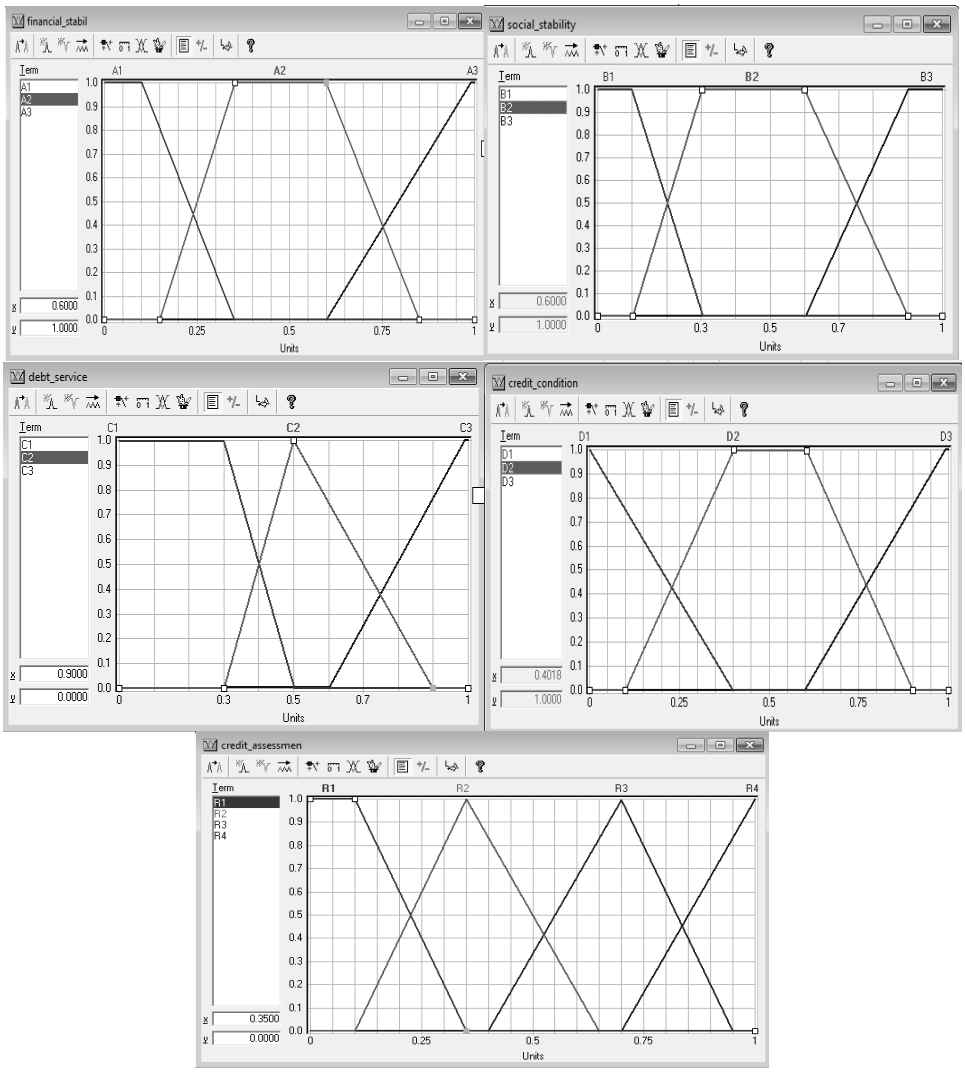
Rules for assessing the creditworthiness of the borrower (fragment)

Rule	Financial stability	Social stability	Debt service	Credit conditions	Overall assessment of creditworthiness
1	weak	weak	Satisfactory	low risk	low
2	weak	weak	Satisfactory	risk	low
…..					
15	enough	enough	Satisfactory	risk	satisfactory
16	enough	weak	Satisfactory	risk	low
…..					
81	enough	strong	Excellent	low risk	very good

Computer representation of membership functions for input components (A, B, C, D) of the general indicator of the creditworthiness of the borrower (R) is shown on Figure 2. Computer representation of membership functions for input variables of the structural components (A, B, C, D) is given in annex 10.

For effective practical use of the model following steps should be done on the stage of implementation of the model: accumulating a sufficient base for each of the input parameters; conducting adaptation; clarification and correction the model (look and membership functions parameters, decision-making rules). Based on data about individuals an approbation of the model of the assessing the creditworthiness of borrowers has been conducted.

Figure. 2
Computer representation of membership functions for input components (A, B, C, D) of the general indicator of the creditworthiness of the borrower (R)



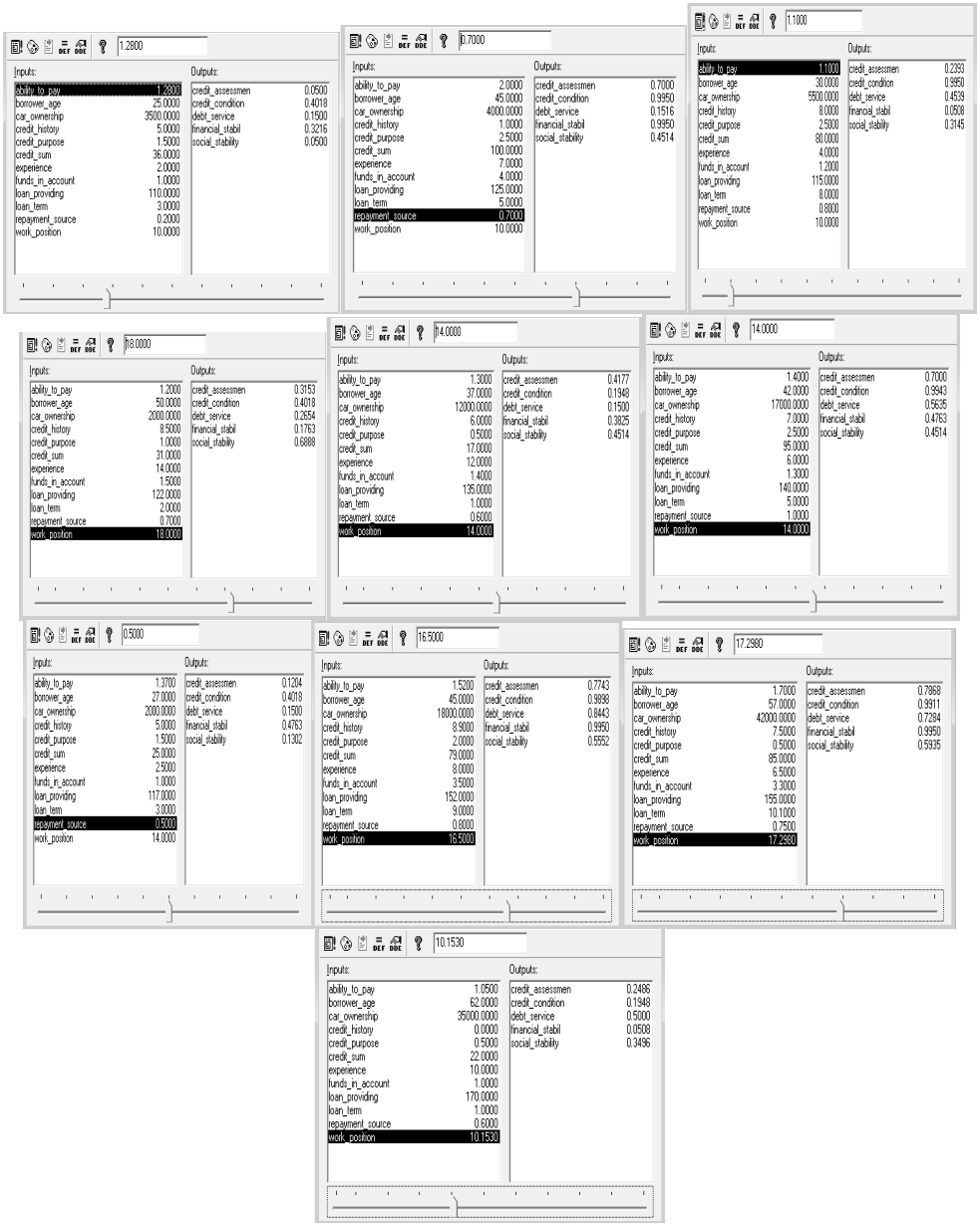
6. Numerical example of calculations

The results of assessing the creditworthiness of borrowers are given on Figure 3, for all potential clients we have received a summary assessment of creditworthiness.

On the left side of each interactive window while working in the program user enters a numerical value (assessment) of input parameters, and on the right side, the program displays the results of calculations for all output parameters (interim and final).

Figure 3

Computer representation of the results of assessing the creditworthiness of borrowers



There are input variables of the model and the results of assessing the creditworthiness of borrowers in Table 4.

Table 4

Input numerical data for each client and the results of assessing the creditworthiness of borrowers

Client	Creditworthiness of the borrower												
	Financial stability (A)			Social stability (B)			Debt service (C)			Credit conditions (D)			Creditworthiness assessment R
	ability to pay	funds in account	loan providing	experience	borrower age	work position	repayment sources	credit history	car ownership	credit purpose	loan term	credit sum	
1	1.28	1	110	2	25	0.5	0.2	5	3500	1.5	3	36000	0.05
2	2	4	125	7	45	1	0.7	1	4000	2.5	5	100000	0.7
3	1.1	1.2	115	4	30	0.5	0.8	8	5500	2.5	8	80000	0.239
4	1.2	1.5	122	14	50	2	0.7	8.5	2000	1	2	31000	0.315
5	1.3	1.4	135	12	37	3	0.6	6	12000	0.5	1	17000	0.418
6	1.4	1.3	140	6	42	1.5	1	7	17000	2.5	5	95000	0.7
7	1.37	1	117	3	27	1.5	0.5	5	2000	1.5	3	25000	0.12
8	1.52	3.5	152	8	45	2	0.8	8.9	18000	2	9	79000	0.774
9	1.7	3.3	155	7	57	2.7	0.8	7.5	42000	2	12	85000	0.787
10	1.05	1	170	10	62	1	0.6	0	35000	0.5	1	22000	0.249

There are grouped assess of the creditworthiness of clients and their linguistic assessment in Table. 5. Of course, these recommendations are not exhaustive; they are carefully developed by employees of the bank, approved by the credit committee, and then provided to the credit manager for further work. Also, a more detailed analysis of direct numerical modeling of our model is the subject of further research.

Table 5

Summary results of the assessment creditworthiness of clients

Linguistic assessment of the creditworthiness of client: «low»	Recommended actions by the bank	Linguistic assessment of the creditworthiness of client: «satisfactory»	Recommended actions by the bank
client 1 client 3 client 4 client 7 client 10	Refuse to provide credit	client 5	Refuse to provide credit, but provide recommendations for correct deficiencies and improve indicators
Linguistic assessment of the creditworthiness of client: «good»	Recommended actions by the bank	Linguistic assessment of the creditworthiness of client: «very good»	Recommended actions by the bank
client 2 client 6	Satisfy an application for credit, but on a lower amount	client 8 client 9	Satisfy an application for credit

We assume, in particular, consider such questions as construction of membership functions based on statistical analysis of expert interviews; the use of more complex forms of membership functions, including non-standard; opportunities for learning and adjustments constructed system fuzzy inference using the neural network; increasing the number of initial model parameters; determine the weights of parameters; development model using different values of weighting coefficients for different initial, intermediate parameters and appropriate decision-making; creation the modules by adding models in the programming language C.

7. Conclusions

The main problem in the analysis of the creditworthiness of borrower – individual is the inaccuracy of data, lack of a base of knowledge of customers' past and the necessity to work with linguistic characteristics that are difficult to mathematical processing. In specific terms of banks functioning methods based on fuzzy logic, including methods based on fuzzy neural network and Mamdani controller give good results. They allow getting grounded decision considering the fuzzy evaluation, fuzzy information about the object, initial settings, that are characterized by fuzzy criteria.

Thus, the work provided practical recommendations for improving the approach to evaluating the quality of the credit portfolio of the bank and ensure its quality on the basis of the model of assessment creditworthiness of borrower – individual. Implementation of advanced methodical tools of modeling the analysis of the creditworthiness of borrower based on fuzzy logic allows the bank's management to implement grounded decisions at the stage of customer service more effectively.

Because complex automation of processing parameters, calculations of results based on these parameters is becoming increasingly important for modern banking systems, the model for evaluating the creditworthiness of borrowers – individuals based on fuzzy logic was developed based on specified parameters and offered to practical use. It is timely to ensure the quality of banks' activity.

The results of research can be used in practical activities of banks to assess the financial status of bank's client according to the established criteria and make a decision by bank's managers concerning expediency granting credit in each case. Formulated theoretical-methodological and practical arrangements may be used for further research in evaluating the quality of the credit portfolio and credit risk management.

Of course, there is a certain subjectivity about building a model. It manifests itself at the initial stage, when on the basis of expert assessments (groups or even one specialist) sets of membership functions, numerical characteristics and the form of sets of terms of linguistic variables.

Therefore, the example given in the article only shows the possibility of developing and using such models on the basis of fuzzy sets theory and fuzzy modeling. Therefore, in practical use, a preliminary adjustment, adaptation of the model, based on specific loan conditions and other features, is required, which can only be identified and accounted for in the practical application of the model.

Considering the interaction of the proposed approach with other existing ones, two main points should be noted.

The first is that in practice it is advisable to simultaneously use several different approaches to solve this problem. And if the results obtained by different methods are the same or almost the same, the decision to lend the borrower can be considered correct. That is, the results confirm each other. Otherwise, additional calculations or use of other methods of developing and making decisions, including, possibly, correcting the calculation models themselves are necessary.

The second point to be noted is that the proposed fuzzy modeling approach requires good statistical preparation at the stage of initial model development. This concerns the definition of a set of evaluation parameters, the numerical values of their individual levels, the nature (kind) of membership functions and linguistic variables. At this stage it is necessary to make maximum use of methods of expert evaluation and statistical processing of their data.

The practical value of the results investigation confirmed the real trends and existing needs of the banking system of Ukraine. Proposed analytical tools can be used by banks in practice. The competitive advantages of it include the flexibility to expand the base of input parameters and the ability to adapt according to the requirements that can permanently change.

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APPENDIX

Annex 1

Indicators (characteristics of membership functions) for assessing of the borrower financial stability (A)

Symbol	Name	Symbol	Linguistic assessment	Triangular and trapezoidal numbers for the value of linguistic variable				Interval
a1	The current ability to pay (CAP)	a11	low	1	1.25			1< CAP <1.25
		a12	middle	1.20	1.3	1.40	1.5	1,25< CAP <1.5
		a13	high	1.45	2			CAP >1.5
a2	Funds on accounts in banks	a21	absent	0	1			No funds on accounts in banks (1 point)
		a22	insufficient	0.75	1.5	2		Funds on accounts in the amount less than the loan amount (2 points)
		a23	sufficient	1.7	3	4		Funds on accounts that exceed the amount of the loan (4 points)
a3	Ensuring the credit (EC)	a31	sufficient	100	110	125		The collateral value of the property less than 25% higher than the amount of credit debt 100%< EC <125%
		a32	middle	120	130	140	150	The collateral value of the property at least 25% higher than the amount of credit debt 125%< EC <150%
		a33	high	145	200	250		The collateral value of the property at least 50% higher than the amount of credit debt EC >150%

Annex 2

Indicators (characteristics of membership functions) for assessing of the borrower social stability (B)

Symbol	Name	Symbol	Linguistic assessment	Triangular and trapezoidal numbers for the value of linguistic variable				Interval
b1	Work experience	b11	low	0	1	3		To 3 years
		b12	middle	2.5	3.5	7	10	From 3 to 10 years
		b13	high	8.5	15			More than 10 years
b2	Age borrower	b21	young	20	25	35		20-35 years
		b22	adult	30	35	45	55	35-55 years
		b23	old	50	65	70		55-70 years
b3	Place of work (position)	b31	low	0.5	1			The worker or employee (0.5 or 1 point)
		b32	middle	0.75	1.5	2		Specialist, top manager of the company (2 points)
		b33	high	1.75	2.5	3		Own business or the head (3 points)

Annex 3

Indicators (characteristics of membership functions) for assessing of the borrower social stability (C)

Symbol	Name	Symbol	Linguistic assessment	Triangular and trapezoidal numbers for the value of linguistic variable				Interval
c1	Sources of debt repayment	c11	unstable	0	0,1	0,2		Unstable additional income (0.2 points)
		c12	stable	0,15	0,4	0,6		Stable additional income (0.6 points)
		c13	stable and reliable	0,50	0,7	0,8	1	The official salary and other confirmed income (1 point)
c2	Credit history	c21	sufficient	0	5			There is a breach of contract (0 points) Not used (5 points);
		c22	good	4	6	8		Systematic delay payments over 7 days (4 points) Systematic delay payments to 7 days (6 points) Delay payments not systematically to 7 days (8 points)
		c23	excellent	7	10			Individual cases of overdue payments (7.5 points) Debt service is good without violations (9 points)
c3	Automobile ownership	c31	cheap	300	1000	2000	3000	Cost up to USD 3,000
		c32	budget	2500	5000	7000	10000	Cost from 3 000 to 10 000 USD.
		c33	medium	9000	15000	25000	30000	Cost from 10 000 to 30 000 USD
		c34	expensive	27000	50000	75000	100000	Cost from 30 000 USD.

Annex 4

Indicators (characteristics of membership functions) for credit conditions (D)

Symbol	Name	Symbol	Linguistic assessment	Triangular and trapezoidal numbers for the value of linguistic variable				Interval
d1	The purpose of lending	d11	Consumer lending	0	0,5			Purchases of consumer goods (0.5 points)
		d12	Auto Loans	0,4	1	1,5	2	Purchase of cars (1 point-domestic, 2 points-import)
		d13	Mortgage Lending	1,75	2	2,5		Purchase of house (2 points - secondary market, construction - 2.5 points)
d2	Loan term	d21	Short	0,1	1			To 1 year
		d22	Medium	0,75	2	3	5	From 1 to 5
		d23	Long	4	10	15		From 5 to 15
d3	Lending amount	d31	Small	1000	5000	10000	20000	To 20 000 UAH
		d32	Medium	18000	25000	35000	50000	From 20 000 to 50 000 UAH
		d33	Big	48000	70000	100000		Over 50 000 UAH

Annex 5

The rules for forming assess of the financial stability of the borrower (A) (A1 weak; A2 sufficient; A3 strong)

The combination of components			Financial stability A
a11	a21	a31	A1
a11	a22	a31	A1
a11	a23	a31	A2
a11	a22	a32	A1
a11	a21	a32	A1
a11	a23	a33	A2
a11	a22	a33	A1
a11	a21	a33	A1
a11	a23	a32	A2
a12	a21	a31	A2
a12	a22	a31	A2
a12	a23	a31	A3
a12	a22	a32	A2
a12	a21	a32	A2

The combination of components			Financial stability A
a12	a23	a33	A3
a12	a22	a33	A3
a12	a21	a33	A2
a12	a23	a32	A3
a13	a21	a31	A2
a13	a22	a31	A2
a13	a23	a31	A3
a13	a22	a32	A2
a13	a21	a32	A2
a13	a23	a33	A3
a13	a22	a33	A3
a13	a21	a33	A2
a13	a23	a32	A3

Annex 6

The rules for forming assess of the social stability of the borrower (B) (B1 weak; B2 sufficient; B3 strong)

The combination of components			Social stability B
b11	b21	b31	B1
b11	b22	b31	B1
b11	b23	b31	B1
b11	b22	b32	B2
b11	b21	b32	B1
b11	b23	b33	B2
b11	b22	b33	B2
b11	b21	b33	B1
b11	b23	b32	B1
b12	b21	b31	B1
b12	b22	b31	B2
b12	b23	b31	B1
b12	b22	b32	B2
b12	b21	b32	B2

The combination of components			Social stability B
b12	b23	b33	B2
b12	b22	b33	B3
b12	b21	b33	B3
b12	b23	b32	B2
b13	b21	b31	B2
b13	b22	b31	B2
b13	b23	b31	B1
b13	b22	b32	B2
b13	b21	b32	B2
b13	b23	b33	B3
b13	b22	b33	B3
b13	b21	b33	B3
b13	b23	b32	B2

Annex 7

The rules for forming assess of the debt service of the borrower (C) (C1 satisfactory; C2 good; C3 excellent)

The combination of components			Debt service C
c11	c21	c31	C1
c11	c22	c31	C1
c11	c23	c31	C1
c11	c22	c32	C1
c11	c21	c32	C1
c11	c23	c33	C1
c11	c22	c33	C1
c11	c21	c33	C1
c11	c23	c32	C1
c12	c21	c31	C1
c12	c22	c31	C1
c12	c23	c31	C1
c12	c22	c32	C1
c12	c21	c32	C1
c12	c23	c33	C2
c12	c22	c33	C2
c12	c21	c33	C2
c12	c23	c32	C2

The combination of components			Debt service C
c13	c21	c31	C1
c13	c22	c31	C2
c13	c23	c31	C2
c13	c22	c32	C2
c13	c21	c32	C2
c13	c23	c33	C3
c13	c22	c33	C3
c13	c21	c33	C2
c13	c23	c32	C3
c11	c21	c34	C2
c11	c22	c34	C2
c11	c23	c34	C2
c12	c21	c34	C2
c12	c22	c34	C2
c12	c23	c34	C3
c13	c21	c34	C2
c13	c22	c34	C3
c13	c23	c34	C3

Annex 8

The rules for forming assess the credit conditions (D) (D1 low risky; D2 risky; D3 very risky)

The combination of components			Credit conditions D
d11	d21	d31	D1
d11	d22	d31	D1
d11	d23	d31	D1
d11	d22	d32	D2
d11	d21	d32	D1
d11	d23	d33	D3
d11	d22	d33	D3
d11	d21	d33	D2
d11	d23	d32	D2
d12	d21	d31	D1
d12	d22	d31	D2
d12	d23	d31	D2
d12	d22	d32	D2
d12	d21	d32	D2

The combination of components			Credit conditions D
d12	d23	d33	D3
d12	d22	d33	D3
d12	d21	d33	D2
d12	d23	d32	D2
d13	d21	d31	D2
d13	d22	d31	D2
d13	d23	d31	D3
d13	d22	d32	D2
d13	d21	d32	D3
d13	d23	d33	D3
d13	d22	d33	D3
d13	d21	d33	D3
d13	d23	d32	D3

Annex 9

The rules for forming assess of the creditworthiness of borrowers (R)
(R1 low; R2 satisfactory; R3 good; R4 very good)

The combination of components				Creditworthiness of borrowers
A1	B1	C1	D1	R1
A1	B1	C1	D2	R1
A1	B2	C1	D2	R1
A1	B2	C1	D3	R1
A2	B2	C1	D2	R2
A2	B1	C1	D2	R1
A2	B2	C1	D3	R2
A3	B1	C1	D1	R2
A1	B2	C1	D1	R1
A1	B3	C1	D1	R2
A1	B1	C1	D3	R1
A1	B3	C1	D3	R1
A2	B1	C1	D1	R2
A2	B2	C1	D1	R3
A2	B3	C1	D1	R3
A2	B1	C1	D3	R2
A2	B3	C1	D3	R2
A2	B3	C1	D2	R2
A3	B3	C1	D3	R3
A3	B1	C1	D3	R2
A3	B2	C1	D1	R3
A3	B2	C1	D3	R3
A3	B3	C1	D2	R3
A1	B2	C2	D2	R2
A1	B1	C2	D1	R1
A1	B1	C2	D3	R1
A1	B2	C2	D3	R2
A1	B3	C3	D1	R2
A1	B2	C3	D1	R2
A2	B3	C3	D1	R4
A1	B3	C1	D2	R2
A3	B3	C1	D1	R3
A3	B1	C1	D2	R2
A3	B2	C1	D2	R3
A1	B2	C2	D1	R2
A1	B1	C2	D2	R1
A1	B3	C2	D1	R2
A1	B3	C2	D2	R2
A1	B3	C2	D3	R2
A2	B2	C2	D2	R3
A2	B1	C2	D2	R3

The combination of components				Creditworthiness of borrowers
A2	B2	C2	D1	R3
A2	B3	C2	D2	R3
A2	B2	C2	D3	R3
A2	B1	C2	D1	R3
A2	B3	C2	D3	R3
A2	B3	C2	D1	R3
A2	B1	C2	D3	R2
A3	B3	C2	D3	R3
A3	B2	C2	D2	R3
A3	B3	C2	D2	R3
A3	B1	C2	D1	R3
A3	B3	C2	D1	R4
A3	B1	C2	D3	R3
A3	B1	C2	D2	R2
A3	B2	C2	D1	R3
A1	B3	C3	D3	R2
A1	B1	C3	D1	R2
A1	B1	C3	D3	R1
A1	B1	C3	D2	R1
A1	B2	C3	D2	R2
A1	B3	C3	D2	R2
A2	B3	C3	D3	R3
A2	B2	C3	D2	R3
A2	B3	C3	D2	R3
A2	B1	C3	D1	R3
A2	B1	C3	D2	R2
A2	B2	C3	D1	R4
A2	B1	C3	D3	R2
A3	B3	C3	D3	R4
A3	B3	C3	D1	R4
A3	B3	C3	D2	R4
A3	B1	C3	D1	R3
A3	B1	C3	D2	R3
A3	B2	C2	D3	R3
A1	B2	C3	D3	R2
A2	B2	C3	D3	R3
A3	B1	C3	D3	R3
A3	B2	C3	D3	R3
A3	B2	C3	D2	R3
A3	B2	C3	D1	R4

Annex 10

Figure 1. Computer representation of membership functions for input variables (a1, a2, a3) of the component "financial stability of the borrower" (A)

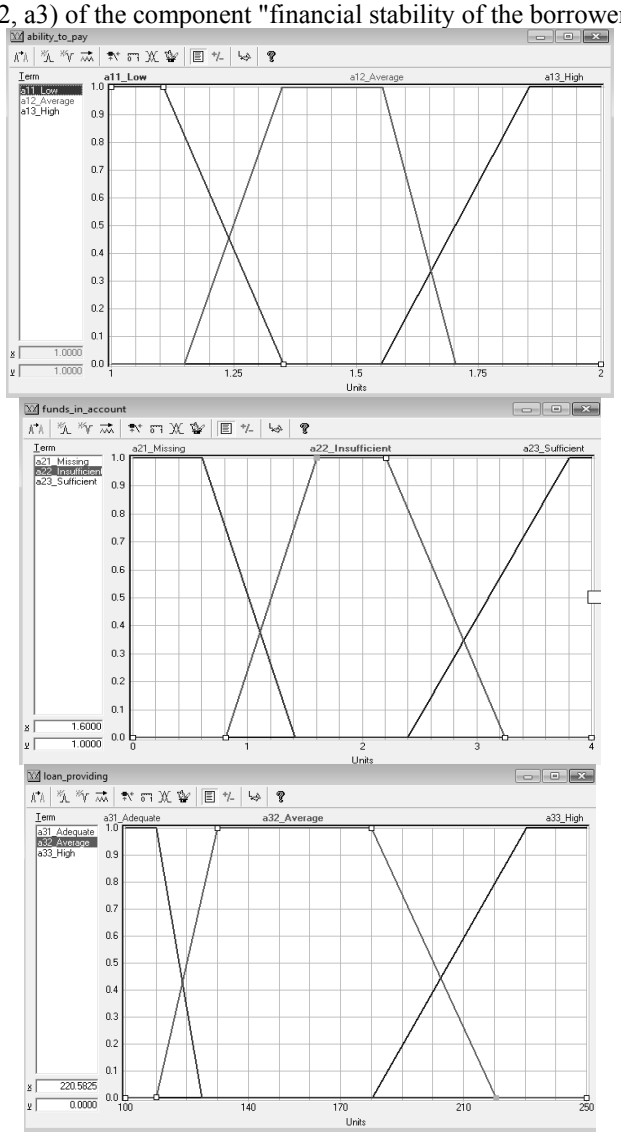


Figure 2. Computer representation of membership functions for input variables (b1, b2, b3) of the component "social stability of the borrower" (B)

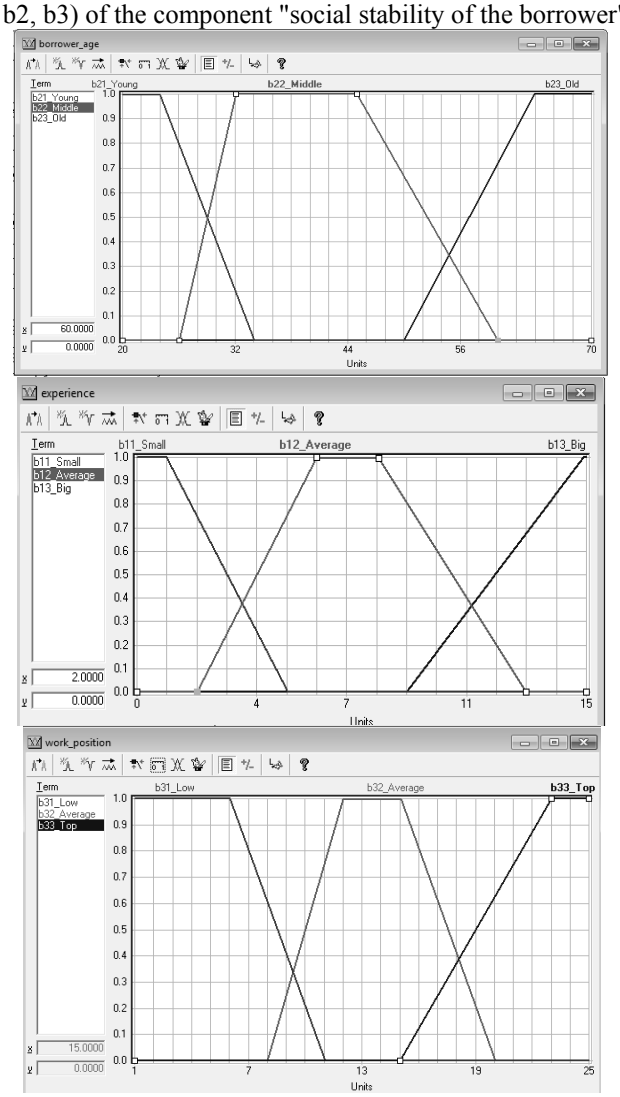


Figure 3. Computer representation of membership functions for input variables (c1, c2, c3) of the component "debt service" (C)

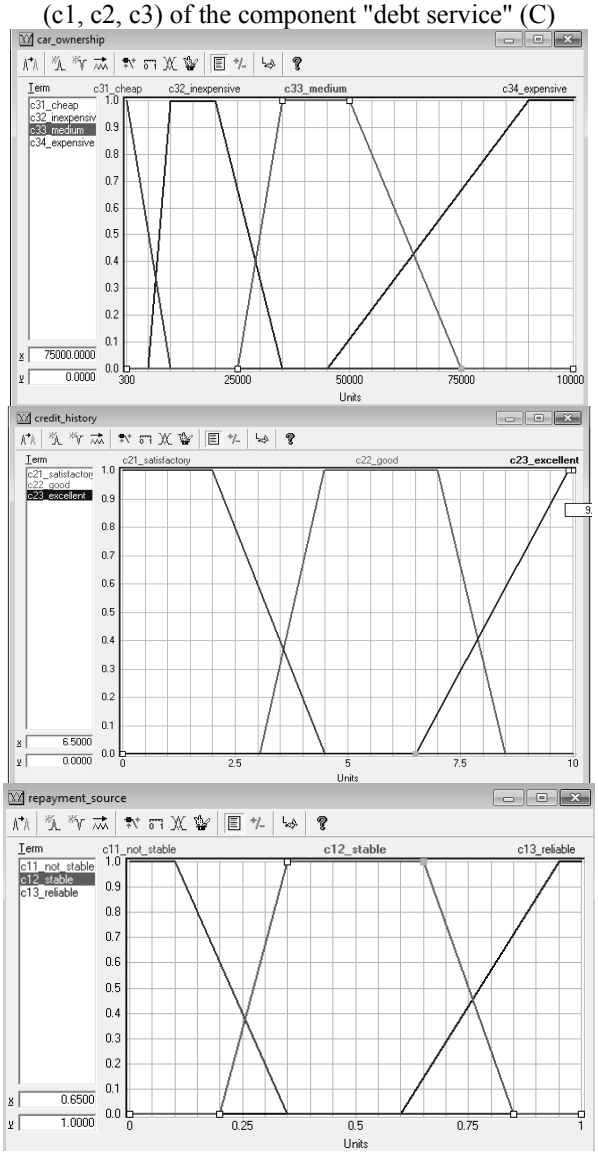
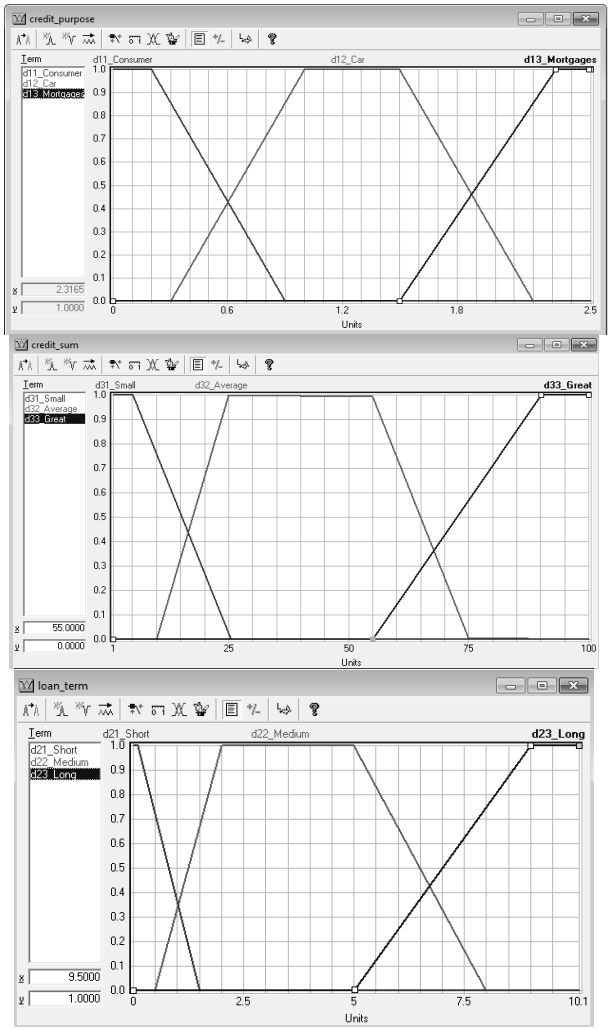


Figure 4. Computer representation of membership functions for input variables (d1, d2, d3) of the component "credit condition" (D)



ИКОНОМИЧЕСКИ ИЗСЛЕДВАНИЯ
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BIBLIOMETRIC REVIEW OF CORPORATE GOVERNANCE THEORIES AND METHODS

The aim of the paper is to carry out a bibliometric review of corporate governance theories and methods. The bibliometric review covers 2322 titles and 11598 keywords for the period 1999-2016. The data were extracted from the SSRN's electronic library.
The paper identifies Top 10 corporate governance theories and methods. The results of bibliometric review define the Agency theory and evidence as a most common theory and method respectively. The Top 10 theories in corporate governance are taken from close scientific fields and the methods used are universal for all sciences.
JEL: C89; G34

Introduction

Corporate governance emerges as a preferred form of capital accumulation and is broadly implemented thanks to its ability for easy control of management. Corporate governance is entering in the public agenda after a series of scandals based on unfair practices by leading audit firms. It can be argued that corporate governance is included in the science agenda when it goes beyond the company boundaries and has a negative impact on the society. We shall analyze which internal processes in the corporation have become known to the external environment, i.e. by analogy with *camera obscura* in parallel we shall perform a look into the corporation and go beyond its boundaries.

In dynamics of market economy the volume of researches on corporate governance is growing and at the same time corporate governance principles remain insufficiently well-known (Ahrens, Filatotchev & Thomsen, 2011). The basis for such an assertion stems from the different characteristics of individual companies and attempts to analyze common characteristics of these companies. The interdisciplinary feature of corporate governance contributes to the application of theories and methods of several sciences, which further complicates the conduct of reviews and the definition of most common theories and

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methods.[2] For example, implementation of the legal „Principal-agent“ model in economics draws attention unilaterally to the „bundle“ of contracts only, and stakeholders remain in the background.

The new economic reality is related to an increased interest in corporate governance. Good practices are widely implemented thanks to their reflection in research publications (Tsvetanova, 2014). Our analysis is focused on a bibliometric review of publications in the fields of corporate governance and we, therefore, hope to contribute for reflection and implementation of good practices. In accordance with the modern economic reality we formulate the following research hypotheses:

H1: Publications of corporate governance follow the trend of general economic dynamics;

H2: Corporate governance is a part of the economics science and therefore uses economics theories and methods.

Our review has a three-part structure. In the first part, we describe the review methodology, including a bibliometric analysis and a web database of research publications. The second part contains the main results for most common theories and methods of corporate governance. The third part presents conclusions and recommendations from the review and paves the way for further researches in the fields of corporate governance.

Methodology

Relatively at the same time when corporate governance becomes a subject of scientific reviews, a new science is born – the bibliometrics. In 1969 A. Pritchard introduces the bibliometrics as a quantitative analysis based on mathematical and statistical methods (Pritchard, 1969). With the dynamics of computer storage of data and their sharing, as well as a change in publishers' policy, it is now possible for corporate governance experts to carry out their own bibliometric review at a professional level.

Due to a lack of consent for the most common theory in corporate governance, we will review a multiplicity of existing theories. Given the interdisciplinary nature of corporate governance, it is advisable to use a bibliometric review (Engwall, Blockmans & Weaire, 2014). It is a deductive approach for quantitative review (Blockmans, Engwall & Weaire, 2014). In some sciences, the bibliometrics is a well-established practice and recognized as a tool for solving the access to scarce resources at the institutional level (Nedelcheva, 2017). By applying a bibliometric review to corporate governance publications, we will reduce the impact of our own perceptions on the review, and the data will be objective.[3] The key advantage of bibliometric review is the high degree of objectivity as the review is carried out after the publication of the data and without direct contact with the author (Durisin & Puzone, 2009).

[2] There are 14 dimensions of corporate governance after carrying out a review of 39 structural measures in 2106 companies (Larcker, Richardson & Tuna, 2007).

[3] There is an approach based on subjectivism – carrying out a review of keywords selected by experts through a „brainstorming“ (Furrer, Thomas & Goussevskaia, 2008).

We will try to explain the theories of corporate governance by using a bibliometric review. In this way, we will define and analyze the theories instead of generating a new theory as is in the case with the use of inductive approaches.

As a source of information, we will use the Web-based Social Science Research Network (SSRN). The database is established in 1994 for free access to published papers, including to forthcoming papers. Some authors recommend the SSRN as a data source due to its wide range of topics and its significant history (International Association of Scientific, Technical and Medical Publishers, 2015). At the time of carrying out the bibliometric review, the SSRN´s eLibrary provides more than 650,000 research papers from more than 360,000 researchers across 30 disciplines.

Our bibliometric review starts from 1999 – a core year given the formulation of OECD principles on corporate governance and their implementation at a local level through national codes of good practice.[4] We will accept 2016 as a final year for the bibliometric review, which is inconsistent with the established practice of databases with impact factor for a time lag of two years between the year of publication in a journal and the year of adding in a database.

Results

Our bibliometric review includes all publications from SSRN that contain in their titles the word combination „corporate governance". For the period 1999-2016, total 2322 publications correspond to this criterion. The analyzed publications have 11598 keywords, 14140 citations, 4249 authors, and 81790 pages.

Our data outline two stages of corporate governance publications (see Figure 1). In first stage, 1999-2010, the number of publications is increasing.[5] We identify two local maximums – unfair audit practices in the USA (2003) and the start of the global financial crisis (2008).[6] The number of publications in the second stage (2011-2016) reflects measures to reduce the effects of global financial crisis by introducing of new roles for corporate governance (for example, a target shift to stakeholders instead of to shareholders).

[4] The OECD principles are globally recognized as an international benchmark for good corporate governance practices after their publication in 1999 (Jain & Rezaee, 2006).

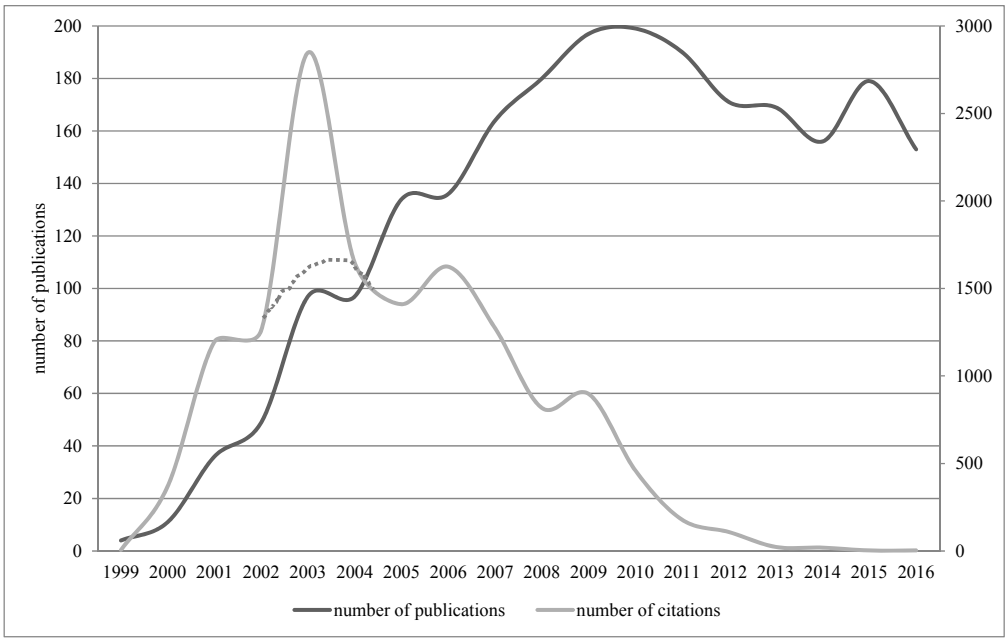
[5] After 1980s, the number of scientific journals and articles increased by an average of 3% each respectively. The reason for growth is explained by the increase in number of researchers internationally (International Association of Scientific, Technical and Medical Publishers, 2015).

[6] As stated in the introduction, when reviewing publications from scientific journals, the time lag between the year of the event and the year of event reflection should be taken into account. In most cases, this lag can be explained with the time it takes to find a case and its analysis by the author, as well as the technological time of the publishing houses for reviewing and publishing the paper. Last but not least, the time lag includes the time to add the paper to a database, e.g. for Scopus the time lag is two years since the paper was published in a journal and the paper was added in the database.

The number of citations follows the dynamics of publications until 2004.[7] Since the same year, the trend for publications has been rising, while citations are fall. It is recommended to analyze this finding by a meta-analysis of citations' quality as the quantitative approach used has limited capabilities.

Figure 1

Number of publications and their citations



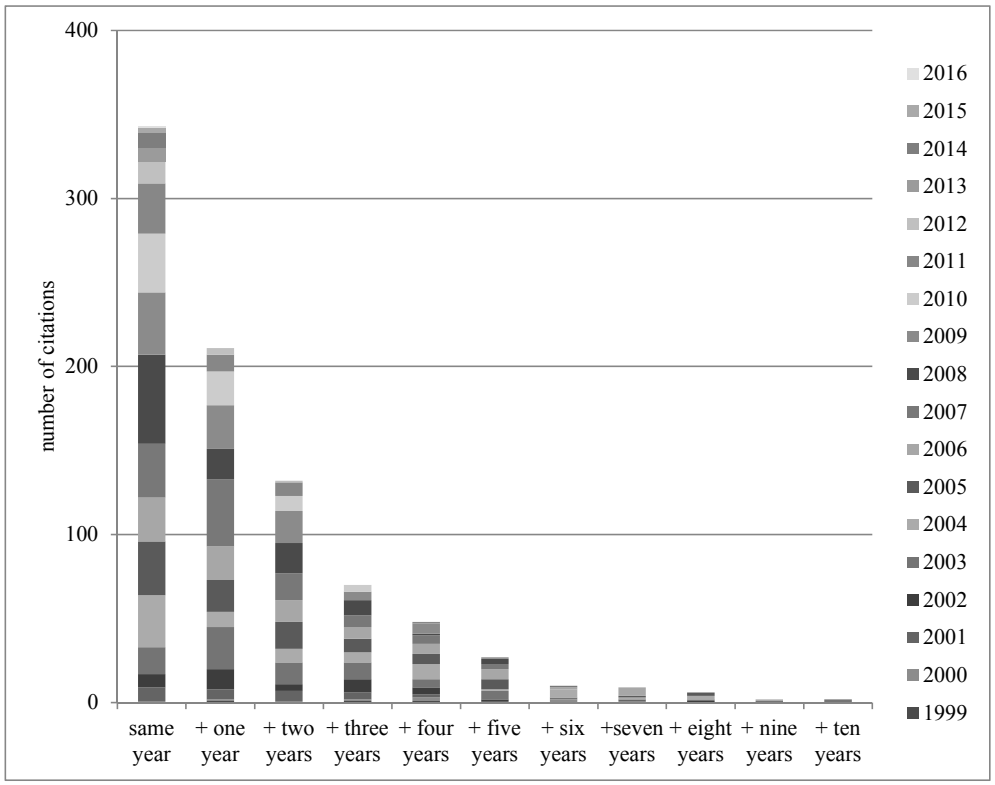
In the beginning of the reviewed period, the publications are mostly conceptual in their content and were cited throughout the whole reviewed period.[8] Since 2005, a time lag has started – the publications have been cited for first time two years and more after their publication. The peak of a number of citations in 2007 and subsequent years is due to the citation in the first three years following the year of publication. There is a peak in the first years after publishing and a further decline – this dependence is on quantitative publications (see Figure 2).

[7] The peak of citations in 2003 is due to one publication entitled „Corporate Governance and Equity" by P. Gompers, J. Ishii & A. Metrick, which has 1281 citations. The results will be different if we ignore the number of citations for this publication. The new situation is presented on the graph with dashed line.

[8] Authors from the start-up period of corporate governance have a great impact on good practices, and modern researches are not able to assess their contribution (Durisin & Puzone, 2009).

Figure 2

Time lag between year of publication and year of first citation

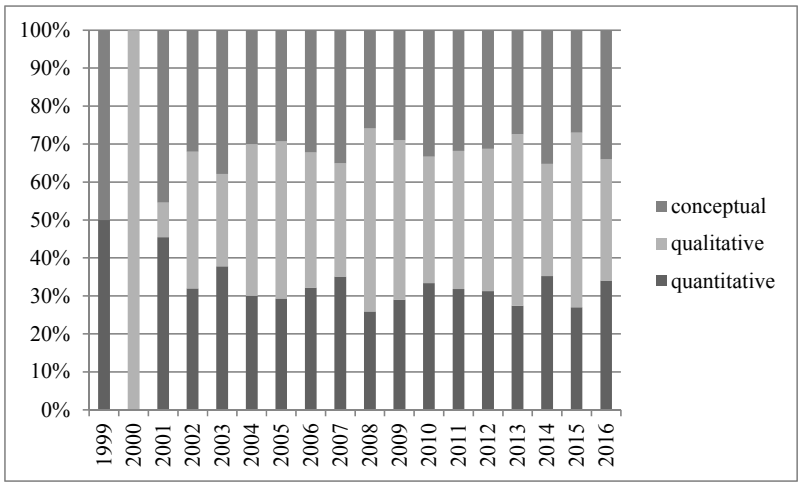


The development of corporate governance is accompanied by dynamism in its theories. The authors use a wide range of scientific theories, which we can divide into three groups: conceptual (based on deductive methods and without empirical indicators) (Saggese & Sarto, 2016), quantitative and qualitative theories (based on inductive methods).[9] In our review, the conceptual theories are characterized by a highest volume of pages (on average over 40 pages), the quantitative theories have a larger number of authors (average of 2.2 authors), and the qualitative theories – the highest number of citations without a time lag (the year of citation is the year of publication). Unlike quantitative theories, the qualitative theories refer to a particular economic sector or state. The largest number of citations has quantitative publications, followed by the conceptual and qualitative publications (the latter with the largest number of downloads from the database). A dynamics of conceptual theories from quantitative to qualitative theories was found during the period under review (see Figure 3).

[9] Another bibliometric review identified publications which are a combination of quantitative and qualitative methods (Lazzarotti, Dalfovo & Hoffmann, 2011).

Figure 3

Epistemological characterization of theories



In view of the publishing policy of journals and the requirements of database for adding publications, the bibliometric review will use both the titles of publications (for corporate governance methods) and the keywords (for corporate governance theories).

Keywords can be used as the main tool for correctly targeting and adopting the publication. In most cases, the keywords are not subject to review and give to the author a greater freedom in presenting his ideas. In our bibliometric review every publication has not more than 15 keywords.[10] The most common keywords other than „corporate governance“ in descending order are „board of directors“, „ownership structure“ and „firm performance“.[11]

Theories of Corporate Governance

The interdisciplinary nature of corporate governance is reflected in its definitions.[12] Typical of corporate governance is the availability of a broad palette of definitions covered by an „umbrella“ (Cochran & Wartick, 1988). Similarly, the theories and methods of corporate governance are numerous and will be considered as a set in the form of an „umbrella“.

[10] The large number of keywords has been explained as a lack of continuity in researches and inconsistency in research focuses (Chuang, Huang & Ho, 2007).

[11] Other authors point to as most common keywords „ownership structure“, „board of directors“ and „manager remuneration“. The difference with our results can be explained by the database used (Huang & Ho, 2011).

[12] Notwithstanding the large volume of publications, the level of knowledge of corporate governance remains low due to the approaches used to reviewing the company's own characteristics and the inability to summarize the characteristics of corporate governance (Ahrens, Filatotchev & Thomsen, 2011).

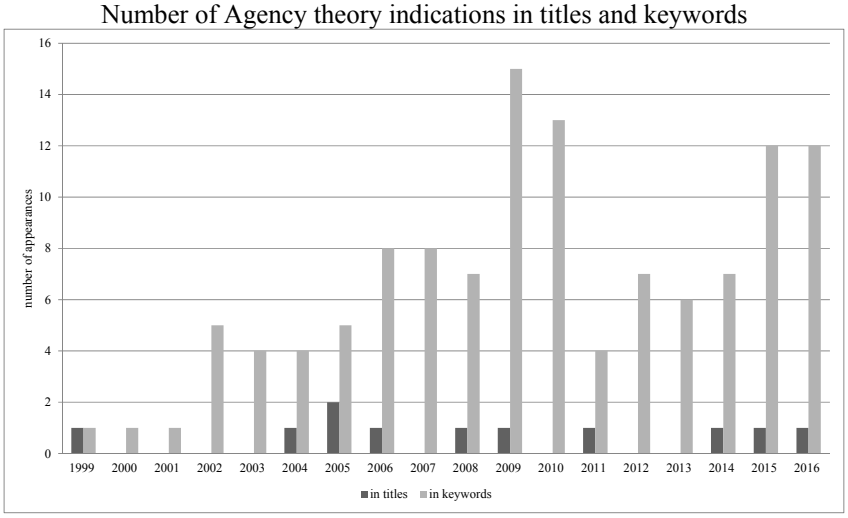
Our data outlines the Agency theory as a basis of the „umbrella" of corporate governance theories.[13] Most other analyzes confirm our conclusion on the leading role of the Agency theory in corporate governance (Durisin, Puzone, 2009). The Agency theory is inspired by the legal model „principal-agent". The first major application of the model is in the field of auditing for a protection of shareholders from managers' actions. Traditionally, the Agency theory presents corporate governance in the fields of accounting and auditing. Increasing interest in accounting and auditing increases the rating of Agency theory, but not of corporate governance.

The next application of Agency theory is in two directions: external and internal mechanisms for control that led to the division of Anglo-Saxon and Continental model of corporate governance.[14] Our results do not give a clear distinction between theories for Anglo-Saxon and Continental model, which may mean there is a course of convergence process.

The data from our review outlines the Agency theory as the most commonly referred: it encounters 10 times in titles and 123 times in keywords (see Figure 4).[15] Its dynamics follows the overall dynamics of publications over the reviewed period (see Figure 1). During reviewed period, the Agency theory is presented each year in keywords with a peak in 2009-2010, which can be defined as the beginning of the global financial crisis, given the time lag of two years between the year of publication and the year of addition of publication to the database.

Figure 4

Number of Agency theory indications in titles and keywords



[13] The development of theories begins with the Agency theory and later on with Resource dependence theory, Institutional theory, and Managerial hegemony (Cohen, Krishnamoorthy & Wright, 2008).

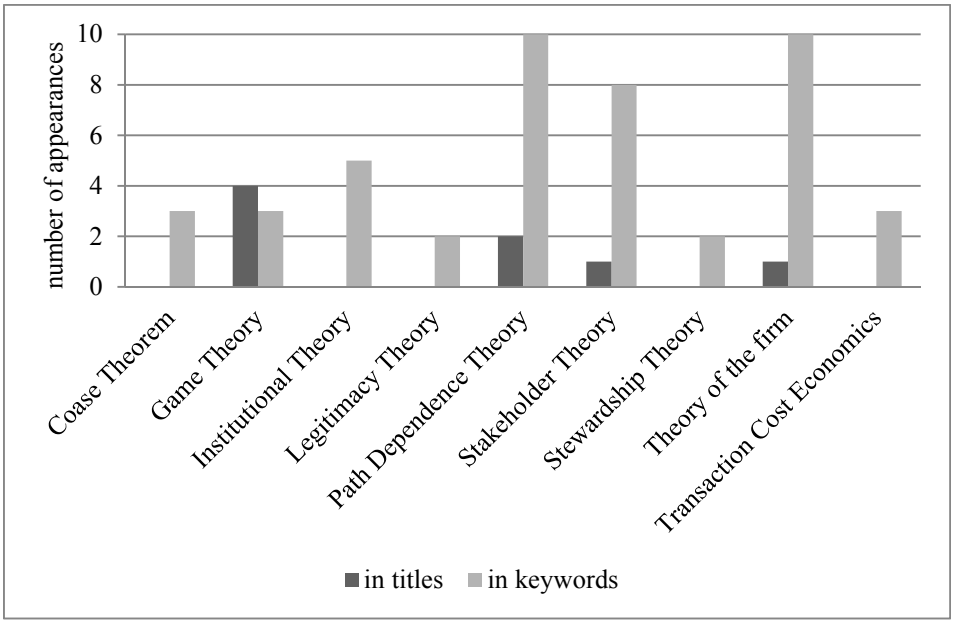
[14] The Agency theory reflects the institutional context of the USA and is unable to explain the forms of government in other countries (Lubatkin, 2005).

[15] The results of another bibliometric review shows as a most common theory the Transaction costs theory followed by the Institutional theory (Ferreira, Pinto & Serra, 2014).

Some authors define the rest theories of corporate governance as evolved from the Agency theory, which are mostly empirical and are related to the prevention of the principal-agent problem (Mannar, 2016). Unlike other reviews in which only the Agency theory is mentioned, in our bibliometric review, we will present other theories. The most commonly referred other theories are different nuances of corporate governance: information asymmetry reducing, legal and institutional environment, protecting the interests of internal and external persons. Besides the Agency theory, the Top 10-1 theories are: Path Dependence Theory, Theory of the firm, Stakeholder Theory, Game Theory, Institutional Theory, Coase Theorem, Transaction Cost Economics, Legitimacy Theory and Stewardship Theory (see Figure 5).

Figure 5

Number of appearances in titles and keywords for Top 10-1 theories



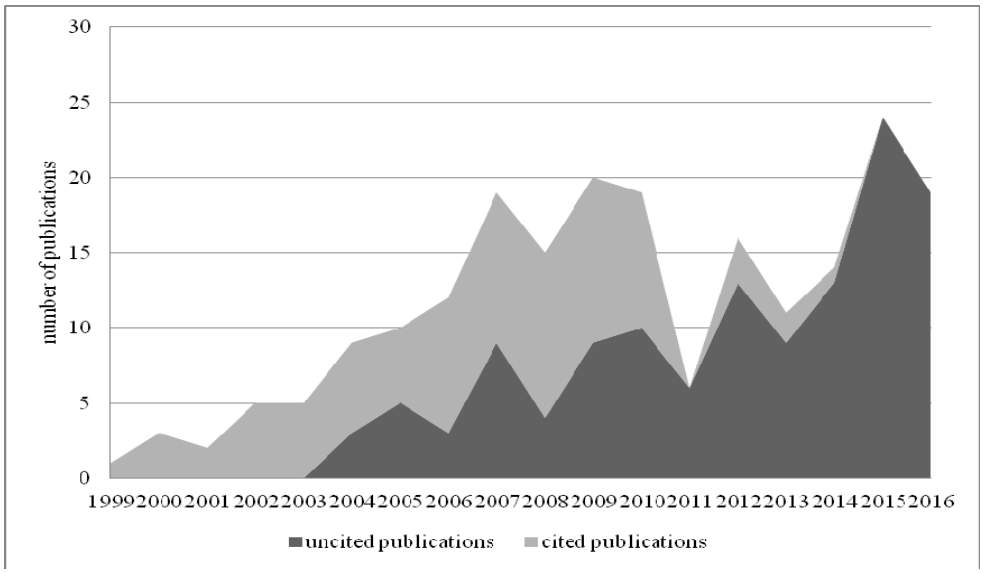
Typical of these nine theories is that, according to our data, they concern the practice of a particular state, unlike the tenth theory, the Agency theory, which does not refer to a geographical scope. Countries appear primarily in the titles, while geographic regions are indicated in the keywords. The most commonly referred theories cover both the Anglo-Saxon system and the Continental system. Most of the referred countries are not members of the OECD, benchmarking data on these countries are not published by the OECD and we can assume that some countries are targeted to "explain" rather than to "comply". In

dynamics the countries stop appearing in titles and in keywords and we can assume there is a convergence process of good corporate governance practices.[16]

The reviewed publications containing the ten most commonly referred theories (see Figure 6) follow the general dynamics shown in Figure 1. The similar dynamics between a publication and a citation marks a turning point in 2011, in which year the subject of publications focuses on corporate governance mistakes and costs incurred by the shareholders, not by the stakeholders.

Figure 6

Number of publications containing in titles and keywords for Top 10 theories



Agency theory has the highest number of citations (a total of 2490 citations), followed by Path dependence theory[17]. The smallest time lag between the year of publication and the year of first citation is for the Agency theory (the first citation is in the same year or one year after the year of publication), and the largest lag – for the Stakeholder theory (1-4 years) (for the Top 10-1 theories, i.e. for the Top 10 theories with the exception of the leading theory, the Agency theory, see Figure 7). Our data coincide with the trend towards an increase in the number of authors (increasing publications by more than one author from 8% in 1988 to 23% in 2009) (International Association of Scientific, Technical and Medical Publishers, 2015). To improve the citation of corporate governance publications, we should follow the recommendations of our previous bibliometric review (Nedelchev, 2017).

[16] The Agency theory is defined as the most appropriate of all theories for conducting convergent processes (Merendino, 2013).

[17] Results of other reviews reveal the most frequently cited theories: Agency theory, Stewardship theory, Stakeholder theory, and Contingency theory (Durisin & Puzone, 2009).

Figure 7

Number of appearances, citations and authors of Top 10-1 theories

The largest combination of theories in a single publication is with a relatively short title – „Theoretical Perspectives of Corporate Governance“ (Abid, Khan, Rafiq & Ahmad, 2014). The keywords to this publication indicate five of Top 10 theories: Agency theory, Stewardship theory, Stakeholder theory, Resource Dependency theory, and Transaction cost economics. The publication in question has a large number of authors (four authors), a small volume of pages (10) and no citations.

Our data defines corporate governance as interdisciplinary and polyvalent – for example in „Valuing Professional Japanese Baseball Players and the Role of Statistics, Economics, Culture and Corporate Governance“ by M. Nichol the corporate governance is used as a tool with three other scientifically fields. In addition to previous reviews, the idea of eclecticism in corporate governance is confirmed (Mannar, 2016). We find that the corporate governance is a point of contact among more than two areas of science – in

addition to economics and management, the corporate governance includes aspects from law, sociology, politics, history, psychology, statistics, culture and ethics[18]. The most comprehensive application of corporate governance is found in accounting and auditing[19].

The Agency theory is present in each year for reviewed period 1999-2016 (see Figure 8). The greatest accumulation of theories has the period that can be related to the beginning of global financial crisis (2010) and the beginning of changes in national corporate governance codes (2014). Since 2007, the Agency theory has been presented together with Stewardship theory. Less, but a significant presence, has the Path dependence theory and Stakeholders theory till 2009, and after 2009 – the Information asymmetry, Institutional theory and Theory of the firm.

Figure 8

Time distribution for Top 10 theories

									Stakeholder Theory			Theory of the firm			Transaction Cost Economics			
					Theory of the firm		Theory of the firm	Path Dependence Theory				Stakeholder Theory			Theory of the firm			
					Stakeholder Theory	Stakeholder Theory	Stakeholder Theory	Organization theory	Stakeholder Theory	Path Dependence Theory	Institutional Theory			Transaction Cost Economics	Theory of the firm	Path Dependence Theory	Legal origin theory, path-dependence	Institutional Theory	
	Path Dependence Theory		Information Asymmetry	Transaction Cost Economics	Path Dependence Theory	Reputation Games	Path Dependence Theory	Information Asymmetry	Information Asymmetry	Institutional Theory	Information Asymmetry			Institutional Theory	Information Asymmetry	Information Asymmetry	Information Asymmetry	Information Asymmetry	Information Asymmetry
Agency Theory	Agency Theory	Agency Theory	Agency Theory	Agency Theory	Agency Theory	Agency Theory	Agency Theory	Agency Theory	Agency Theory	Agency Theory	Agency Theory	Agency Theory	Agency Theory	Agency Theory	Agency Theory	Agency Theory	Agency Theory	Agency Theory	Agency Theory
1999	**2000**	**2001**	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**

For a better presentation of our results we will use a visualization approach named „tag cloud". The number of representations of a given theory (tag) is shown with different font size, i.e. the more frequently the theory is presented in titles and keywords the larger font size it will be reflected. The Agency theory is reflected with the largest font size, i.e. that it is the most commonly presented theory in titles and keywords (see Figure 9). Smaller fonts, i.e. fewer presentations, reflect the rest theories.

We will present the results for the Top 10-1 theories through a visualization technique called „Chernoff faces". Multidimensional data are first presented in an appropriate manner in 1973 by Herman Chernoff. The technique includes the representation of similar objects through human faces, each feature of which corresponds to predetermined data (see legend). The Path dependence theory has the best overall results followed by the Theory of the firm and the Stakeholder theory (see Figure 10). We can identify as friendly faces those theories that have a large number of citations and publications (the mouths and faces), and as unfriendly faces the theories with a large time lag between publication and citation (the brows).

[18] Since World War II, the number of academic disciplines has been increasing significantly (Claveau & Gingras, 2016).

[19] According to other reviews, the corporate governance has been greatly reflected in auditing and accounting literature following the scandals of unfair audit practices in the USA in the 2000s (Carcello, Hermanson & Zhongxia, 2011).

Figure 9

Tag cloud for corporate governance theories

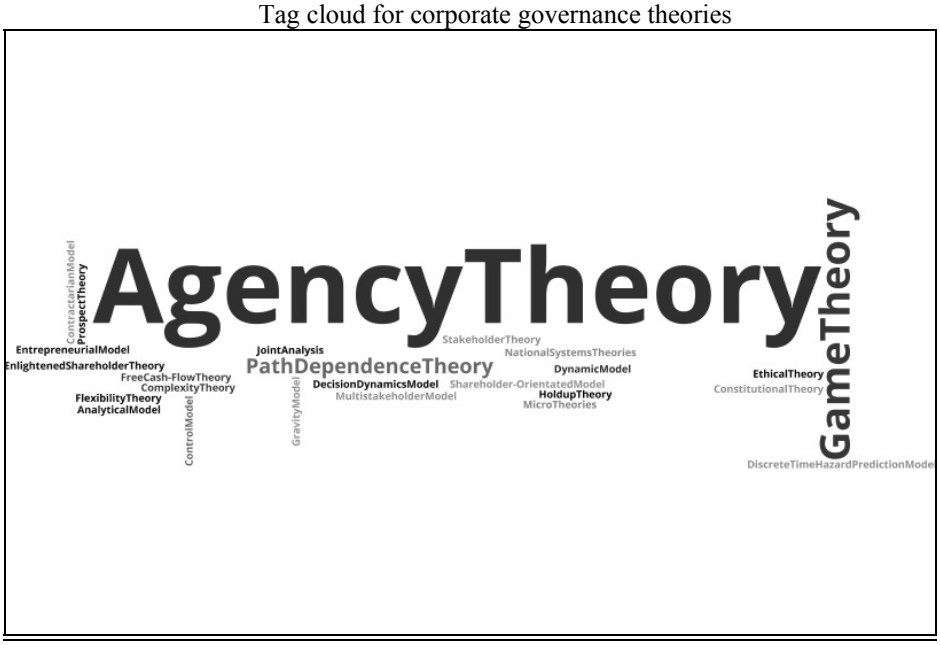
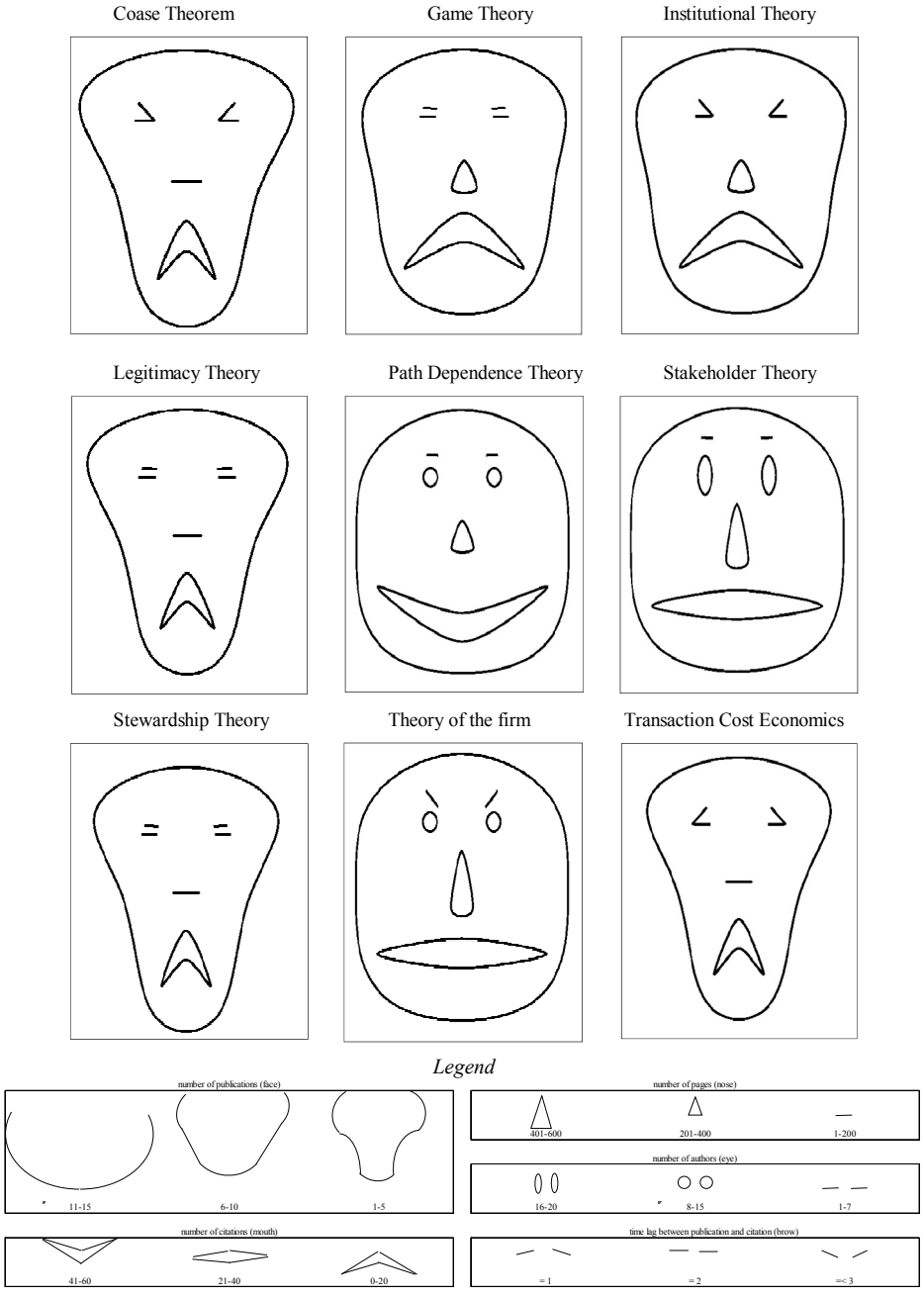


Figure 10

Chernoff faces for Top 10-1 theories

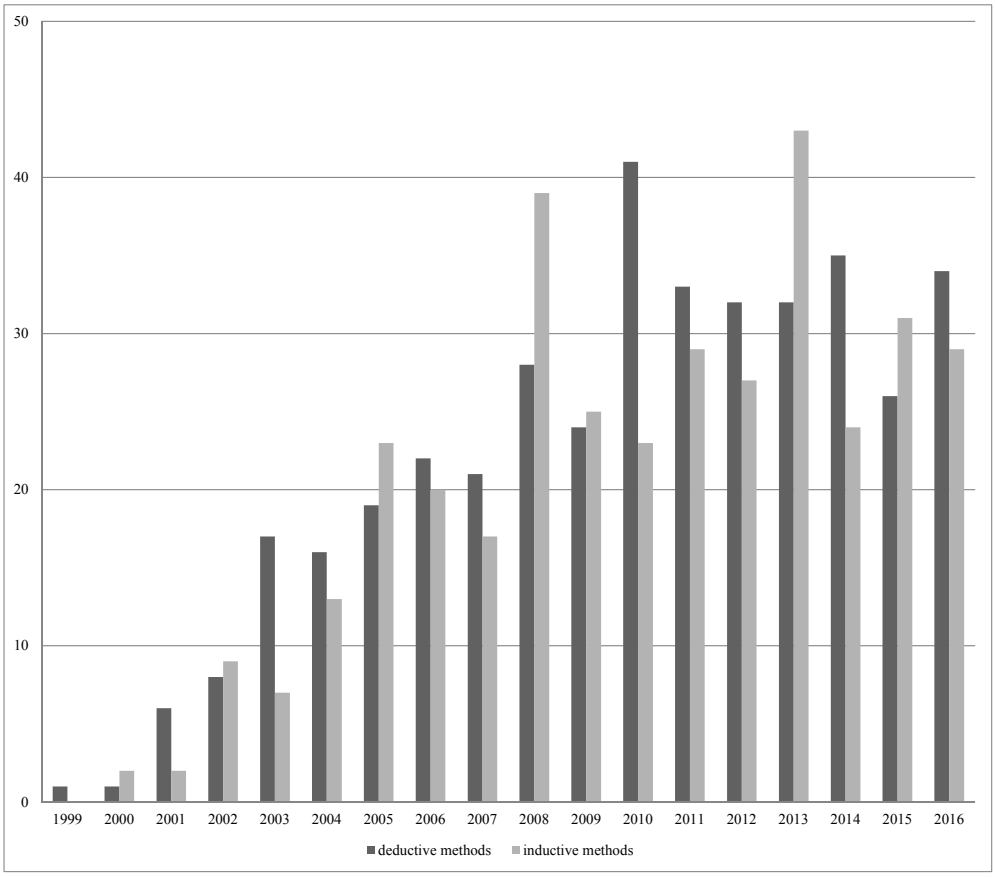


Methods of Corporate Governance

The method is defined as a set of scientifically-based principles and norms for review of corporate governance. The proper method selection contributes to proper understanding and presentation of corporate governance. In most publications, the methods are presented in the title, while the theories – in keywords. It can be argued that after the onset of the global financial crisis, deductive methods prevail (see Figure 11).

Figure 11

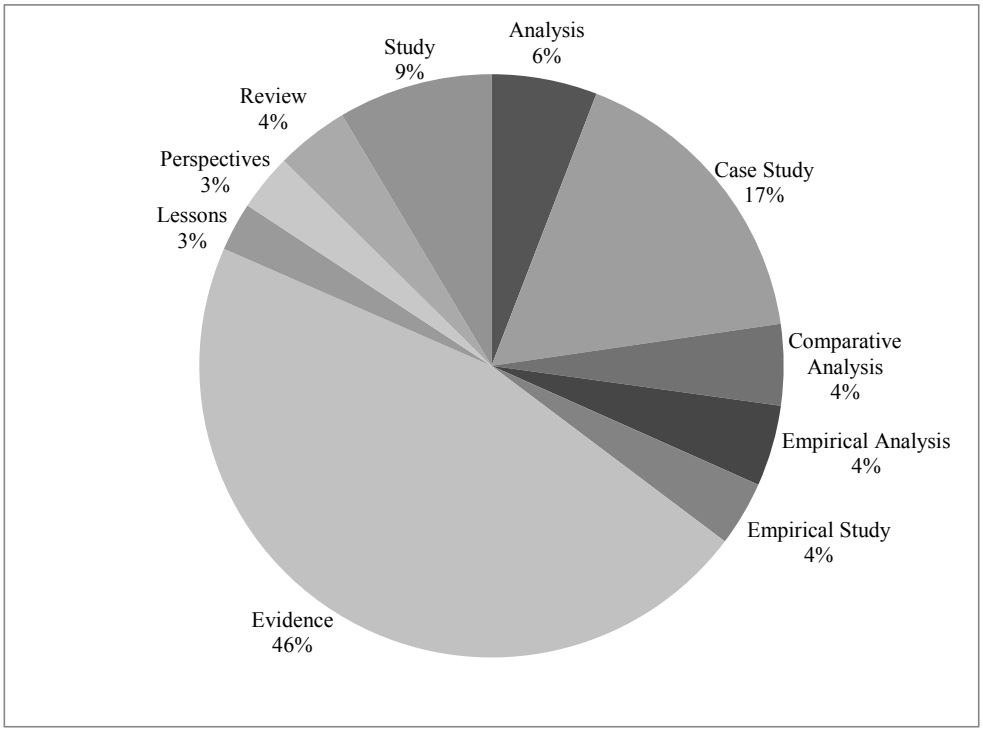
Number of deductive and inductive methods



The interdisciplinary feature of corporate governance is reflected in an „umbrella“ both from theories and methods. The Top 10 methods are headed by evidence and case study (see Figure 12). In rare cases, the authors use more than one method, for example, „A Contemporary Literature Review of Corporate Governance: An Overview“ by Linjian Pan.

Figure 12

Top 10 methods of corporate governance

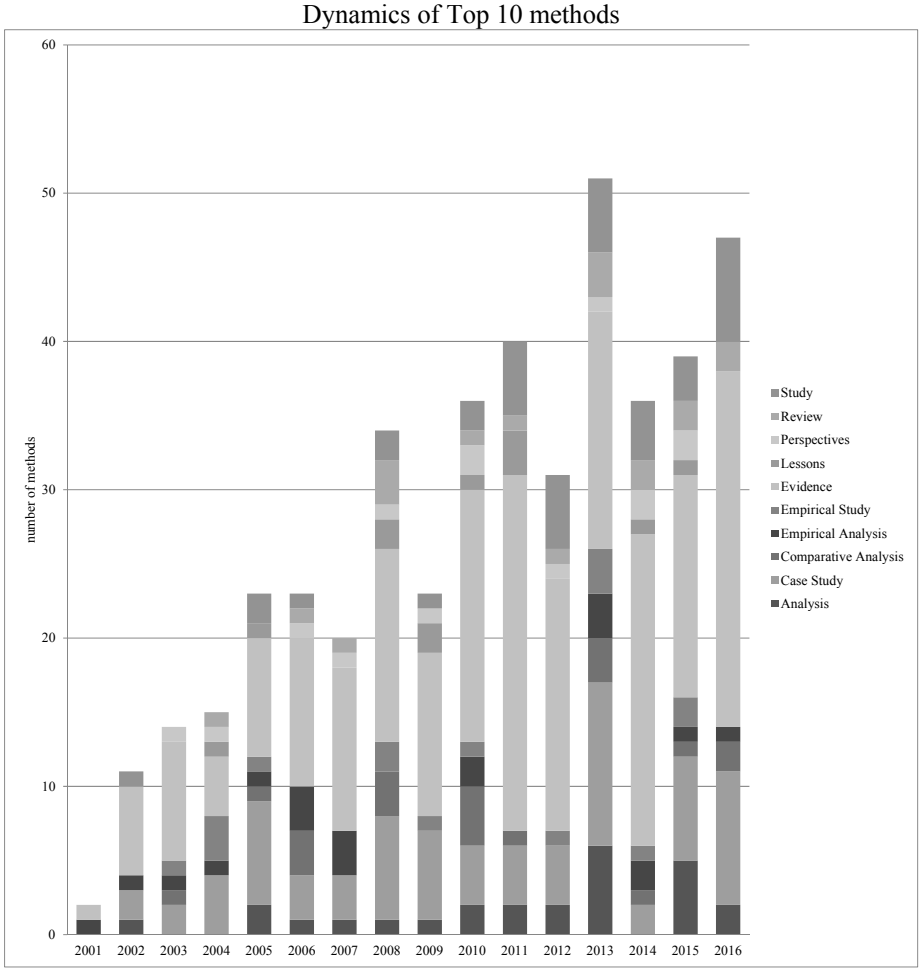


The dynamics shows usage of a large number of methods in 2013 – a total of 51 methods and increase the number of Case study (see Figure 13). There is an increasing number of methods used while retaining the leading share by Evidence. In most cases of using Evidence is for a combination of corporate governance aspect with an economic indicator for a specific country.

Trends in science over the past 10 years have limited the scope of bibliometrics to the analysis of citations. The number of citations is three times greater than the number of publications. In the case of five methods (Case Study, Comparative Analysis, Empirical Analysis, Empirical Study, and Evidence) the number of citations is greater than the number of publications (see Figure 14).

Figure 13

Dynamics of Top 10 methods



While other studies find a „citation inflation", i.e. the number of citations increases faster than the number of publications, we observe a specific case – some methods have a large number of presentation and at the same time small number of citation. In the classical case of „citation inflation" the number of publications is increased by 33%, while citations increased by 55% for 1999/2003 and 2004/2008, (International Association of Scientific, Technical and Medical Publishers, 2015). In our case some corporate governance methods have proactive citations, i.e. the number of citations is larger than the number of publications (Case study, Comparative analysis, Empirical analysis, Empirical study, Evidence). For the rest methods (predominately qualitative methods) the number of publications is larger than the number of citations. And in the case of Lessons, as a conceptual method, there is equality between the number of publications and citations (12).

Figure 14

Number of publications and citations for Top 10 methods

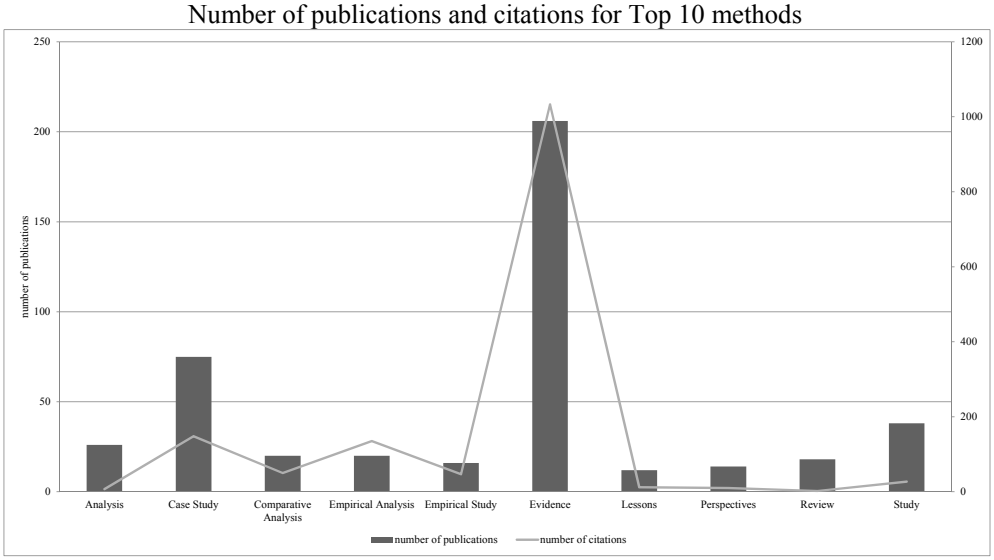
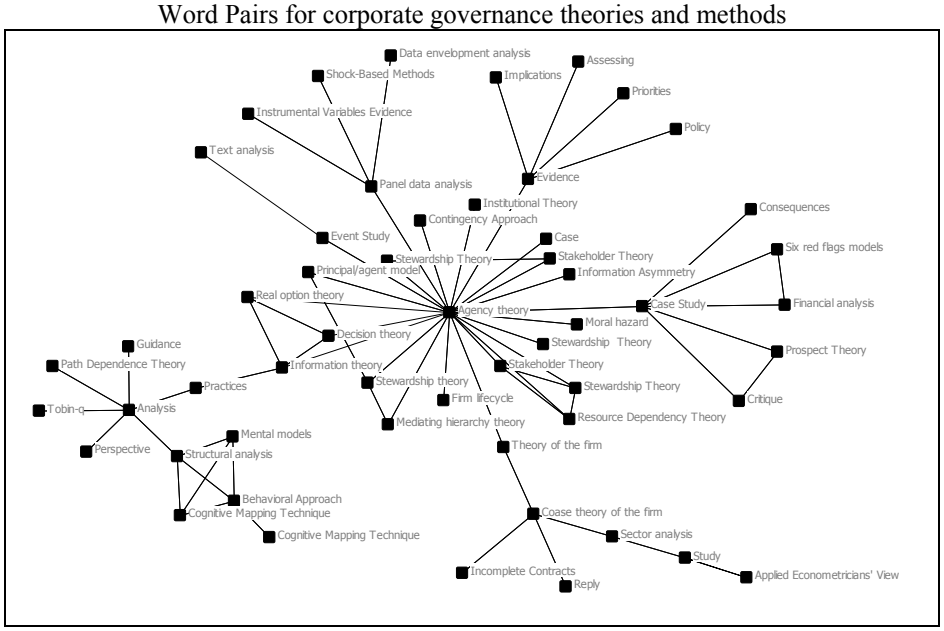


Figure 15

Word Pairs for corporate governance theories and methods



To illustrate the combination of theories and methods of corporate governance we will use „word pairs“ approach. The approach was introduced in the 1990s to visualize relationships

between individual variables after an empirical study was completed. Thanks to modern software we differentiate not only individual theories and methods, but also their interrelations. The Agency theory is the main center and its periphery includes both methods and other theories (Figure 14). An interesting case is the interrelation between the two top theories, the Agency theory and the Path dependence theory, as two methods are between them – Analysis and Practices (at the bottom on the left in Figure 15). There is an impressive case – the Institutional theory has not any relations to other theories and methods. In another case which is not less interesting is separation of a cluster in the shape of a triangle among Agency theory, Stakeholder theory and Stewardship theory.

Conclusions and recommendations

Given the results, we can summarize that the „umbrella" of definitions for corporate governance is reflected in an „umbrella" of theories and methods. Irrespective of a large number of corporate governance publications, their theories are shared from a range of other sciences or rather the theories are taken from close scientific fields. Overall the theories are very specific for corporate governance while the methods are universal and applicable to all sciences.

Throughout the reviewed period all corporate governance theories are related to control over management of ownership and not to a separation of control and ownership. The top position is reserved for the Agency theory and it cannot be claimed that both the importance of this theory is exhausted and that there is a need for a new theory.

The increased interest to good corporate governance practices is due to the new economic reality. The contribution of scientific researches is a multiplication of good practices and creation of a specific form of capital based on the knowledge.

Our results partially support the First hypothesis (*H1*). The number of publications directly reflects all the peaks and downturns of economic development, which supports the hypothesis (Nedeltchev, 2004). Additional indicators of publications, such as a number of pages and authors, are included to the support of *H1*. Other indicators of publications, such as the number of citations, have registered a fall after a historical moment of economic development, linked to significant scandals such as unfair auditing practices in 2003. We can argue that after this moment the corporate governance becomes subject to other sciences beyond the economics, while retain a limited number of theories and increasing the number of methods used.

The results reveal a large number of theories and methods used in corporate governance publications. An additional critical attitude towards the Second hypothesis (*H2*) is the application of theories and methods of a large number of sciences close to the economics. While the economic development has its own peaks and falls, the corporate governance has steadily increased the number of publications due to the new roles assigned to corporate governance. As a confirmation of our conclusion is the discrepancy in the trend between the number of publications and their citations – while the number of publications follows the

dynamics of the economy, the number of citations reflects the real dynamics of corporate governance and more specifically – the dynamics of good practices.

The beginning of the measures against effects of global financial crisis revealed an increase in diversity of theories and methods of corporate governance. At the same time there is a transition to protection the interests of stakeholders rather than to shareholder wealth maximization and a shift of theories from Shareholder primacy to Stakeholder theory. Increasing number of theories from the external environment and targeting on "hard" legislation most clearly give an idea of the new direction of economic development and, accordingly, of the practices and researches of corporate governance.

With an increase in the number of researches reduces the significance of results and contribution of the author due to the need to process a large volume of data. Our results outline a balancing process – with an increase in the volume of publications, there is a return to a narrow set of theories introduced since the very beginning of good corporate governance practices. We can sum up the results to the need for a functioning theory, not the need to increase the number of theories and to introduce new theories according to the tempo of increase number of publications and authors. A further confirmation of reaching a saturation point is the number of citations, which from 2004 marks an opposite tendency to the trend for increase the number of publications and authors. The modern publications of corporate governance have found equilibrium around a particular number of theories and methods by balancing with the good practices.

Special features of corporate governance are both its long history and its relatively recent reflection in the scientific literature. In the present review we attempted to describe 100 years good practices of corporate governance through 20 years of scientific publications. In addition to the large number of corporate governance reviews, we add yet another based on bibliometrics, i.e. new results with a low level of subjectivism. Thereby we suppose that our results will raise new questions for further corporate governance reviews.

For further development of good corporate governance practices through scientific publications we recommend to authors to use the following combinations of theories and methods in keywords and titles respectively:

- Agency theory + evidence;
- Coase theorem + analysis;
- Game theory + lessons;
- Institutional theory + case study;
- Legitimacy theory + evidence;
- Path dependence theory + analysis;
- Stakeholder theory + assessment;
- Stewardship theory + case study;
- Theory of the firm + study;
- Transaction cost economics + test.

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ИКОНОМИЧЕСКИ ИЗСЛЕДВАНИЯ
ECONOMIC STUDIES

Volume 27 (4), 2018

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A MODEL FOR ASSESSING ECONOMIC RISK IN FINANCING INNOVATION PROJECTS OF VENTURE CAPITAL FUNDS

In regard to the content, each business venture carries an element of risk, which includes both threats and favorable opportunities.
Risk assessment makes it possible to manage the business more effectively, which is a prerequisite for avoiding unwanted or unexpected events. Moreover, it enables the enterprise to operate more closely to the unforeseen costs limits. It also makes possible the release of resources for developing the activity and assessing the opportunities for profitable investments.
The aim of this study is to present a model for economic risk assessment using some methods developed by the author. In order to achieve this aim, the author has applied the model for risk assessment to a real innovation project related to the production of drones, which is the subject of research in the present paper.
The results of the study will show the practical suitability of the model presented. Applying an adaptive model for risk assessment to innovation projects is an important condition for the increase in risk financing in Bulgaria in the context of the need for increasing competitiveness of the Bulgarian economy.
JEL: G24; O31; O35

1. The Importance of Risk Capital for Innovation Development

The main prerequisite and, at the same time, characteristic of the environment for the realization of innovation projects is the presence of favorable opportunities for using appropriate funding instruments. The variety of such instruments and, especially, the terms of their usage define, to a certain extent, the horizon of planning the general development of enterprises, their innovation development as well as the possibilities they have for realizing innovation projects of different size and complexity.

In the process of providing a financial resource for realizing innovations, risk capital funds play the leading role. Their importance is related to the possibilities ensured by financing

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through equity participation defined also as equity financing (Stevenson, Roberts, Sahlman, 1999). Another advantage enterprises whose innovation activity is financed through risk capital can take is providing know-how, enterprising directions, expert advice, contacts, external consultant services and total expert support in the realization of innovation projects.

The generators of ideas which do not have enough finances for realizing their innovative ventures can benefit from the intermediary role of risk funds, which actually connect those who have money but do not have ideas with those who have ideas but need a financial resource for their realization. The intermediary of the funds providing risk capital is expressed in the way they find finances for the realization of their activity.

The main investors in risk financing funds are pension funds, corporative funds, individual investors, financial and insurance companies, mutual investment funds (Zider, 1998). The capital invested in high-risk investments gives an opportunity for effective risk diversity to those investors who want to achieve higher market profitability together with a way of decreasing the general risk for the capital they have invested.

An important characteristic of the activity of risk funds stems from the fact that they practically invest finances in other people's conceptions, i.e. they do not generate innovative ideas. This means that, after an enterprise becomes stable and starts working well, it can be sold at a good profit.

Actually, a risk fund strives for sending its equity participation in the enterprise at a price that is higher than the invested capital. In this way, the profitability of the managing fund is formed. The objective of the fund is to invest successfully as its investors also have expectations related to ensuring certain profitability of the capital they have invested.

The activity of risk funds has certain specific characteristics. Some of them, for example, invest in the early periods of an enterprise's development while some other ones wait and invest after noticing a clear evidence of market success. Some risk companies tend to wait for exiting from an enterprise's property through an initial public offer, through merging and taking over or through buying back.

2. Risk Capital in Bulgaria

Although providing risk financing is perceived as a relatively new phenomenon in Bulgaria, this type of financing is developing very fast globally. There are hundreds of professional risk funds in the world managing a significant amount of capital. The nature of their activity contains opportunities to provide new business ventures with financial support as well as to finance every following stage of the enterprise's development.

The author's research shows that risk funds in the country invest the capital they have attracted in three main groups of enterprises classified, according to the stage of their market development, and positioned in the segment of micro, small and medium-size.

- Capital investments in start-up enterprises without any turnover that have no customers but have a product, which is not compulsory.
- Investments in enterprises having basic customers and certain turnover and reporting income of repeated character. Their product satisfies real customers' needs in a convenient for them way.
- Investments in well-established enterprises demonstrating a stable trend towards market developing.

Special attention deserve the opportunities provided by "JEREMIE" program aimed at financing highly risky innovation projects with the participation of risk capital funds in the country.

„JEREMIE" program is a joint initiative set in motion by European Commission and European Investment Bank and aimed at improving the access of micro, small and medium-sized enterprises in the European Union to financing through the Union's structural funds.

The investment strategy of „JEREMIE" combines in a balanced way debt instruments and share capital instruments aimed at improving the access of micro, small and medium-size Bulgarian enterprises to financing. Thus the existing differences between the demand and the offer of finance engineering instruments are addressed.

In Bulgaria, "JEREMIE" holding fund is financed by European Region Development Fund and 15% of finances come from a state budget operational program named Development of Competitiveness of Bulgarian Economy from 2007 to 2013. In relation to this, former Ministry of Economics, Energy and Tourism provided budget on the basis of Priority Axis 3, including national co-financing, of 199 million euros for implementing "JEREMIE" initiative in the country.

Due to the requirement of raising private capital on financial instruments, private financing is added to public financing on "JEREMIE"(199 million euros). As a result, the total sum on the initiative is up to 563 million euros aimed at developing Bulgarian SMSE in the form of equity investments and loans. Thus, to each euro of public financing on the initiative, a sum of 1.83 euro of private financing is added. In "JEREMIE" program there is a fund for risky investing whose capital is 30 million euros, a great part of which (70%) comes from the financial resources provided by the program.

"JEREMIE" program provides the opportunity to combine effectively joint forms of financing which include providing financial resources on the operational programs of the EU, budget funds and funds provided by individual and institutional investors in highly risky innovation projects. It is beneficial for Bulgarian micro, small and medium-sized enterprises working on innovation projects as, apart from financial support, the beneficiaries are given an opportunity to receive consultant support, when needed, provided by financial intermediaries.

Table 1

Classification of financing through risk capital in Bulgaria

According to the enterprise's economic history	Investment goal	Degree of risk for investors
Start-up enterprises (mainly micro-enterprises)	Seed financing	High
Enterprises in a process of market/product establishing	Extended financing of development	Relatively lower
Enterprises well-established in a market and product sense (mainly SMSE)	Finance and consultant support for late financing of development	Low

Source: Author's research work.

3. Specificity of analyzing risk by risk funds in the country

The summarized results of the author's survey conducted in most of the risk funds in the country proved a practical need for a systematic model approach to assessing economic risk in choosing an alternative investment project intended for financing through risk capital. Generally, the survey showed that:

- In relation to the assessment models specified in the survey and used in practice by risk capital funds, it was confirmed that they are well-known and widely used in risk assessment. In assessing risk in start-up enterprises, risk capital funds mainly rely on available market information about the enterprises having the same or similar purpose.
- It was confirmed that a step-by-step approach to risk assessment has practical benefits. However, what has to be considered is frequent market changes of the enterprises' business environment. This requires a full evaluation of risk threats, respectively, the economic effectiveness of financed projects at every stage of the project implementation.

As it had been expected, the key role of a selective approach to defining risk effects and the degree of their risk manifestation was confirmed. This means that it is necessary to make a precise and objective assessment of the basic threats for the economic profitability of an innovation project, including risk managers' good knowledge of the specific characteristics of the business environment in Bulgaria. However, there is one more important thing to consider in this issue. It is the segmentation of risk effects according to the degree of their risk manifestation and developing a map of risks on this basis. In relation to this, including a map of most significant risks in the model for risk assessment was considered to be an approach of great practical importance in risk assessment and its more effective management in innovation projects financed by means of risk capital funds.

The choice of an approach used in assessing economic effectiveness in innovation projects according to the criterion of a stage in the enterprise's development is another important issue proved by the survey. The results support the thesis that there are certain similarities in the practices used for risk assessment irrespective of whether or not enterprises have economic histories. For example, in assessing economic effectiveness of enterprises, risk funds successfully use so-called "Model DCF" based on the presumption that the assessed

enterprises will achieve good results. Cost determination of the enterprise's assets by using "Model DCF" requires: defining the discounting norm of free cash flows for investors; correctly defining free cash flaws; finding an appropriate solution in relation to the long-term functioning of the business.

The assessment by means of the model mentioned above is used successfully both in new enterprises without economic activities and in well-established enterprises that develop or are in the process of developing a new product.

- In relation to what indicators of business environment are used by risk funds, the summarized answers show that, in the practice of risk funds in the country, there is not a preliminarily established group of indicators of business environment included in risk assessment. The main reason for this is the lack of unified criteria for making a classification of basic risk factors derived from the change in system indicators of internal and external business environment. At the same time, the projected change in the indicators of business environment is in the basis of making a decision about a risk investment in enterprises, respectively, innovation projects.

On the basis of the conducted survey and the detected lack of a unified practice of risk assessment in Bulgarian risk capital funds, the author developed a model approach for risk assessment. It is not meant to be unique by nature, but it is based on good practices which are crucial for increasing the importance of risk capital for innovation development of Bulgarian enterprises. The presented model provides an opportunity to limit the number of approaches in risk analysis and to choose the ones that are praised by risk funds in the country. On this basis, it can be considered to be a model of important practical use for establishing risk capital as an alternative form of financing.

4. Requirements for Risk Analysis

The analysis of economic risk (and the model for risk assessment) should consider some specific characteristics in which an enterprise functions. At the beginning, it is necessary to analyze the business environment, the potential and market position of the enterprise, its market share, the quality and competitiveness of the manufactured product or provided service.

At this initial stage, the preliminary analysis of the business environment gives a possibility to make a general assessment of the enterprise's risk profile before using any specific analytical methods and methodologies.

As a rule, risk capital funds (RCF) in Bulgaria invest in micro-small and average-size enterprises. Such enterprises have a smaller market share and very limited possibilities to influence the change of market prices in general. Their position is less favorable from the point of view of economic risk in comparison with big enterprises-monopolists.

In particular, the model for economic risk assessment has to meet certain requirements, as follows:

- **First,** the model is supposed to provide some results based on an objective assessment of risk factors that form the specific conditions of the environment in which an innovative enterprise functions.
- **Second,** the choice of business environment indicators and their determining factors respectively should be made on the basis of their connection with the overall finance state of the enterprise. This clarification is necessary due to the fact that risk capital in Bulgaria is directed to innovative enterprises that have relatively limited market presence and have developed, or are still developing very few new products or services, and, as a result, the change in quality indicators of business environment can provoke significant deterioration of their financial situation.
- **Third,** the model should not be too complex to be applied.
- **Fourth,** the indicators included in the model are defined on the basis of the importance of economic risk assessment in the current period. However, in order to assess the economic effectiveness of the enterprise's activity and its innovation activity in particular, it is necessary to consider the probable changes in environment parameters as well as the factors that provoke them. Thus, in making the model, predicted data for a period of 12 months are used. The argumentation refers to the practical possibility of relatively precise forecasting the change in business environment parameters as well as to the big database provided by official statistics and used in forecasting the expected changes in the practical research. The importance of predicting environmental changes requires selecting data including two scenarios at least – a realistic prediction and a pessimistic version containing the most negative possible development in business environment indicators. Created in this way, the model will provide acceptable precision in defining the meanings of some variables such as the expected profitability of the innovation project and the enterprise in general as well as a probable loss.
- **Fifth,** data selection is based on a relatively wide range of sources such as the overall assessment of the enterprise's project plans, its accountancy documents and statistical data on the state of the business environment, economic sector and region in which it functions and sells its product. Here, it is important to emphasize the significance of official statistical sources providing a huge base of data, real and prognostic, on the state and the changes in the business environment.
- **Sixth,** a process approach should be applied in risk assessment, i.e. the model should be based on following a certain sequence of actions defined as composite phases of a model. In this respect, the omission or the change of a certain phase can lead to an unrealistic assessment of risk factors and the final investment decision of the risk investor.

The beginning stage of developing the model for economic risk assessment starts by localizing one basic risk factor or a group of potential risk factors which an innovative enterprise can face or which can directly influence its financial state. Their range can be wide as there are numerous risk factors influencing the extent of risk that innovative enterprises face. This assessment is made by the innovation enterprise as well as by the risk fund assessing the potential of the innovation project in which the enterprise is interested.

On the basis of the author's research on Bulgarian business environment, a group of basic risk factors can be identified and used in assessing economic risk in the presented model. Such factors are the demanded volumes of the product or the service, the market where the enterprise offers its produce, the expectations for a change in the volume of market demand. The risk factors mentioned above make it possible to plan more precisely the enterprise's activity and, in particular, to predict the necessary production expenditure necessary for realizing the basic activity of the enterprise in the period of survey.

The following system factors have also been included in the model for risk assessment: the level of household consumer expenses and their expected change, gross formation of the enterprise's basic capital, the level of consumer trust, expected change in the level of households' financial state, consumers' assessment of the general economic situation in the country at the present moment and expected changes in it, expected inflation, the enterprise's expenditure on labor, GDP produced per working hour, consumers' expectations for the change in the level of nominal incomes, the unevenness coefficient of labor force in the enterprise's region of functioning assessed on the basis of the indicator of acquired bachelor's and master's degrees, the size of tax-insurance burdens and the marginal size of corporate tax on profit and expected changes in them, the assessed enterprise's expenditure on acquiring LTI. It is assumed that some indicators determine the overall assessment of the enterprise's financial state in the direction of improvement while some other ones provoke deterioration and are defined as de-stimulators. The range of indicators can vary according to the assessment aims, to the factor of time necessary for implementing the innovation project as well as to the assessor's risk profile.

After identifying the main risk factors, their influence is assessed in regard to the preliminary aims related to the activity of the assessed innovative enterprise.

5. A Stage Approach to Determining the Level of Economic Risk

Stage 1 – Identifying the basic groups of risk areas, risk groups and the risks they contain

The approach used at this stage is based entirely on expert assessment, which does not mean it is improbable numerous different suggestions to be made. However, in the completed version, it is important to achieve certain consensus around a group of factors considered to be factors of great risk importance in relation to the aims set. It is a crucial condition as the aim is achieving a maximum objective risk assessment corresponding to the specific characteristics of the environment in which the enterprise functions.

At this initial stage, the model for economic risk assessment includes a graphic presentation of risk areas containing the main potential threats for the enterprise. It is important to define them clearly in order to localize precisely all the probable reasons for the occurrence of risk effects. Therefore it is possible to apply Ishikawa method also known as Fishbone.

The reasons for the occurrence of risks can be positioned in every one of the main risk areas depending on the classification risk indicator defined as an indicator of the greatest importance.

Before starting the Fishbone presentation, it is necessary to clarify that risk factors are defined on the basis of three groups of characteristics such as:

- Characteristics related to the nature of the enterprise's activity and characteristics that are specific for the project implementer respectively;
- Characteristics related to the nature of the innovation product;
- Characteristics related to the environment in which the enterprise functions.

On the basis of the whole information the risk fund has, six main risk groups are localized:

- Technological risks related to manufacturing drones for video-monitoring and data transmission in real time. These risks also include normative requirements for the quality characteristics of drones and, respectively, the possibility for technological applicability of improved technology of better quality; the expiry date of the drones adapted for video-monitoring, data transmission, installation of sensors, etc. This group includes also project security in terms of research and development activities, and faster development of technologies in particular. It should be noted that the implementation of projects of manufacturing high-technology products, access to modern designs and novices as well as the availability of well-trained personnel is of vital importance for the success of the project implementation. Thus technological risk in the areas mentioned above should be considered in regard to the specific characteristics of the innovation and the enterprise that realizes it.
- Regulation risks related to insecurity in regard to general requirements in drone exploitation. It is important to note here that although the European Commission has assigned European Agency for Aviation Security (EAAS) to set a number of rules of using drones, there is still a lack of clear and single regulation. At this stage, the rules in the area of aviation require drones of more than 150 kg to be regarded and regulated as all other means of aviation.[3] The lack of clear regulation requirements poses a risk for both investors and manufacturers of drones. It should be taken into consideration in the overall risk assessment at the stage of localizing main risk factors. Thus it can be expected that, in a short period of time, innovations in manufacturing drones and technologies related to expanding their application will be developed mainly in Asia[4], where the introduction of regulation laws in this area is more advanced than in Europe or the USA.
- Market risks according to the following three groups of specific characteristics: heavy dependence on several final customers; dependence on a limited number of suppliers of production materials and equipment; clearly segmented market in terms of the market application of the final product; difficulty in providing insurance protection.

[3] For more information about the regulations governing the use of drones see: Regulation (EO) № 216/2008.

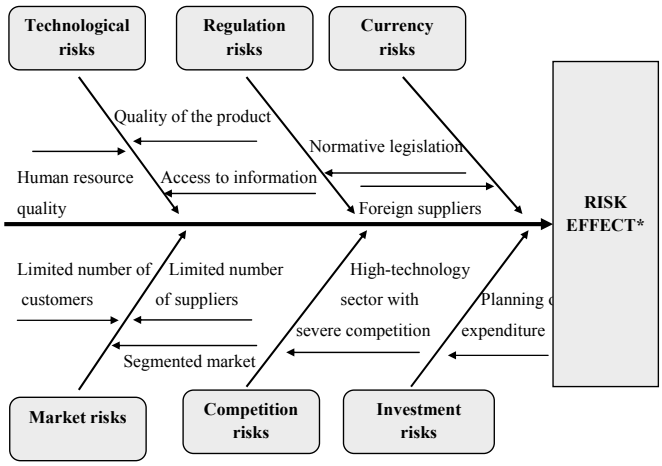
[4] According to Forbs magazine, the biggest manufacturer of drones is Chinese company DJI worth about 10 billion USD. For more information: http://www.forbes.com/sites/ryanmac/2015/04/14/worlds-largest-drone-manufacturer-dji-seeking-to-raise-at-10-billion-valuation/#c7b37cc77dbb.

- Risks related to the competition on the market of drones. In general, these risks are a direct consequence of the nature of the market of drones, i.e. this is a new industry and the number of manufacturers is limited; the product is innovative and thus it poses a risk of greater level for investors.
- Currency risks, namely risks related to unexpected changes in the rate of local currency to US dollar. This risk should be taken into account as the suppliers of production materials and equipment are from abroad and about 80% of them are paid in US dollars. Meanwhile, the main part of expenditure is related to obtaining goods for production purpose, i.e. they form the main part of production expenditure of drone manufacturing.
- Investment risks, especially risks related to managing expenditure which, to a certain extent, is related to the currency risks mentioned above.

The main risk areas, the reasons for their occurrence and the risk effect they provoke are presented on the graph of Fishbone type.

Figure 1

Main risk areas, the reasons for their occurrence and the risk effect they provoke during the implementation of the project of manufacturing drones for video-monitoring and data transmission in real time[5]



*High dependence on a limited number of main suppliers functioning on the same market, a currency risk posed by the suppliers' profile and the payments to them predominantly in one currency; high dependence on several big customers; limited market possibilities for selling the final product; lack of legal regulation and lack of information about the quality characteristics of the product in relation to the degree of applicability in regard to the application characteristics of the final product preliminarily set by the manufacturer; high level of risk related to research and development activity, including project security due to the lack of well-trained human resources; a risk related to managing expenditure as well as its effective planning at every stage of implementing the project.

Source: Author's research work.

[5] Stage 1 (sub-stage 1.1) of the model for economic risk assessment.

At the second stage of the model for risk assessment, the economic effectiveness of the innovation project is assessed, so-called Analysis of Assessment Sensitivity. This stage has a key importance for economic risk assessment as it gives information about the economic significance of risk investment.

Stage 2 – Assessment of the economic effectiveness of an innovation project

In the present model for economic risk assessment, it is suggested to use statistical assessment methods, particularly the method of net current value. It is a successful method which makes it possible to measure the financial effect of risk investment during the whole implementation period of the project, respectively, the possibility for the risk investor to get a return on their investment if a certain risk event happens.

The assessment of economic effectiveness is based on some data about the project presented in Table 2.

Table 2

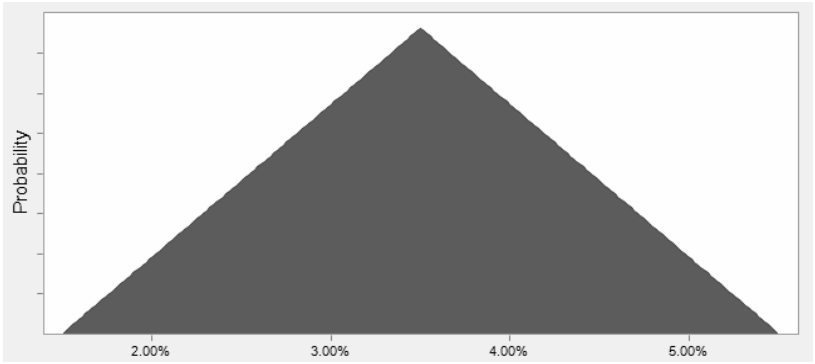
Data about Development and Introduction of Autonomy Aviation Machines innovation project

EUR/BGN	**1,95583**					
USD/BGN	**1,75**					
Inflation	**5,00%**					
Real salary growth	**10%**					
Taxes	**10%**					
Discount rate	**2%**					
Period	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**
Income	95880,2	162030	239462	310022	390494	456764
Sales of drones	12	24	36	48	60	72
Prices of drones	4900	4900	4800	4800	4700	4700
Income from drones sold	58800	117600	172800	230400	282000	338400
Spare parts (% sales)	15,00%	20,00%	25,00%	30,00%	35,00%	35,00%
Spare parts (% sales)	50,00%	50,00%	50,00%	50,00%	50,00%	50,00%
Income from spare parts	4410	11760	21600	34560	49350	59220
Services (hours, years)	576	576	768	768	864	864
Price of services per hour	56,7191	56,7191	58,6749	58,6749	68,4541	68,4541
Income from services	32670,2	32670,2	45062,3	45062,3	59144,3	59144,3
Expenditure	105737	146577	183770	298900	337607	477056
Number of employed programmers	2	2	2	3	3	4
Programmers' salaries	3200	3696	4268,88	4930,56	5694,79	6577,49
Expenditure on programmers	76800	88704	102453	177500	205013	315719
Number of other employed people	0	0	1	2	2	3
Average salary of other employees	830	958,65	1107,24	1278,86	1477,09	1706,04
Expenditure on the salaries of other employees	0	0	13286,9	30692,7	35450,1	61417,3
Cost of drones (% price)	50%	50%	40%	40%	35%	30%
Production expenditure	26306	52611,9	61845,9	82461,2	88312,9	90836,1
Other fixed expenditure	2630,6	5261,19	6184,59	8246,12	8831,29	9083,61
Predicted financial result	-9856,4	15453,1	55691,9	11122,3	52887,5	-20292
Predicted cash flow	-9856,4	13907,8	50122,7	10010,1	47598,8	-20292
Current value of cash flow	-9710,7	13499,7	47933,2	9431,34	44184	-18558

In Table 3, the results of the analysis of risk factors are presented, respectively, the results of economic risk assessment based on the data presented above

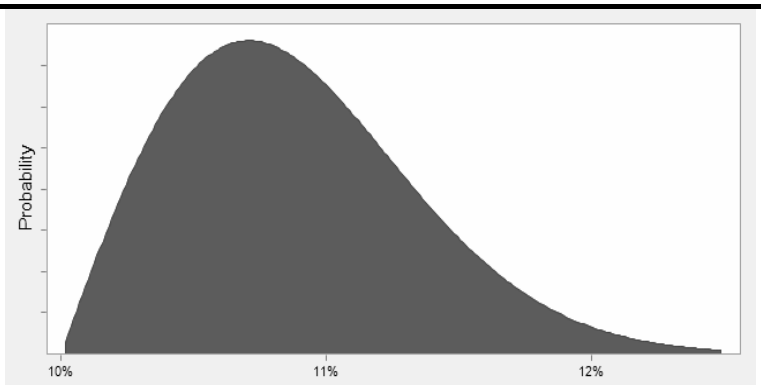
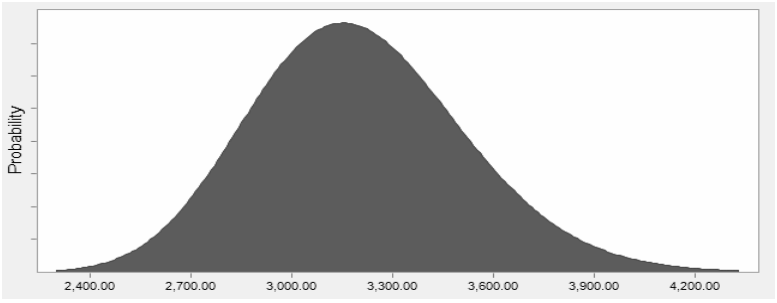
Table 3

Expected changes in system factors

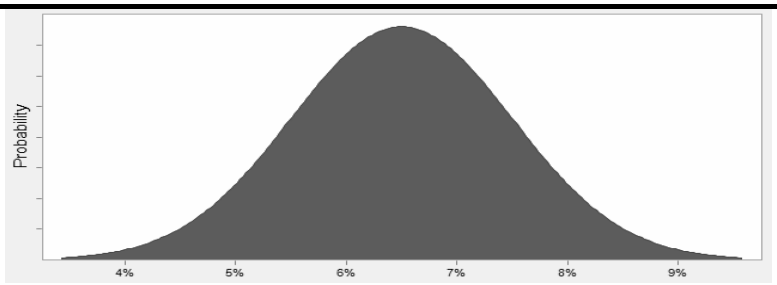
Inflation	It is presumed that the average inflation rate will be between 1.5% and 5.5% (3.5% per year is most probable).[6] The level of inflation is directly related to the enterprise's expenditure on acquiring LTI, including acquiring intellectual property rights on innovations; acquiring, respectively, developing specialized software for introducing the innovation product; consultant services of engineering-technical character related to the process of introducing the innovation product. According to the data of studying business environment in the country, the managers of the enterprise, who have taken part in the survey and who form 75 % of the internal investments in the country, consider expenditure on acquiring DMA to be the main indicator of the level of innovation activity. According to the conducted survey, the pace of the increase in the expenditure on acquiring LTI is rising, which supports the assumption that, for the whole period of investment, inflation expenditure of the enterprise will be formed at an average annual level of 3.5%.  Graph 1. Expected change in the level of inflation
Payment in IT sector	It is assumed that salaries in IT sector will rise by 10% to 13% per year. Weibull distribution has been chosen considering the characteristics of labor market for IT specialists. It is not expected the payment to be below 10% on average every year.[7] The tendency of an increase in the expenditure on labor is proved by the survey of the business environment. The conclusion is that, for the period 2009-2014, it grew steadily. The reason for this can be low incomes in the country that fall behind the average incomes in the EU as well as the lack of well-trained people in certain economic areas. These conclusions show the situation in IT sector which, together with the favorable possibilities for developing outsourcing services in this area, allow experts to suggest that the predicted annual growth of expenditure on paying IT specialists will reach 13% per year.

[6] The data about expected inflation are based on the analysis of the enterprises' expenditure on LTI and medium term budget forecast for the period 2016-2018 due to predicted strengthening of world economy.

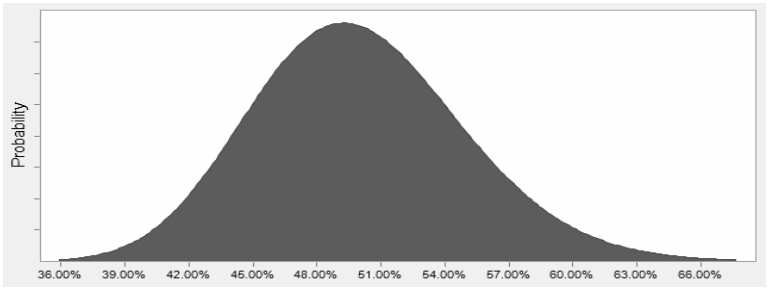
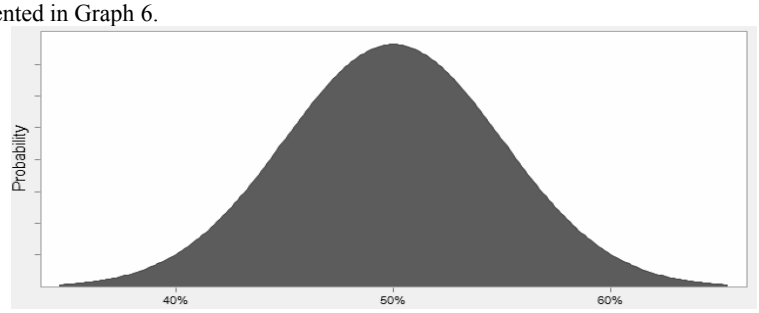
[7] The expected increase in the expenditure on wages is based on the change in the amount of average wage in the sector of IT services, which rose by 70% on average (14% per year) in Plovdiv, where the enterprise is located, from 2008 to 2013.

	 Graph 2. Predicted percentage of the change in the level of expenditure on labor force
Project expenditure on labor force for the employed IT specialists	It is predicted that gross expenditure on one employed IT specialist follow lognormal distribution of the average value of a wage of 3,200 lv. and standard deviation of 320 lv. It is assumed that wages change due to inflation and the growth of incomes for the sector of IT services.  Graph. 3 Predicted change in the value of labor expenditure
Scale of taxation	It is assumed that corporate tax will not change during the period of project implementation, i.e. it will not exceed 10%. This prediction is based on the medium-term fiscal forecast not predicting a change in the scale of corporate taxation until 2018.[8] Higher expenditure can be added to tax expenditure due to the increase in maximum insurance income. However, this is less important for the sector of IT services as the average wages for the sector exceed significantly its amount. If this fact is not taken into account, it can be assumed that the amount of minimum insurance income is directly related to the enterprise's expenditure on labor. This assumption is supported by the survey of business environment showing that about 80% of interviewed managers of small and average-size enterprises consider taxation-insurance burden to be heavy or very heavy. To a certain extent, this also refers to the present project as, during the first year of the implementation of the project, the enterprise cannot generate significant income from sales.
Discount percentage	Considering the specific characteristics of the project and the nature of activity, distribution of 6.5% on average and standard deviation of 1% is considered to be normal. The amounts have been calculated by finding the closest distribution corresponding to the yield of corporate stocks of BBB rating. The result has been used to motivate this assumption.

[8] For more information: Medium term budget forecast for the period 2017-2019.

	 Graph 4. Predicted change of discount percentage
Amount of sales	The planned sales on internal market are as follows: 1st year – expected level of sales of 12 units; 2nd year – expected level of sales of 24 units; 3rd year – expected level of sales of 36 units; 4th year – expected level of sales of 48 units; 5th year – expected level of sales of 60 units; 6th year – expected level of sales of 72 units; It is acceptable for sales to vary by +/-10% every year. The amount of the units sold is small as the final product is specialized.[9] Although, according to the analysis of consumer expenditure for the period between 2009 and 2014, the increase reaches about 13%, it should not be expected to find a direct connection with the expected sales of drones as the specific characteristics of the product limit its practical use. A further factor behind the low percentage increase in sales is market competition.
Price of the product	The sale price is planned to be formed as follows: 1st year – expected price of 4,900 lv., normal distribution and standard deviation of 490 (10%); 2nd year – expected price of 4,900 lv., normal distribution and standard deviation of 490 (10%); 3rd year – expected price of 4,800 lv., normal distribution and standard deviation of 480 (10%); 4th year – expected price of 4,800 lv., normal distribution and standard deviation of 480 (10%); 5th year – expected price of 4,700 lv., normal distribution and standard deviation of 470 (10%); 6th year – expected price of 4,700 lv., normal distribution and standard deviation of 470 (10%). The expected price of an item of the product decreases from the first year to the end of the period due to expected increase in competition based on the factor of market success of the innovation project. This is supported by the survey on the business environment, in which the managers give the highest mark exactly to the factor of competition. The project realization of the product should consider mainly the factor of external competition due to the specific characteristics of the innovation product mentioned above and the presence of established world leaders in the area of drone manufacturing.
Income from the sales of spare parts	It is assumed that spare parts are a percentage of sales, as follows: 1st year – income from the sales of spare parts of 4,410 lv; 2nd year – income from the sales of spare parts of 11,760 lv.; 3rd year – income from the sales of spare parts of 21,600 lv.;

[9] For more information: See Table 1.

	4th year – income from the sales of spare parts of 34,560 lv.; 5th year – income from the sales of spare parts of 49,350 lv.; 6th year – income from the sales of spare parts of 59,220 lv. It is expected the price of spare parts to vary around 50% of the price of the final product. The distribution is lognormal as it is assumed that the share of the income from spare parts will rather increase than decrease or fall below zero. The distribution is presented in Graph 5.  Graph 5. Predicted change of the incomes from the sale of spare parts
The cost of the final product	It is assumed that the cost of the final product is about 50% of the sale price. The data are presented in Graph 6.  Graph 6. Predicted change in the cost of the final production product
Other incomes	It is assumed that the enterprise can allocate between 30% (at the beginning of the project) and 40% (in the last years) from the total working hours to generate other incomes (outsourcing, providing external services). These incomes reach 29 EUR per hour, which matches normal wages in IT sector for qualified labor force in Bulgaria. Thus it important to consider the fact that, during the last several years, Bulgarian enterprises invest more and more money in research and development activities. A great part of these sums is directed to the high-technology sector. Using Fishbone method and the suggestions in the studied model, it is possible to give solutions and different versions respectively of the time that the enterprise can spend on outsourcing and external services. The nature of these potential revenues is not related to the main subject of the project activity - the production of drones, which enables additional revenues to be realized. Their size does not depend directly on the sales of the main product, of the market competition for the drones market. This increases revenue generating sources while reducing reliance on market competition, which can be defined as risk diversification, including market, competitive and price risks.

Risk analysis results

After the risk fund defines the predictions on the basis of the expected changes in the value of risk factors, it is possible to start defining the expected net advantages of financing the innovation project. For the purpose of this, Monte Carlo model is used.[10]

At this stage, the risk fund is very much interested in the following two questions:

- **First,** what is the distribution of the expected net advantages of the project?

The answer to this question can be found in the results of the carried out simulation presented in Table 4.

Table 4

Simulation results

Indicator	Value
Average value	87,513.25
Median value	88,536.46
Mode	87,513.25
Standard deviation	95,922.54
Asymmetry coefficient	-0.1411
Excess coefficient	3.12

- **Second**, what is the probability that the advantages of the project will be smaller than or equal to the amount of risk financing (i.e. net effect for the fund will be zero or sub-zero)?

The results presented that it is expected net result to be below or equal to 58,675 BGN which means a probability of 37.03%. The analysis of the results shows that the distribution of expected advantages is close to normal, i.e. despite expected risks, the innovation project will bring economic advantages and it can be implemented.

Conclusion

In graphs, the model for economic risk assessment in innovation projects can be presented as a unified system consisting of three main parts: entrance dimensions, a simulation model for assessing risk effect and exit dimensions.

Entrance dimensions have expected probability parameters so they can be defined as random entrance dimensions. Their expected values can be identified on the basis of the data about past periods or by examining and summarizing expert opinions and analyses based on business environment assessment.

[10] The results reached by using Monte Carlo simulation (by using software Oracle Crystal Ball) in 10,000 repetitions. The studied goal variable is the current value of the received net cash flows.

In its final version, the presented model makes it possible to measure precisely the parameters of risk level, which gives an answer to the main question that every potential investor asks: what are the possibilities for market return on invested capital?

Risk is assessed regularly at every stage of the project implementation. The purpose of this is embracing as many indicators of the business environment as possible and, as a result, achieving a high level of predictability of the changes in market conjuncture in a medium or a long period of time.

Despite the fact that project investments in innovation projects are characterized by a potentially higher level of risk, the application of the model for risk assessment based on a unified methodology is a condition for increasing risk financing of Bulgarian enterprises as well as for increasing innovation potential of national economy respectively.

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ИКОНОМИЧЕСКИ ИЗСЛЕДВАНИЯ
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POST-CONFLICT ECONOMIC DEVELOPMENT: A WAY FORWARD

In times of persistent violent military conflicts and in post-conflict contexts, water resources and infrastructure are often destroyed or become inaccessible. This has been confirmed both in the literature and in practice. This research has shown effective water management is vital for mitigating new tensions over water resources. Otherwise it will be a major obstacle in the development of economy in post-conflict society. Early intervention in the water sector can help societies set the foundation for more equitable and sustainable water use and in turn support better economic recovery in post conflict areas.

A qualitative research approach with a fieldwork was applied in Northern Sri Lanka where an economic recovery deemed necessary at the end of the three-decade long civil war, opening up communities to reconstruction and economic rehabilitation. Semi-structured interviews and observations were applied to derive findings on current challenges in the water sector in post clearance areas. Main findings from this research lead to the conclusion that the lack of water supply and water sources are primary challenges for land users. They are not aware of sustainable land management (SLM) strategies to improve water use efficiency and productivity. The study proposes a framework to integrate SLM for post-conflict economic development.

JEL: O1; Q1

1. Introduction

According to the UN (United Nations), there are about 100 violent conflicts that have been suspended over the last ten years, with the consequences being a disrupted sustainable development and unsustainable forms of land use. The economic challenges faced by the parties after the end of the conflict are severe: land degradation, destroyed human and

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social capital, impossible access to livelihoods due to landmines and unexploded ordnance (UXO), loss of income and widespread poverty.

Recently, the recognition of the role of land in post-conflict contexts is attracting the attention of international practice, politics and scientific debates (Gbanie et al. 2015; Nackoney et al. 2014) but still little is known about the processes and outcomes of such events. Information about the level and degree of conflict-induced impacts on both land and environment serves as a guide to post-conflict economic recovery programmes. This is significant because 90% of civil conflicts between 1950 and 2000 ensued in countries with rich biodiversity, and 80% took place within biodiversity hotspot areas (Hanson et al., 2009).

Armed conflicts are among the most drastic shocks that can impact societies and thus land. Dead and casualties, both among those fighting and among civilians (Landmine Monitor, 2017), the internally displaced people fleeing from unsafe areas (Wanninayake, 2015), human rights abuses, and the obliteration of livelihoods (Justino, 2011) are some of the critical effects of conflict, and widespread literature exists assessing the causes and outcomes of conflicts for societies.

Whilst many scholarly works in the contexts have focused on investigating the impact of conflict on wildlife, others have investigated the effect of conflicts on forests (Ordway, 2015) and cultivation lands (Witmer & O'Loughlin, 2009) or where fighting affects natural ecosystems directly. Academics have used varied technologies in conflict and post-conflict research to understand ecosystem variations, forest cover and resource extraction (Gorsevski et al. 2013). Similarly, it is also important to examine what drives people's land management decisions and how land systems may evolve in the future and for identifying strategies to steer land systems towards desired outcomes.

Generally, it is believed that conflicts affect land management decisions but, research on how armed conflicts affect land management decisions and thus land use practices are scarce. This is unfortunate, considering that the few existing studies suggest that these effects can be drastic (Baumann & Kuemmerle, 2016), comprehensive and long-lasting (Baumann et al. 2015). Investigating how war affects water resources should also be a priority because armed conflicts, sadly, destroy water supply and contaminate water wells.

For example, in 2012, a Swiss-based demining agency reported that 2,214 groundwater wells have been cleared removing more than 42 antipersonnel mines (AP mines), 556 items of unexploded ordnance (UXO) and nearly 57,468 items of explosive remnants of war (ERW) in Vavuniya, Mannar and Mullaitivu districts in Sri Lanka facilitating 47,000 beneficiaries (Thoms, 2012). The researchers were informed by the Sri Lanka Regional Mine Action Office that well clearance is still being conducted in Sri Lanka.

With the recognition of the important role that land plays in conflict and post-conflict contexts, the paper examines the interventions of improving water productivity and water use efficiency in conflict-affected areas in Northern Sri Lanka.

We conducted a qualitative estimation of how conflict affects land management decision making in terms of water resources. Specifically, we sought to answer three interrelated research questions:

(1) Which water sources are predominantly affected by armed conflict?

(2) What are the challenges faced by residents living in Northern Sri Lanka in terms of access to sufficient water for domestic and industrial use?

(3) What are the mechanisms to improve water productivity and water use efficiency?

To address these questions, a qualitative research approach (informal interviews and focus group interviews) was applied to our case – Kilinochchi District. We then compiled a database incorporating information on access to water use for industrial and domestic use in Northern Sri Lanka before the war and after the resettlement. We then conducted a literature review on studies that established a relationship between sustainable land management (SLM) and water productivity. We synthesized the findings of these studies with regards to the post-conflict economic development, its proximate drivers, and the causal mechanisms to address the gaps of land and water resource management.

Primary data was collected from the local population involved in farming and secondary data was collected from the District Planning Secretariat. A comprehensive literature review complements this research. Based on these findings, a model was developed to improve water productivity and water use efficiency in the post-conflict land.

Continuous investments in water resource management in Northern Sri Lanka suggest a need for efficient and effective mechanisms to improve water capture, decrease erosion and increase agricultural output. Northern Province's unique biophysical variability provides the underlying conditions for abundant freshwater resources. However, deforestation due to agriculture expansion, fragile soils, and heavy seasonal rains makes the land vulnerable to soil erosion in the rainy season. During the dry season in Northern Sri Lanka, water scarcity and low water tables cause a rapid reduction in water levels affecting agricultural yields.

According to Sivakumar (2018), preliminary calculations based on per capita water use for domestic needs, irrigation sector, industrial and commercial water show a trend of increasing demand. Despite the water resources (surface irrigation facilities as well as groundwater extraction facilities) established by the Government for economic and social well-being of the community, there is a significant deficit of water for domestic and agriculture purposes. Therefore, the importance of conservation and efficient management of available water resources should be addressed properly. There is increasing scientific evidence of the potential advantages of adopting SLM technologies to protect biodiversity and secure the quantity and quality of water resources.

Sustainable land management (SLM) represents a holistic approach to achieving long-term productive ecosystems by integrating biophysical, sociocultural and economic needs and values. SLM can be referred to 'optimal use of land resources for the benefit of present and future generations' (Davies et al., 2015). SLM is a knowledge-based procedure that helps integrate land, water, biodiversity, and environmental management (including input and output externalities) to meet rising food and fiber demands while sustaining ecosystem services and livelihoods (Smyth and Dumanski, 1993). SLM encompasses soil, water and vegetation conservation measures, and is based on the key principles of enhancing the productivity and protection of natural resources, while being economically viable and socially acceptable (Schwilch et al., 2014).

The policy makers and residents who live in war torn areas means that they should be responsible to maintain the quality of land and water, because, it is affected by landmines and UXO, habitat destruction, pollution, loss of biodiversity, over-exploitation and degradation of natural resources during explosions.

War is seldom good for anything, especially protracted conflicts like the one in Sri Lanka, which dragged on for over three decades and claimed between 80,000 to 100,000 lives. According to a survey undertaken by Wanninayake (2015), by the end of war 2009, there were more than one million people were displaced in Sri Lanka, while the same number of people was living as refugees and asylum seekers abroad. The resettlement started from 2010 when the landmine clearance in residential areas was completed. At the time of writing this paper, humanitarian deminers have cleared an area of 2,325Km2 has been cleared removing and destroying 735,444 AP mines, 2,073 antitank mines and 556,385 items of UXO. The remaining hazardous area for mine clearance is 27.1Km2 in the country. The contamination of these ERW has similarly affected land and water resources.

It is now a realistic prospect that one of the worst affected countries in the world could be the next to be declared mine-free having Sri Lanka acceded to the Ottawa Treaty (Mine Ban Treaty contributes to the shift in norms away from use, production and trade of anti-personnel mines) on 13 December 2017. Sri Lanka also deposited its instrument of accession to the Convention on Cluster Munitions on 1 March 2018, becoming the 103rd State Party (Landmine Monitor, 2017). By joining the Convention Sri Lanka will undertake to destroy all stockpiled AP mines it owns or that are under its jurisdiction or control, not later than four years after the acceding to this treaty (Landmine Monitor, 2017). The accession has wider implications for the rebuilding and socio-economic development of a country years after the end of the conflict. Therefore, it is timely to introduce SLM as a major modernizing factor to be considered under the post-conflict development strategy. The northern province is referred as the “dry zone” of Sri Lanka, a largely agriculture-based area and home to about a third of Sri Lanka’s population of about 21 million (Asian Development Bank, 2017). The majority of Northern inhabitants are depending on rice farming; cash crops, livestock and fisheries are pivotal sub-sectors. After the resettlement, people were provided with food aid for nearly six months until ERW was removed off their farmlands and related livelihood areas.

Kilinochchi District being an agricultural district, largely depends on the irrigation network for its development and it has 7 river basins and there are 4 major tanks and 5 medium tanks connected to conserve rainwater. The climatic conditions of the district are dry and humid with an average annual rainfall of 3533.40mm. It receives rainfall in one monsoon season each year. The weather is extremely variable and droughts are common; household incomes are around 10% lower in the dry zone than in other parts of the country (Asian Development Bank, 2017). Gradually, this situation will be worsened due to the rapid population growth and further rainfall diminishes due to global warming and climate change.

Water is scarce and not totally sufficient to supply water to the entire cultivation area in the name of economic growth. Water for agriculture and human use are alternatively withdrawn from tube wells and dug wells too. In the context of sustainable land management, this study focuses on how to improve water productivity in areas where

humanitarian demining operations have been conducted. SLM means technologies which farmers implement in their fields to manage crop yields with available water. Various scholars have shown that application of SLM has managed to optimize the use of storage infrastructure and minimize the number of new dams that need to be built.

According to the findings, some farmers have been provided with tanks to collect rainwater and awareness programmes on rainwater harvesting and groundwater recharge by UN-Habitat and Coca Cola Company in Punnaineeravi GN division and Kandavali DS Division in Killinochchi district. Typically, these measures have been used in early resettlement period. However, only five percent of farmers in the interview adopts such SLM technologies.

The study reveals that excessive concentrations of iron and nitrates, from agrochemicals and fertilizers have deteriorated the soil over the past few years. The focused group farmers reported that the supplement of excessive synthetic chemicals and fertilizers to crops replaced the water shortages and increased the yield of a particular crop or set of crops, which are genetically modified.

81% of the study participants informed that water sources were microbiologically unsuitable for drinking in Kilinochchi district. Most people consume raw water from these unacceptable water sources. It was also found that the surrounding environment is highly conducive for contamination of well water in the study area. The study participants had poor knowledge on transmission of bacteria through water and the prevention of water-borne diseases.

This background paper draws on water productivity components of SLM and how it can be integrated and scaled up in the target area. Scaling up generally focuses on expanding, replicating, adapting and informing policies, programs or projects in geographic space and over time to reach a greater number of people. Institutional changes – both within the public and the private sector as well as initiated by policy makers – are needed to create an enabling environment that can promote scaling out via the adoption of SLM practices from person to person, and community to community.

The remainder of the article is structured as follows. Section 2 provides the approaches towards data collection for qualitative evidences on the water management issues in the selected area. There is then a discussion on key elements of improved water productivity and water use efficiency through SLM policies and practices adopted institutionally identified from the literature. The final section concludes with a guiding framework for sustainable water use and economic development in post-conflict settings in the future.

2. Methodology

2.1. Description of the Study Area

The study was carried out in Kilinochchi District in Northern Province of Sri Lanka, an area about the size of 1237km2 and inland water covers an area of 444.3Km2. This district reports the highest landmine and ERW contamination subsequent to the war. While mine

clearance is ongoing, as at 31 December 2017, Regional Mine Action Officer of Northern Province reports a total of 354,614 landmines and ERW were recovered from this district and approximately 584 km2 of contaminated area has been cleared and released for resettlement. The mine clearance is still going on in close proximity to livelihood areas in some parts of this district. Therefore, the study results can be generalized for any post conflict setting as the extreme case has been considered in this research.

As of end 2017, total population of the district 124,000 people (Department of Census and Statistics Sri Lanka, 2018). Kilinochchi district is predominantly an agriculture economy depending mainly on tanks and irrigation works. The secondary livelihood is based on fishing, livestock, industrial activities, government and private establishments. The estimates based on the Household Income and Expenditure Survey (HIES) conducted by the Census and Statistics Department of Sri Lanka, Kilinochchi district is 51% below the average monthly income (average monthly income LKR 54,999) of Sri Lanka. Therefore, SLM implications, particularly in this district, will be beneficial for the communities to boost the economy and the impact of SLM integration will be evident and be simply measurable for future studies.

2.2. Data Collection Methods

The research was carried out for 55 days in March-April 2018 with qualitative data collection that included observations of 45 community wells and irrigation sites and 35 semi-structured interviews and focus group discussions with farmer associations, Rural Development Societies, community-based organizations, NGOs and government stakeholders. Review of existing literature on the SLM model, influence of post-conflict conditions, measures of sustainability and rural water supply set the context of the research and identified areas for further study. Use of the statistical handbook of District Planning Secretariat, reports of the Agriculture Department, information management system for mine action (IMSMA) database of the Regional Mine Action Office provided a vast source of data specific to the region with which to triangulate collected data. Literature sources that examined the interconnectedness of sustainable land management in post-conflict conditions were limited at the time of the study.

2.3. Data Analysis

Data collected through semi-structured interviews, field observations and focus group discussion were analyzed thematically through a content analysis technique. The descriptive analysis of data helped to capture the demographics of the people involved in the study, their water use and water saving strategies during normal day-to-day life and agriculture.

3. Improved Water Productivity and Water Use Efficiency

Water use efficiency and productivity directly contribute to increase production from the land. In dry zones of the world, water is the most common limiting factor in food production due to a mixture of scarcity, and extreme variability, long dry seasons and droughts. Water scarcity and lack of access to water for consumption and productive uses is a major constraint to enhancing livelihoods in rural areas (Castillo et al., 2007; Faurès & Santini, 2008).

Water productivity means growing more food or gaining more benefits with less water. Commonly it is reduced to the economic value produced per amount of water consumed. This is done by reducing high water loss through runoff and unperceived evaporation from unprotected soil, harvesting water, improving infiltration, maximising water storage – as well as by upgrading irrigation and managing surplus water.

The top priority is to improve water use efficiency in rainfed agriculture; here lies the greatest potential for improved yields with all the associated benefits. Conveyance and distribution efficiency are key water-saving strategies for irrigated agriculture (Gurtner et al. 2011). This is done through well maintained, lined canals and piping systems. The farmers practice to use low-pressure sprinkler irrigation during the night or early morning, to reduce evaporation losses.

Oweis and Hachum (2001) state that spreading limited irrigation water over a larger area allows gaining considerably higher total crop yields and water use efficiency compared to using water for full irrigation on a smaller area. Supplementary irrigation is a key strategy for providing water during no-rain periods, at water-stress sensitivity stages in plant growth.

A cost-benefit study undertaken by Fox et al. (2005) discovered that maize-tomato cropping systems using supplementary irrigation reached annual net profits of US$ 73 in Burkina Faso and US$ 390 in Kenya per hectare. In comparison, traditional systems showed net income losses of US$ 165 and US$ 221, respectively.

McIntyre (2009) mentions that water harvesting and improved water storage for irrigation during times of surplus is useful to water stress times. Rainwater harvesting can be made as small dams and other storage facilities, which are combined with community-level water management, can be introduced as alternatives to large-scale irrigation projects.

According to Studer (2009), integrated irrigation management is a wider concept going beyond technical aspects to coordinate water management, maximised economic and social welfare, assured equitable access to water services, without harming the ecosystems. Based on results from a hydrological model and a household survey analysis presented by Schmidt and Zemadim (2015), investments in agricultural water management are vital to increasing agricultural productivity in degraded watersheds.

Access to Safe and Clean Water

In Northern Sri Lanka, deposits of landmines and ERW have contributed excessive levels of calcium in groundwater. Also, this results in high levels of heavy metal and high concentrations of fluoride. The study has found that majority participants are suffering from kidney stones due to the high dose of calcium, salt and mineral consist in drinking water, have given rise to dangers to human health. Therefore, it is important to find out effective as well as affordable means of providing safe drinking water.

In early resettlement period in 2012, deminers have worked in close cooperation with WATSAN (Water, Sanitation and Hygiene) organizations and National Water Supply and Drainage Board in Sri Lanka to follow on water purification in ERW-free wells. Deminers informed WATSAN of each well cleared on a regular basis to ensure that follow up purification can take place and encounter a freshwater source for the returnees.

However, focus group discussions derived that water purification is no longer followed up or practiced on a regular basis. In the selected area, 95.5% of the households do not know how to purify water at all, and of those that do, the most common method by far is to strain water from buckets, which offers little or no disinfection of disease-causing agents. Only 4% of household boil water for drinking. Families need to understand how to purify and store clean water to maintain a healthy lifestyle. The study suggests that WATSAN component should be reactive to purify water and conduct community awareness programmes to promote the use and consumption of clean water to improve health conditions.

Rain Water Harvesting

Rainwater Harvesting is commonly practiced by people in semi-arid areas with common seasonal droughts as in Egypt, Ethiopia, Tanzania, Niger, Somalia, Sudan and Uganda where rainwater is collected with various technologies to make it available for agricultural production or domestic purposes. Rainwater harvesting can be done through a collection of runoff water where infiltration is low, a storage system where water is accumulated for future use - in pits, ponds, tanks or dams. The water harvested can be used for home gardening watering of cereals, vegetables, fodder crops and trees but also to provide water for domestic and livestock use, and sometimes for fish ponds which benefits the community (Liniger et al., 2011).

The surface water in Kilinochchi is known to be saline therefore, a well-developed mechanism to store and harvest water for daily consumption is essential. Pipe-borne water is still sparse and there is a high demand on existing water storage methods. Domestic rainwater harvesting is a very effective and advantageous water management system which can be used in Kilinochchi district.

The Water and Drainage Board and UNHCR, through the Village Headman of each area, should organize community awareness programmes about the benefits and methods of rainwater harvesting. The stored rainwater will reduce the current use of saline water which may have negative impacts on the health of the communities. Further, rainwater harvesting

will reduce the need to transport heavy loads of water over long distances and purchase of water in these areas.

In-situ rainwater conservation can be practiced by residents where rainfall water is captured and stored where it falls. This avoids water runoff and evaporation loss is minimised. Mulching, cover crops and contour tillage are promising agronomic measures for in-situ rainwater conservation. Micro-catchment is another method for individual farmers within farm field systems digging holes, pits, basins, bunds constructed to collect surface runoff from the vicinity of the cropped area. The farmer has to control both the catchment and the storage area.

Macro-catchments are designed to send more water for cultivation lands through gullies and streams during storm flood seasons. The farming community should build large earth canals, dams and ditches to store huge volumes of water. Farmers do not necessarily should have serious engineering skills to build small dams and ponds for the collection and storage of runoff from external land surfaces. Farmers can design furrows or channels below terraces banks.

The housewives should secure rainwater from rooftops for domestic use. Tiled roofs, or roofs sheeted with corrugated steel are recommended, to collect clean water. A systematic conveyance system consists of gutters or pipes to transport the rainwater falling on the rooftop to storage vessels. The storage tank should be constructed with an inert material such as reinforced cement, plastic, fiberglass, or stainless steel. During the north-east monsoon, each family might be able to collect over 10,000 litres of water. The residents should be provided with storage tanks to practice rooftop catchment.

Maximising Water Use

The residents in Kilinochchi district use tube wells and hand dug wells to receive water for domestic use and home gardening. People grow banana trees near water wells to apply human/animal bathed water to grow trees. A family may use at least 30 litres of water per day for cooking and washing etc. There is no system in place to convey and distribute kitchen wastewater for vegetables beds in home gardens. Wastewater emerging from the kitchen has high organic material from the food dishes as well as oil and grease from typical Northern Sri Lankan Tamil cooking.

Through the Community Liaison officers of NGOs, the community should be informed and educated to convey water used to wash fruits and vegetables in the kitchen to vegetable gardens through PVC pipes. The communities should avoid using soap mixed dish wash for plantation because it could imbalance the P^H level of the soil. Wastewater treatment is a complex exercise where communities need proper training from experts to recycle water. Generally, people in Kilinochchi seen to bath livestock from water wells. The animal bathed water can be poured to banana, neem, jack and coconut plants.

Supplementary Irrigation

Supplementary irrigation by complementing rain during periods of water deficits, at water-stress critical periods of the crop growth cycle, in order to stabilize and improve yield quantity and quality. Supplementary irrigation is a key feature, still underused, for unlocking rainfed yield potential and water productivity and water use efficiency by a temporary and discontinuous irrigation regime.

Yi et al. (2011) have read that for most of the cultivated species, legumes, sunflowers and some tree crops having a dense and deep rooting system the stages of maximum sensitivity to water stress are those from pre-flowering to fruit setting and cellular extension of fruits.

In extremely sunny dry seasons in Kilinochchi during the February-September period, an irrigation immediately after sowing is decisive in favouring a rapid crop emergence, an ideal plant density and satisfactory yields. In this connection, the experimental data obtained in southern Italy by Caliandro & Boari (1996), in dry months, stress that one irrigation immediately after sowing resulted in a grain yield increase of 132% whereas irrigations only at the booting stage or at sowing and during the booting stage caused yield increases, respectively 146%.

In dry years, one or two irrigations to broad bean and pea in flowering to seed enlargement stages, result in significant increases of yield quantity and quality. Under optimal soil moisture conditions, for sunflower, one irrigation in the period between flower bud appearance and flowering results in significant yield increases (Caliandro & Boari, 1996).

The optimal soil moisture can be achieved by applying compost fertilizer and one irrigation only is an ideal opportunity to grow sunflowers in Kilinochchi.

The surface methods (flooding, surface runoff and furrow irrigation) and sprinkling are common strategies for supplementary irrigation. The surface methods can be applied in Kilinochchi because the land is flat and does not require high capital for levelling and water distribution; sprinkler irrigation performed by different machines is the best for supplementary irrigation and can be used under all soil types; both groups of methods can be used for legumes, herbaceous and other tree crops. Among the sprinkler irrigation machines, self-propelled guns; self- propelled sprinklers, skid-mounted sprinklers, center pivot sprinklers or linear move laterals are popular.

Deficit Irrigation

Deficit irrigation is spreading limited water over a larger area, irrigation aiming at optimizing water use efficiency can be practiced in environments where the rainfall regime is such thereby not fully satisfying the crop water requirements. This system helps to gain considerably higher total crop yields and water use efficiency compared to using water for full irrigation on a smaller area (Oweis and Hachum, 2001). The groundnut requires 331mm – 616mm water supply for three seasons a year (Dharmasena, 2013). Deficit irrigation is ideal for groundnut as it does not require a considerable volume of water.

Agronomic Water Management

Multiple cropping system is quite commonly practiced in home gardens for water sharing to save water. Thus, output per unit area increases with diverse returns to the growers. The farmers should be educated about best water resources cropping systems, multiple cropping system in well water home gardening and short-term crops (45 days) with less water.

4. Proposed Framework for improved water productivity and water use efficiency

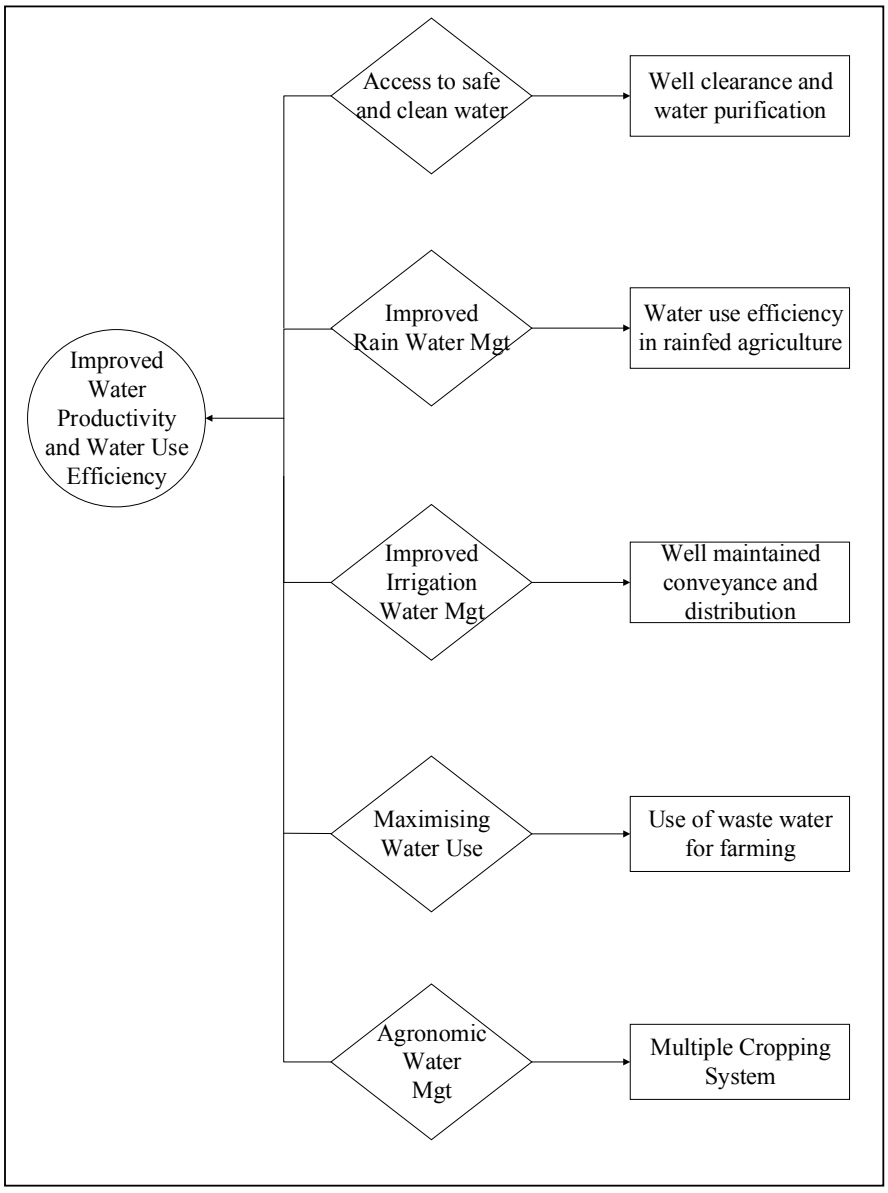
The study found that access to safe and clean water should be the priority to start SLM in post-conflict areas to ensure that people consume clean water to improve health conditions. Dumanski (1994) developed and propagated a framework for the evaluation of SLM that focusses on determining appropriate technologies in the respective water management system which should be (1) ecologically protective, (2) socially acceptable, (3) economically productive, (4) economically viable, and (5) effective in reducing risk. They explained water conservation technologies that aim to reduce negative impacts, such as salinity, physical impacts, or other chemical processes. Scientists and policy makers jointly can use the developed framework by Dumanski (1994) to evaluate potentials for enhancing sustainable water management.

In contrary, this paper focuses more on productivity as opposed to research only where the later involves more the researchers and policymakers while productivity involves more on the farmer as related to other key stakeholder including the policymakers and researchers. Hence, we present a general framework for how to improve water productivity and water use efficiency in complex areas. The development of this framework as illustrated in Figure 1 is based on the results of the literature review and observations of authors and discussions with land users in Kilinochchi district.

The framework will help increase knowledge about a practical solution to obtain clean water and prevent future kidney disease in the areas. The framework must be disseminated and explained to the land-users by the District Planning Secretariat and Northern Provincial Council. This paper argues that SLM decisions about the restoration, management, and protection of water resources have vital consequences for short-term stability, longer-term sustainable development, and successful post-conflict reconstruction.

Figure 1

The proposed Framework for improved water productivity and water use efficiency



7. Conclusions

Planned interventions in the water sector are integral to all stages of the post-conflict process, from the end of the conflict, through SLM. For the best possible use of water resources in water-scarce areas, there is a need for a comprehensive approach. This comprehensive approach includes a series of measures to be taken in a post-conflict setting: policy reforms and building of sound water institutions, careful planning of water use to achieve sustainable economic development.

Working cooperatively on crucial existential concerns may also bring people and communities together and build a norm of joint responsibility and multilateral cooperation. It is also true that these forms of cooperation may shift the focus from disconnected and short-term interactions into a continuous relationship that has scope for future larger gains. However, the positive spillover effect of this action is only possible if the involved stakeholders are prepared and willing to take advantage of it.

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ИКОНОМИЧЕСКИ ИЗСЛЕДВАНИЯ
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EFFICIENCY ANALYSIS OF AGRICULTURAL COOPERATIVES IN TRENTINO-ALTO ADIGE

Collective organization of agricultural production is assumed to be a sufficient choice taking into a consideration a several reasons why mergers of existing farms promote efficiency, such as: increase in optimal scale from reduced duplication; reduced transaction costs; synergies from complementary activities; and improved management and coordination.
Data envelopment approach (DEA) is applied to the input and output variables to reveal the efficiency levels of cooperatives in Trentino-Alto Adige in Italy. The analysis is also developed to estimate input utilization and changes that might occur in terms of their optimizations and higher level output.
JEL: D61; P32; Q13; P13; C14

Introduction

Common Agricultural Policy (CAP) is a classic example of intervention policy – product support, production quotas, aid schemes and direct payments. Early retirement schemes, grants for setting young farmers and diversification initiatives promote intra-sector structural change and assist for reduction of the low mobility of production resources. Indeed these measures are often assumed also as an impediment for the efficient allocation of resources as they are aimed at intervention in a primary production sectors. Even direct transfer payments are not qualified as an efficient instrument for employment promotion as they have a short-term effect. Defining the impact of the agricultural market policy reveals as highly problematic and controversial not only considering the expected results. The main argument supporting this statement is that the policy hardly suited and is less efficient in supporting structurally weak rural areas. Therefore characteristics of the CAP objectives have received considerable attention and discussion due to their broad impact and influence.

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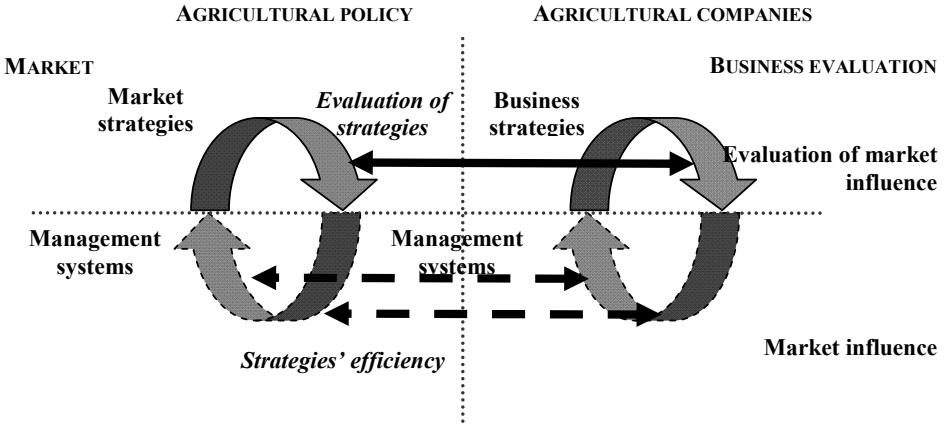
Rural areas and agricultural policy in Italy

Cluster policy at the sub-national level in Italy is enhanced by the support of strong regional governance and active society awareness. In the context of agricultural policy implementation, the term *"cluster policy"* refers to the provision of institutional incentives for companies in the sector to act as a competitive industrial framework (Figure 1).

Figure 1

Competitive agro-industrial framework



Source: Own resources.

Considering the presence of high concentration of small agricultural companies it is interesting how they appear to be competitive in terms of quality, production costs and price? The answer is in their ability to behave as part of a group, binding together on the base of produced product or geographical region and benefiting from their common competitive advantage in terms of specialization, cooperation and flexibility. Still, this characteristic of the Italian agricultural sector does not provide for equal development and adaptation of all regions. The regional economic policy is complicated and varies because of the heterogeneity of the regions. On one side they fall into different European funding categories. From the other, not all Italian regions possess the same institutional power and autonomy[4] – there are five regions with a special statute and extended legislative power – Sicily, Sardinia, Friuli–Venezia Giulia, Trentino-Alto Adige and Valle d'Aosta.

Due to the diversity of characteristics and dynamics' level of its rural regions, in Italy the Common Agricultural policy has different impact and implementation results. The most important aspect for the better accumulation of policy resources – both institutional and

[4] Constitution of the Italian Republic, Art.116, "Friuili-Venezia Giulia, Sardinia, Sicily, Trentino-Alto Adige/ Südtirol and Valle d'Aosta/ Vallee d'Aoste have special forms and conditions of autonomy pursuant to the special statutes adopted by constitutional law.

financial, is the degree of technological innovation, capital investment opportunity, intensification of the production process, level of competitiveness and environmental undertakings. The common finding about the entire development of the European agricultural sector is applicable to the development of the Italian agricultural sector: large-scale farmers and big food companies play a significant role in the agri-food chain. From one point this fact could be observed as rather beneficial, since the concentration of production and distribution process has initiated new production technologies and imposed high-quality standards for the final product. At the same time the process, acknowledged as the *"modernization"* of the agricultural sector caused its restructuring in a manner less favourable for the small-scale producers and enterprises. Their position has been even worsened when the large companies acquired some specific niche products (in respect to their quality and regional characteristics). Hence, the quality that once was found only in small-scale farms' products now could be guaranteed by the quality brands of competitive enterprises. Many traditional productions that failed to adjust to the new institutional circumstances and to apply new technological strategies just ceased their existence.

While developing their quality and improving their production technology, milk and beef production have experienced a process of de-territorialization and standardization. Strong regional identity was preserved in wine and cheese production, where local production systems have emerged, based on small-scale production. This was an opportunity to preserve small-scale and semi-subsistence farming by exploring the opportunity for part-time farming and integration through a large set of cooperative arrangements.

Beside production restructuring, there was also observed a change in the consumption behaviour and attitude. The focus has been shifted towards environmental policy and quality of production. The diversification process in the agri-food chain was associated with several different aspects like: health, quality, innovation, technological progress and preservation of traditions (Table 1).

Table 1

Perspectives of participants in the agri-food chain

Food companies	▪ Environmental measures; ▪ Market segmentation; ▪ Product innovation; ▪ Exploiting competitive advantage of the regions.
Retailers	▪ Quality standards; ▪ Extension of after-sell services.
Consumers	▪ Quality of consumption

Specificity of the agricultural production has influenced the institutional measures and initiatives taken in respect to the Common Agricultural Policy framework. This influence could be characterized in the light of *"both localization and broadening of agricultural scope". "(...) Localization through intensified interaction and cooperation is perceived as a*

viable strategy of defence"[5]. Drivers of the change in the agricultural sector in Italy could be summarized in four groups: political, economic, social and technical. Political factors are associated with the large consensus between public authorities and private sector representatives; high influence of farmers' unions and consumers' organizations; promotion of high quality and origin of production; and focus on the environmental policy. The economic factors are mainly related to the long-standing tradition resulting from a large number of family farms; concentration of retail system; and the competitive advantage of local production. As social factors, significantly contribute the level of food culture, the new trends in consumers' attitude towards smaller quantities and higher quality of food and the efficient communication between farmers and consumers. Last but not least is the importance of the technical factors and the increasing levels of the technological innovation.

Italian national reference framework *Programmi di sviluppo rurale* (2007-2013) established the basis for the regional programing in a way to allow continued progress both towards the convergence of the Italian economy with the Community average and the convergence of the economies of Italian regions amongst themselves.[6] Furthermore, even within the Italian regions with a higher level of development, particular attention is given to certain specific areas. For the entire programming period available amount was close to 8,3 million euro of which 90 % come from EAFRD and the rest from the debits of EAGGF (2000-2006) and from the CMO tobacco reform (Council Regulations (EC) 1782/2003 and 864/2004)[7]. According to the classification scheme of the policy interventions, there are four basic types of interventions: diffusion of innovation; promotion and reinforcement of the relationships among firms; diffusion of information and training to improve the internal functioning of the agricultural structures; and promotion of economic growth.

Nevertheless there are some weak aspects in characteristics of regional development that should be mentioned, such as: lack of coordination among undertaken incentives, low level of monitoring and evaluation control, policy implementation is efficient only in regions with already established efficient regional structures, and difficulty in identifying appropriate level of policy-making regarding different production sectors.

[5]Brunori, G., R. Cerutti, S. Medeot, A. Rossi, F. Valini (2002) Marketing sustainable agriculture: an analysis of the potential role of the new food supply chains insustainable rural development. Macro-level analysis of food supply chain dynamics and diversity, National report – Italy

[6]State aid N 324/2007 – Italy, Regional aid map 2007-2013

[7] In April 2004, the Council of EU Agricultural Ministers decided to reform the raw-tobacco sector in two phases: a transition phase (2006-2009) a second phase (2010 and after). At the first phase, Member States may either completely break the link between production and the financial aid provided to the tobacco sector. After 2010, all Member States will be required to completely decouple production and the aid. 50% of aid to the tobacco sector will be incorporated into the Single Payment Scheme. The other 50% will go towards strengthening rural development programmes, particularly in tobacco-growing regions.

Table 2

Strategic and Specific objectives in the RDP (2007-2013)

Strategic objectives	Specific objectives
Promotion of modernisation of businesses and integration of industries	• Increase and maintenance of the competitiveness in the agro-forestry sector is prioritised by investing in human capital through increasing training opportunities and valuing young farmers
Develop the quality of agricultural and forestry production	• Developing and modernising local infrastructures, and supply mountainous areas with it
Improvement of infrastructure	• Developing product/ process innovation
Encourage entrepreneurship	• Improving the quality of local agricultural and forestry produce through improved commercialisation services and promoting local products and tourism

The rural development programme for the next period (2014-2020) found its place in the Operational programme of the Province in Trento, which included the following three priorities:

- stimulate the competitiveness of the agricultural and forestry sector;
- ensure the sustainable management of natural resources and climate action;
- achieve balanced territorial development of rural economies and communities, including the creation and retention of jobs.

The Province proposed 12 measures with a total amount of 301 million euro of public expenditure co-financed by the European Union, the State and the Province (Sforzi et al., 2015).

Efficiency analysis

The literature on total factor productivity (TFP) growth can be broadly categorized in two main streams: frontier (parametric and non-parametric approaches) and non-frontier approach. The frontier approach, represented by Stochastic and Bayesian approach requires structuring a functional form (production, cost, profit functions or regression equations). The non-parametric estimates are conducted by data envelopment analysis, which is characterized as a linear-programming methodology. Before proceeding to the implementation of the stochastic frontier (SFA) and data envelopment analysis (DEA) to the cooperative data set, it is necessary to define the term "frontier" which appears as the key element in the analysis.

According to the definition provided by Mahadevan (2002) *"(...) a production frontier traces the set of maximum outputs obtainable from a given set of inputs and technology, and a cost frontier traces the minimum achievable cost given input prices and output. The production frontier is an unobservable function that is said to represent the 'best practice'*

function as it is a function bounding or enveloping the sample data." Data envelopment analysis (DEA) is a non-parametric approach that could be both input and output oriented. The methodology optimizes on each observation unit with the objective to calculate a discrete piecewise frontier determined by the set of Pareto efficient decision-making units. As DEA does not produce standard errors, it could not be applied in the testing hypothesis. When the analysis is oriented towards inputs, it defines the frontier by seeking the possible proportionate reduction in input usage, with the output levels hold constant. If DEA is output-oriented – it defines the maximum proportional increase of output level with input levels held fixed. The two measures provide the same results within testing constant returns to scale, but different in case of variable returns to scale.

Charnes, Cooper and Rhodes (1978) used the optimization method of mathematical programming, to generalize Farrell's (1957) single-output to single-input technical efficiency measure, to calculate multiple outputs to multiple inputs cases by construction a single "virtual" output to a single "virtual" input relative efficiency measure. The proposed CCR model estimates the overall efficiency and identifies the sources of inefficiency in the model.

It is reasonable to assume constant returns to scale (CRS) in cases when all studied decision-making units operate at the optimal scale. Nevertheless, dynamics related to market operations and the influence of other external factors suggest for more reliable assumption – variable returns to scale (VRS). Afriat (1972); Färe, Grosskopf, Logan (1983) and Banker, Charnes and Cooper (1984) adjusted the CRS DEA model to account for variable returns to scale situations. The model BCC accounts for pure efficiency and differentiates among constant, increasing and decreasing returns to scale.

One of the advantages of DEA is that the approach not only rates efficiency, but also estimates sources and amounts of the inefficiency components. The meaning of inefficiency score is calculated by a slack analysis of inefficient decision-making units, so that the result would be an operating surplus on the revenue and expense statement. DEA provides methods for estimating production frontiers and measurement of productivity that require a minimal set of assumptions regarding technology and minimum extrapolation from observed data.

There are two important properties of the efficient frontier that need to be specified (Zhu, 1996):

Property 1: Convexity $\sum_{j=1}^{n} \lambda_j x_{ij}$ (i= 1, 2, …m) and $\sum_{j=1}^{n} \lambda_j y_{rj}$ (r= 1, 2, …s) is the possible set of outputs and inputs achievable by the DMU_j, where λ_j (j= 1,2, …n) are non-negative scalars such that $\sum_{j=1}^{n} \lambda_j = 1$.

Property 2: Inefficiency: it is expected that the same level of output y_{rj} could be

$\hat{}$ $\hat{}$

Achieved by using x_{ij}, considering that $x_{ij} < x_{ij}$, or that the higher level of $\hat{y}_{rj}$ could be produced using the same quantities of input x_{ij}, satisfying the $\hat{y}_{rj} > y_{rj}$.

The input oriented DEA determines the minimization of the level of used inputs in order to produce the same level of output (Banker, Charnes, Cooper, 1984). The model is represented by:

$\theta^* = \min \theta$, subject to

$$\sum_{j=1}^{n} \lambda_j x_{ij} \leq \theta x_{i0} \qquad (i = 1, 2, \ldots m)$$

$$\sum_{j=1}^{n} \lambda_j y_{rj} > y_{r0} \qquad (r = 1, 2, \ldots s)$$

$$\sum_{j=1}^{n} \lambda_j = 1$$

$$\lambda_j \geq 0 \qquad (j = 1, 2, \ldots n),$$

where decision-making unit (DMU) represents one of the n DMUs under evaluation, x_{i0} and y_{r0} are the i-th input and r-th output of the DMU.

The value of θ represents the efficiency score of the evaluated DMU. If it is estimated that $\theta = 1$ then this is a feasible solution for the evaluated unit. This means that the current inputs cannot be reduced proportionally and that DMU has already achieved its position on the efficient frontier. In cases when $\theta \leq 1$, the DMU under evaluation is dominated by the frontier.

Important specification is given by Cooper et al. (2007) with the definition of the production possibility set P,

$$\mathbf{L} \leq e\, \boldsymbol{\lambda} \leq \mathbf{U},$$

where $e = (1 \ldots 1) \in R^n$ and, $L \leq 1$ and $U \geq 1$ are respectfully the lower and upper bounds to the intensity of λ.

In the input-oriented model the estimates of L = 1 and U = 1 signifies that the DMU operate under constant returns to scale (CRS), the values of L =0 and U = 1 correspond to increasing returns to scale and finally if L = 1 and U = ∞ then the calculations show decreasing rate of return.

Scale efficiency determines how close the estimated DMU is to the optimal scale size. Førsund and Hjalmarsson (1979) have defined three measures of scale efficiency. The first measure "*shows the distance from the observed plant to the optimal scale on the frontier function by the ratio of an input coefficient evaluated at the technically optimal scale for the observed input ratios and the corresponding observed input coefficient*" (Førsund, Hjalmarsson, 1979, pp. 294-315). The measure signifies for the possibility to achieve an optimal scale of production by relative reduction of inputs. This first measure leads to the following two measures that correspond of how the evaluated units could be moved closer

to the optimal production frontier – in horizontal or vertical direction and show the distance from the transformed isoquant corresponding to the unit's position towards the optimal scale.

Scale efficiency is calculated as the ratio of the technical efficiency (TE) estimates under the assumption of constant returns to scale (CRS) to the values of technical efficiency under the assumption of variable returns to scale (VRS) (Banker, Charnes and Cooper, 1984; Färe, Grosskopf and Lowell, 1985). The scale efficiency is given by the ratio:

$$\mathbf{SE\ (X, Y) = \theta^*_{CRS} / \theta^*_{VRS}}$$

A decision-making unit appears to be scale inefficient if it exceeds the most productive scale size (thus experiencing decreasing returns to scale), or if it is smaller than the most productive scale size and failing to take advantage of the production capacity (experiencing increasing returns to scale) (Charnes, Cooper, Lewin, Seiford, 1994). Traditional DEA does not include uncontrollable inputs in the sensitivity analysis, because by definition management cannot manipulate in terms of improvement or change these variables.

Descriptive analysis – financial ratios

During the last few decades, financial statements in the agricultural sector have been standardized, which allowed for ratios and measures commonly used in the other industrial sectors for estimating economic efficiency to be successfully applied to data sets of agricultural producers and their organizations. In the present analysis are included 69 cooperatives with location Trentino Alto-Adige, which have developed their production in three sectors – fruit and vegetables, dairy and wine. Additionally is included a forth category of cooperatives which provide services for the agricultural sector.

Relying on the available financial information, estimated financial ratios represent their liquidity and solvency for the period 2014-2015 (Table 3).

Table 3

Average value of the calculated financial ratios, 2014/ 2015

Finacial ratios	2014	2015	Mean	Median	Standard deviation
Solvency ratios					
Long term debt/ Equity - leverage	1,15	1,36	1,25	1,25	0,15
Long term debt/ Total assets	0,19	0,19	0,19	0,19	0,00
Total liabilities/ Total asset	0,67	0,69	0,68	0,68	0,01
Equity/Asset	0,28	0,26	0,27	0,27	0,01
Cash/Sales	0,10	0,08	0,09	0,09	0,01
Current liabilities/ Total liabilities	0,73	0,73	0,73	0,73	0,00
Liquidity ratios					
Tobin Q	0,95	0,95	0,95	0,95	0,00
Current ratio	1,32	1,40	1,36	1,36	0,05
Quick ratio	1,48	1,15	1,30	1,31	0,23
Depreciation/ Total sales ratio	0,04	0,04	0,04	0,04	0,00

Source: Own calculations.

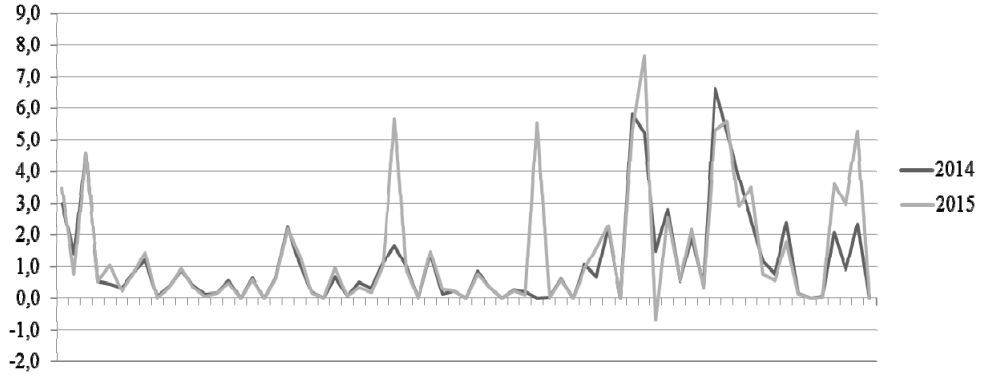
Solvency by definition is the ability to pay off all debts if the business were to be liquidated. Solvency ratios deal with the relationship among total assets, total liabilities and net worth. The three standard solvency ratios are as follows: debt to asset ratio; equity to asset ratio and debt to equity ratio. *Liquidity* measurements are concerned with the cooperative ability to generate sufficient cash flow and to maintain a balanced proportion between current assets and liabilities. These ratios are represented in the analysis by Tobin Q, current ratio, acid test. The current liabilities or the obligations that cooperatives are expected to cover during the normal operating cycle include as a general rule the information about: trade accounts, short-term notes payable, payroll liabilities, sales and taxes. The current assets should be easily converted to cash and concern the cash level, short-term investments, accounts receivables, prepaid expenses and inventory. The current ratio is calculated to signify the amount of assets available to pay current obligations. Another way to define cooperative ability to meet current obligations is simply to calculate the working capital, which is represented by the remainder of the current assets after the current liabilities are paid.

The first calculated ratio represents the relation between the *long-term debt* and the *equity* (Graph 1). The long-term debt stands for amounts owed after more than one year for goods and services purchased on credit terms. The equity represents the value of shareholders' interest in the cooperative and is calculated by decreasing total assets by total liabilities. It is composed by share capital, reserves and retained profit. As equity is derived residually any change in the value of assets and liabilities would cause a proportionately larger change in the value of equity. The long-term debt to equity ratio measures cooperatives' financial leverage. The ratio looks at how the equity of the cooperatives is leveraged by using debt capital. It compares the relationship of the amount of debt to the amount of equity for the two year period.

There are no firmly established rules for an acceptable debt-to-equity ratio. Generally speaking companies with debt exceeding 60 – 65 % of capital (that is the leverage of 1,8 : 1 or above) are less viable over a long-term period. The common rule is that if the ratio is greater than 1, the majority of assets are financed through debt. If the coefficient is smaller than 1, assets are primarily financed through equity. In the data set 61 % of cooperatives achieved debt-to-equity ratio smaller than 1. For the rest of cooperatives, the primary conclusion is that a lot of debt has been used to finance increased operations in cooperatives. These cooperatives do not possess the capacity to generate more earnings without outside financing. In the optimal case, this outside financing could increase earnings by a greater amount than the debt cost (interest) and consequently more earnings would be spread among the same amount of members. Nevertheless, the opposite situation when the cost of this debt financing might outweigh the return that the cooperatives generate on the debt through investment and business activities should not be underestimated. This could lead to lower financial results and in cases of unfavorable economic conditions even to bankruptcy.

Graph 1

Long-term debt to Equity ratio estimates (2014-2015)

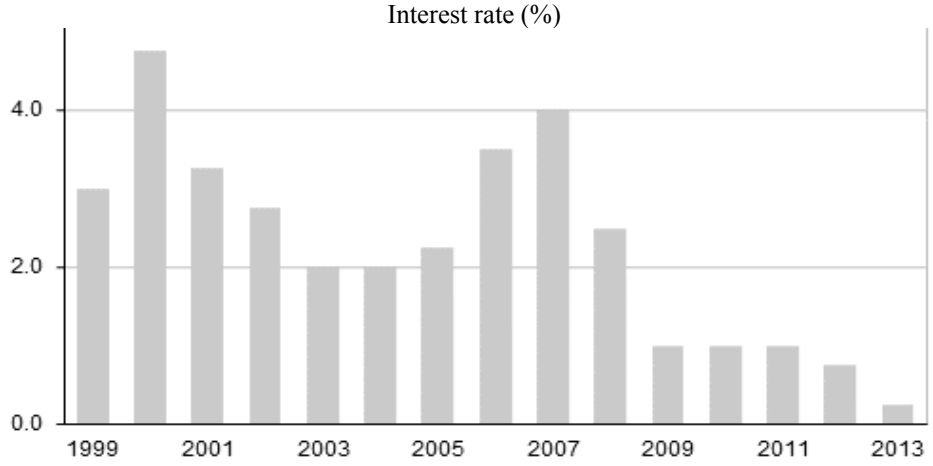


Source: Own calculations.

Investing in a company with a higher debt-to-equity ratio might be riskier, especially in times of rising interest rates, due to the additional burdening of the debt. The general information about the interest rates shows their relative decrease in the rate charged by banks on loans to prime customers (Graph 2):

Graph 2

Interest rate (%)

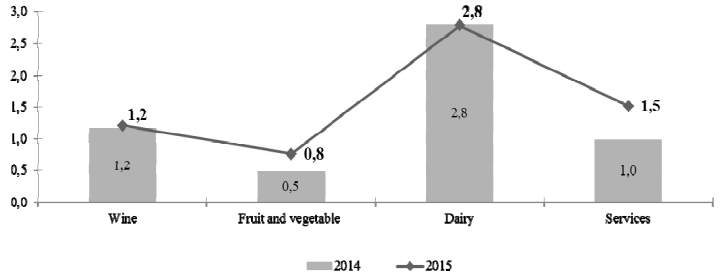


Source: Forecast economics.

The interest rate is not the only factor when assessing the financial status of the organizations. The results of the debt-to-equity ratio also depend on the sector in which the cooperatives operate and could be interpreted regarding the type of production (Graph 3).

Graph 3

Debt-to-equity ratios by sectors



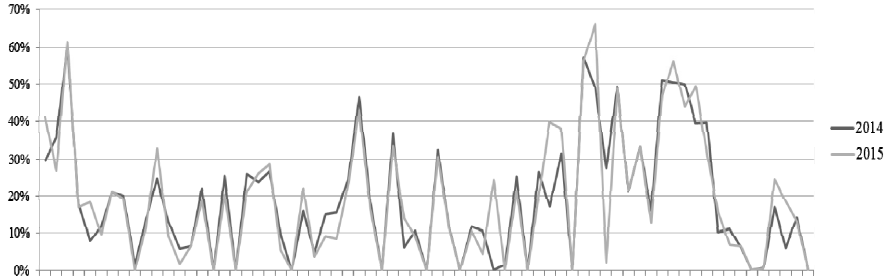
Source: Own calculations.

Capital-intensive sectors tend to have a debt-to-equity ratio above 2, while other types of industries have a debt-to-equity ratio under 0,5, which has been confirmed by the calculated ratio results per sectors. Higher coefficients' value is calculated for dairy cooperatives (average 2,8 for the two years), followed by the wine producing cooperatives (average 1,2). The debt-to-equity ratio for cooperatives in the fruit and vegetable production is estimated to 0,5 for the first year and 0,8 for 2015; while the average values of the service cooperatives are 1,25 for the entire period.

The simplest way to calculate what portion of the cooperatives' total assets is financed from long-term debt is by the ratio *long-term debt to total assets* (Graph 4) According to theoretical formulations when cooperatives have less than 25 % of their assets financed by loans or any kind of debt mechanisms they maintain their position stable. This position becomes more vulnerable if this percentage increases to 50 % and above. In the present data set, 68 % of cooperatives have less than 25 % of their assets financed by loans, and only 4 cooperatives have above 50 % of their assets financed by loans. The long-term debt to asset ratio should not be separated from the loan terms and structure of financing. In some cases, the lower interest rates and extended loan repayment could lower the cost of borrowed funds and therefore the cooperative's business could support a higher debt-to-asset ratio.

Graph 4

Long-term debt to assets ratio (%)



Source: Own calculations.

The ratio *total liabilities to total asset,* reveals another aspect of cooperatives' ability to pay their total obligations. The average ratio for 2014 is 0,67 and for 2015 0,68. This indicates that for every 1 euro of assets 0,67 to 0,68 euro cents are owned to total liabilities. The *equity-to-asset ratio* signifies the percentage of total assets that are owned by the cooperative. The average ratio of 0,27 for the two years indicates that for every 1 euro assets 0,27 euro cents are owned equity.

The financial strength of the cooperatives is further represented by the *total cash-to-total sales* ratio. This ratio looks at the effectiveness of cooperatives to collect cash payments from debtors. The higher the value of this ratio, the stronger the cooperative is. In other words, this percentage measures the cooperative ability to convert released sales into cash. The high percentage indicates that there is sufficient cash flow to finance additional production, and the low number indicates for the opposite. The calculated percentage of the cash-to-sales ratio is relatively low – 9 %. This result could be related to the seasonal character of agricultural and the contract arrangements with the wholesalers and the final customer. Producers expect to receive their payments upon the immediate sale of their production or to receive down payments. However, most of the contracts specify that cooperative receives its payments after the released sale of the production. In some cases, the crop is stored for a certain period before it is sold. All these factors contain possible reasons for the clash of interests between producers and the cooperatives. Therefore it is necessary to consider an efficient payment scheme that is consistent with cooperatives' contracts with clients and members' payment expectations. One working scheme is to organize payments to the members five times per year. Cooperative allocates the revenues in proportion to the quantities delivered, reduced with the costs related to processing and marketing of production. Another possibility is to retain a certain percentage (up to 10 %) from the revenue that would be used for the next year. This way the payments to the producers are secured no matter that the actual sale of production is still not released.

The *debt-structure ratio* measures the proportion of current liabilities to total liabilities and in general, its high value indicates for solvency problems. Regarding cooperatives included in the present dataset – their average estimated value is 0,72 and infers for relatively solvency stability. Nevertheless, calculations of this ratio do not consider the value of long-term liabilities that are included in total liabilities. In cases when their value is low, the higher values of debt structure ratio do not necessarily predict some solvency problems for cooperatives.

An appropriate way to compare the market value of the cooperatives and the value of cooperatives' assets is calculating *Tobin Q*. The ratio represents the sum of equity, liquidation value and total liabilities, divided to the value of total assets. A ratio of 1 indicates that the market value of cooperative is based solely on its assets. When the ratio is less than 1 – the market value of cooperative is less than the value of its total assets. The most efficient situation is achieved when the value of Tobin Q ratio is greater than 1. This result usually characterizes companies that operate and invest in assets that are expected to create value added. Performed calculations show that the average ratio for the data set is close to unity – 0,95. By using Tobin Q as a variable the question whether cooperative management optimizes cooperatives' value is addressed. In other words: do cooperatives trade at Tobin Q that is as high as it could be possible in the given input set? And whether

investment decisions are optimally taken? There are two necessary characteristics to be fulfilled in order to answer these questions. The first one is that the ratio should hold constant the output level and to optimize utilization of the inputs. The second characteristic implies that it is stochastic or allows errors in the estimations. These assumptions are based on the empirical results of Land et al. (1994), who estimated a strong negative relation between leverage and subsequent investment, but only for firms with weak growth opportunities or with Tobin Q less than 1. For firms with higher expectations towards cash flows and net worth, leverage is less a constraint on investment since the firms have strong growth prospective.

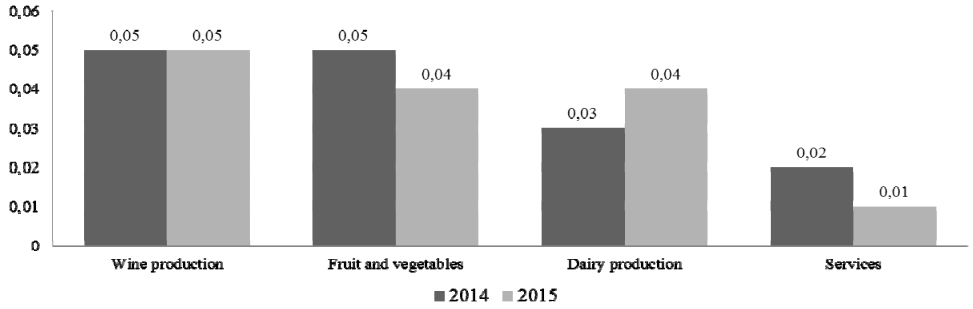
Quick ratio or the acid-test in the analysis is calculated as the sum of cash, medium-term investments and receivables (trade debtors) divided to current liabilities. Exclusion of inventories in the calculation allows for an assessment of the medium-term liquidity position of cooperatives. The ratio of 1 indicates that there are enough assets of liquid nature to cover current liabilities. The optimal value of the quick ratio varies accordingly to the type of farming activity. In general, the ratio of 1 to 1 is acceptable. However, it should be considered that the quick ratio does not predict the timing or the adequacy of the future cash flows.

The *current ratio* (working capital ratio or real ratio) is a standard measure of business' financial health. In the present dataset, it is calculated to define whether cooperatives are able to meet their current obligations by measuring if they have enough assets to cover their liabilities. The generally accepted ratio is 2:1, while the minimum acceptable ratio is 1:1. A ratio under 1:1 indicates that cooperative's current liabilities exceed its current assets and the ability to pay its obligations when they become due might be impaired. Calculations of the current ratio show that its average value is 1,35. This infers that debt of cooperatives is covered over 1,35 times in short-term aspect. It is calculated that only 6 cooperatives in the dataset have achieved the optimal current ratio of 2:1. Only 10 % of cooperatives have a current ratio under 1. It could be assumed that they have difficulties in converting account receivables to cash or have long inventory turnover cycles.

Depreciation expense to sales ratio defines the cost of depreciation of annual sales (Graph 5).

Graph 5

Average values of depreciation to sales ratio



Source: Own calculations.

By definition the greater the ratio, the more equipment and building on farms has per sales, therefore for higher profitability of cooperatives this ratio is expected to be kept low. However, the low values of the coefficient might also indicate for insufficient investment in machinery, building and storage capacity.

Data envelopment analysis (DEA) – empirical results and discussions

The calculated ratios are based on the historical information in cooperatives' financial statements. Therefore they account for the cooperatives' financial position for the past two year period and provide for general perspective of how cooperatives have maintained their business activity. Nevertheless, there are other important relationships that could be derived from the balance sheet information that should be considered as significant in studying cooperative economic efficiency. Further analysis is focused on efficiency calculation by the implementation of the data envelopment analysis.

I. Efficiency coefficients calculations

Cooperatives included in the data set represent three sectors of agricultural production – fruit and vegetables, wine and dairy products as well as a provision of services for the agricultural production.

Table 5

DEA efficiency coefficients

	2014			2015		
	Efficiency $_{CRS}$	Efficiency $_{VRS}$	Scale efficiency	Efficiency $_{CRS}$	Efficiency $_{VRS}$	Scale efficiency
Wine	0,919	0,979	0,938	0,958	0,982	0,975
Fruit and vegetables	0,958	0,974	0,985	0,966	0,979	0,986
Dairy products	0,930	0,961	0,968	0,956	0,967	0,988
Services	0,980	0,986	0,994	0,982	0,987	0,995

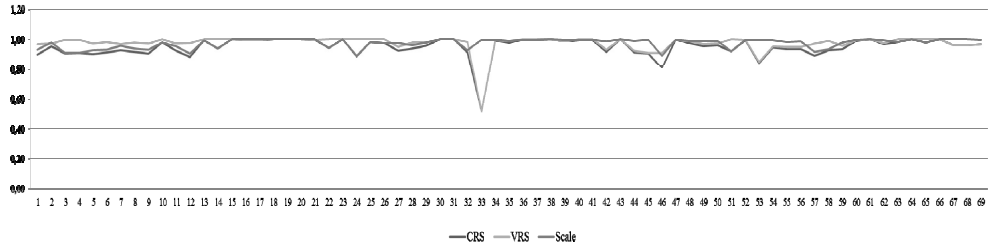
Source: Own calculation.

The highest efficiency scores are achieved by the cooperatives in the service sector. Results signify for their stable position under constant and variable returns to scale for the entire period. In 2014 cooperatives in the service sector, which represent 14 % of the total decision-making units, operate under the highest average efficiency coefficients. Their average efficiency value is 0,98 both under constant and variable returns to scale. A more intensive increase in the efficiency levels is observed among the cooperatives in wine and dairy sector, which have managed in one year to improve their productivity by 3,92 % and 2,57 % respectively. The average efficiency scores for the wine and fruit and vegetable cooperatives does not differ significantly – 0,97.

The estimated efficiency scores of the cooperative included in our dataset are represented on Graph 6.

Graph 6

Efficiency coefficients (2014)



Source: Own calculation.

In 2014 under constant returns to scale (CRS) 18,9 % of the cooperatives in the data set operate on the optimal production frontier – they have achieved an efficiency coefficient equal to unity. The rest decision-making units' efficiency coefficients range between 0,63 and 0,99. This implies that 81,2 % of the less efficient cooperatives achieve on average 0,94 of their optimal efficiency level. Calculations for variable returns to scale (VRS) show that a relatively higher percentage of cooperatives – 27,5% has achieved production at the optimal production frontier. The average efficiency score for the rest of cooperatives is estimated to 0,98. Calculated average scale efficiency is 97 %, which represents how close cooperatives are from the efficient production size.

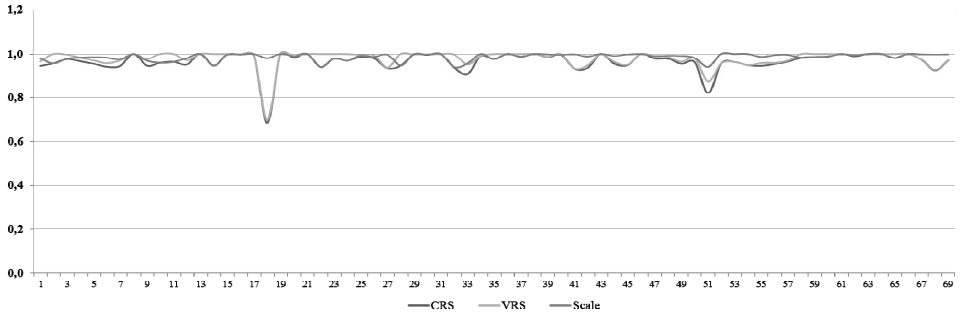
In terms of their scale economies results show that 71 % of cooperatives exceed their efficient productive scale and thus operate under decreasing rate of return. The percentage that characterizes this exceeding ranges between 9,1 and 27,3 for all included in the analysis inputs. In general, this implies that on average 24,03 % input increase will result in less than 24,03 % output increase.

Cooperatives, whose actual production scale is smaller than their potential efficient scale represent 10,1 % of the total number studied cooperatives. These cooperatives operate under increasing returns to scale and on average they have input capacity of 44,9 % that is not utilized properly in the production process.

In 2015 the least efficient sector is the dairy sector. Cooperatives that represent this type of production have achieved 96 % of their optimal efficiency levels. Regarding other three cooperative type – there is an insignificant difference among their efficiency results. Their average efficiency score is 0,98 (Graph 7).

Graph 7

Efficiency coefficients (2015)



Source: Own calculations.

The average efficiency coefficient of the cooperatives for 2015 under constant returns to scale (CRS) is 0,96. Of their total number 20,29 % perform under increasing returns to scale with average efficiency coefficient of 0,94. Cooperatives that are estimated to belong on the efficient frontier represent 18,84 % – these results do not differ substantially from the previous year. Nevertheless the majority of cooperatives in data set – 60,87 % still continue to operate under decreasing returns to scale with average efficiency coefficient of 0,96. Under estimations for variable returns to scale (VRS), 42 % of cooperatives belong to the efficient frontier. The rest less efficient units have the average coefficient of technical efficiency of 0,96.

Efficiency coefficients derived from variable returns to scale model are higher than the ones estimated by constant returns to scale model. Results give a broad picture of achieved productivity of cooperatives, as well as prove for a satisfactory efficiency level. One of the main problems that appear during studied period is that most of cooperatives operate under decreasing returns to scale. As the scale economies are the flip side of returns to scale, it is reasonable to assume that considerable part of cooperatives operates under diseconomies of scale or that their long-term average costs increase with the increase of their production.

Furthermore data envelopment analysis is developed in terms of sensitivity analysis in order to provide more detailed information about input utilization and opportunity to increase efficiency through their more appropriate re-distribution in the production process.

II. Sensitivity analysis

The calculations of this model applied to the present data set under the assumption for both CRS and VRS provide the following results:

Table 6

Calculations on possible input optimization

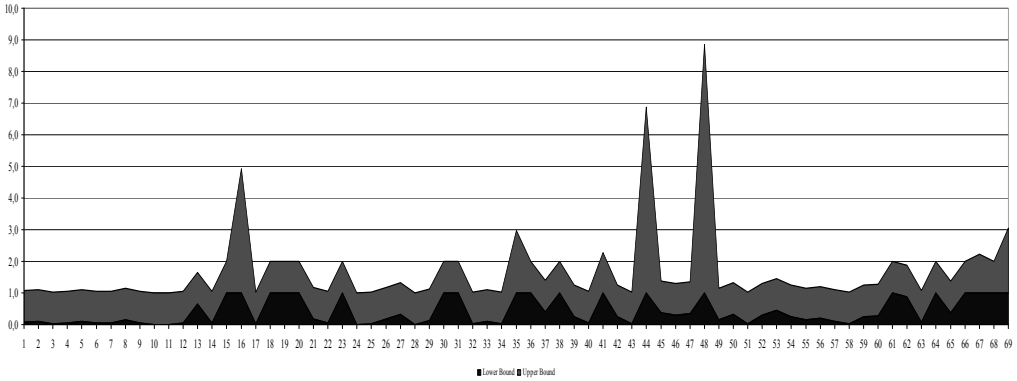
Number of cooperatives on the efficient frontier	CRS	13/ 69
	VRS	21/ 69
Number of cooperatives with less than 10% request to decrease their inputs		26/ 69
Number of cooperatives with more than 10% request to decrease their inputs		43/ 69

Source: Own calculations.

The estimates of the lower and the upper bound of stability regions under variable returns to scale are calculated for each evaluated cooperative in the data set and represented on the following Graph 8. Estimated percentages reveal by how much inputs in each cooperative could be changed (decreased or increased) without influencing its efficiency levels. For those cooperatives that have no input slacks, any input change or decrease of the output would worsen their efficiency level. In any other case, the value of β^0_k gives maximum possible optimization of the inputs (considering IRS or DRS), while preserving the efficiency level of cooperatives. Represented hypothetical frontier points of the minimum and maximum points of this increase are given in the percentage values of the lower and upper bounds.

Graph 8

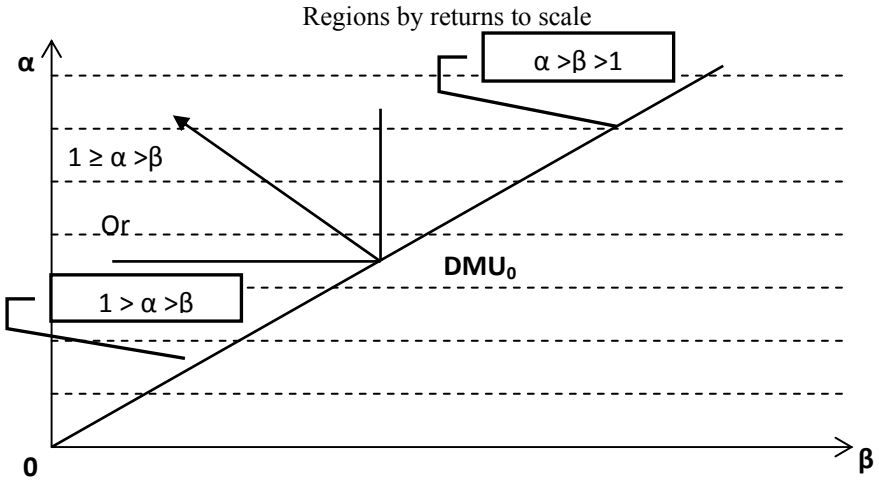
Stability regions (%)



Source: Own calculations.

Calculated bounds define the input stability region only for these cooperatives that remain efficient even after they increase their inputs within these bounds. Defined regions are associated with the directions of the returns to scale – constant, increasing or decreasing (Graph 9). According to the variables – α represents proportional change in the outputs of cooperatives, while β stands for the proportional change of all inputs utilized in the production process. Increasing returns to scale occur when $\alpha > \beta > 1$ for each decision-making unit, $1 > \alpha > \beta$ indicates for decreasing returns to scale. The cooperatives that fall in between $1 \geq \alpha > \beta$ or $1 > \alpha \geq \beta$ means that they are technically inefficient.

Graph 9



Further analysis reveals three sensitivity regions, accordingly to the performed returns to scales in cooperatives. In 2014 for the Region I are included 7 cooperatives that operate under increasing returns to scale – they do not explore their optimal production capacity and still have the opportunity to increase it (Table 7).

In the Region II belong 13 cooperatives that operate on the optimal production frontier under constant returns to scale. As it was expected the calculations under VRS have placed more cooperatives on the efficient production frontier. At the same time there is a considerable excess of inputs being used to produce less output– the rest 49 cooperatives included in Region III operate under decreasing returns to scale.

An interesting result reveals the sensitivity analysis for 2015 estimating six sensitivity regions (Table 8). The Region I is represented by 12 cooperatives that operate under an increasing return to scale. Their average efficiency under constant returns to scale is 0,94, while calculations assuming variable returns to scale estimate efficiency coefficient of 0,95. Under constant returns to scale perform 13 of the cooperatives (Region II). Their technical efficiency is estimated to be 1 and thus they are defined as the benchmark in the data set, belonging to the best-practice frontier. The majority of the cooperatives that fall in the third region (Region III) operate under a decreasing rate of return. 40 cooperatives are estimated on average with 0,961 (CRS) and 0,982 (VRS) technical efficiency coefficients.

Table 7

Stability regions (2014)

	Region I		Region II		Region III	
No	**CRS**	**VRS**	**CRS**	**VRS**	**CRS**	**VRS**
1	1,00	1,00	1	1	0,90	0,97
2	0,98	0,99	1	1	0,95	0,97
3	0,99	0,99	1	1	0,91	1,00
4	0,91	0,92	1	1	0,91	1,00
5	0,98	0,99	1	1	0,90	0,97
6	0,96	0,96	1	1	0,91	0,98
7	0,96	0,96	1	1	0,93	0,97
8			1	1	0,92	0,98
9			1	1	0,91	0,98
10			1	1	0,98	1,00
11			1	1	0,92	0,97
12			1	1	0,89	0,99
13			1	1	0,99	1,00
14					0,94	1,00
15					0,99	0,99
16					0,99	1,00
17					0,94	1,00
18					0,89	1,00
19					0,98	0,99
20					0,97	1,00
21					0,93	0,95
22					0,94	1,00
23					0,96	0,98
24					0,91	0,98
25					0,64	1,00
26					0,99	0,99
27					0,99	1,00
28					0,98	0,98
29					0,99	0,99
30					0,92	0,93
31					1,00	1,00
32					0,91	0,91
33					0,81	0,91
34					0,99	1,00
35					0,95	0,97
36					0,96	0,97
37					0,92	1,00
38					0,99	1,00
39					0,85	0,85
40					0,95	0,95
41					0,93	0,95
42					0,94	0,95
43					0,89	0,97
44					0,93	0,99
45					0,93	0,96
46					0,99	0,99
47					0,98	0,98
48					0,98	1,00
49					0,98	1,00

Source: Own calculations.

Table 8

Stability regions (2015)

	Region I*		Region II**		Region III***		Region IV****		Region V*****		Region VI******	
No	**CRS**	**VRS**	**CRS**	**VRS**	**CRS**	**VRS**	**CRS**	**VRS**	**CRS**	**VRS**	**CRS**	**VRS**
1	0,996	0,998	1,000	1,000	0,943	0,964	0,978	1,000	0,956	0,956	0,962	0,962
2	0,994	0,994	1,000	1,000	0,955	1,000	-	-	0,947	0,947	-	-
3	0,686	0,700	1,000	1,000	0,974	0,997	-	-	-	-	-	-
4	0,908	0,950	1,000	1,000	0,965	0,982	-	-	-	-	-	-
5	0,990	0,990	1,000	1,000	0,954	0,969	-	-	-	-	-	-
6	0,976	1,000	1,000	1,000	0,940	0,956	-	-	-	-	-	-
7	0,931	0,933	1,000	1,000	0,944	0,969	-	-	-	-	-	-
8	0,953	0,962	1,000	1,000	0,945	0,976	-	-	-	-	-	-
9	0,978	0,986	1,000	1,000	0,959	1,000	-	-	-	-	-	-
10	0,972	0,973	1,000	1,000	0,963	1,000	-	-	-	-	-	-
11	0,923	0,926	1,000	1,000	0,951	0,970	-	-	-	-	-	-
12	0,970	0,972	1,000	1,000	0,945	1,000	-	-	-	-	-	-
13	-	-	1,000	1,000	0,996	1,000	-	-	-	-	-	-
14	-	-	-	-	0,982	0,991	-	-	-	-	-	-
15	-	-	-	-	0,939	1,000	-	-	-	-	-	-
16	-	-	-	-	0,968	1,000	-	-	-	-	-	-
17	-	-	-	-	0,987	0,995	-	-	-	-	-	-
18	-	-	-	-	0,979	0,993	-	-	-	-	-	-
19	-	-	-	-	0,933	0,936	-	-	-	-	-	-
20	-	-	-	-	0,946	1,000	-	-	-	-	-	-
21	-	-	-	-	0,997	0,998	-	-	-	-	-	-
22	-	-	-	-	0,995	0,999	-	-	-	-	-	-
23	-	-	-	-	0,936	0,998	-	-	-	-	-	-
24	-	-	-	-	0,987	1,000	-	-	-	-	-	-
25	-	-	-	-	0,984	0,986	-	-	-	-	-	-
26	-	-	-	-	0,995	1,000	-	-	-	-	-	-
27	-	-	-	-	0,935	0,947	-	-	-	-	-	-
28	-	-	-	-	0,948	0,950	-	-	-	-	-	-
29	-	-	-	-	0,979	0,990	-	-	-	-	-	-
30	-	-	-	-	0,953	0,963	-	-	-	-	-	-
31	-	-	-	-	0,960	0,979	-	-	-	-	-	-
32	-	-	-	-	0,821	0,875	-	-	-	-	-	-
33	-	-	-	-	0,944	0,958	-	-	-	-	-	-
34	-	-	-	-	0,953	0,958	-	-	-	-	-	-
35	-	-	-	-	0,964	0,969	-	-	-	-	-	-
36	-	-	-	-	0,982	1,000	-	-	-	-	-	-
37	-	-	-	-	0,985	1,000	-	-	-	-	-	-
38	-	-	-	-	0,987	1,000	-	-	-	-	-	-
39	-	-	-	-	0,989	0,996	-	-	-	-	-	-
40	-	-	-	-	0,981	1,000	-	-	-	-	-	-

* Increasing returns to scale
** Constant returns to scale
*** Decreasing returns to scale
**** Increasing returns to scale in input-oriented DEA calculations, constant returns to scale in output-oriented DEA calculations
***** Constant returns to scale in input-oriented DEA calculations, decreasing returns to scale in output-oriented DEA calculations
****** Increasing returns to scale in input-oriented DEA calculations, decreasing returns to scale in output-oriented DEA calculations

Source: Own calculations.

To the region IV belongs only one cooperative with technical efficiency coefficient of 0,978 (CRS) and 1 (VRS). This unit appears to operate under increasing returns to scale

when input-oriented DEA is performed, but under constant returns to scale when output-oriented DEA is calculated. A possible conclusion is that this cooperative operates on the edges of the production frontier and could not be easily associated with a particular type of returns to scale.

For the two cooperatives that fall into Region V the average efficiency estimates are 0,951 both under CRS and VRS. When input-oriented DEA is calculated it appears that these cooperatives perform under constant returns to scale, while according to output-oriented DEA they operate under decreasing rate of returns. The last Region VI is represented only by one cooperative that operate under increasing returns to scale when input-oriented DEA is calculated, but under decreasing returns to scale when output-oriented DEA is performed. For the case of the last two regions it is difficult to specify the type of returns to scale. Golany (1997) suggests that: *"(…) no feasible solution exists in the region (i) since the existence of a convex combination of other DMUs in region (ii), established in the current solution, indicates that DMU_0 lies on a decreasing RTS piece of the frontier and the piece-wise concavity assumption precludes the possibility of an increasing RTS piece to the 'right' of a decreasing RTS piece"*[8].

Identification of returns to scale for each cooperative in the data set is incomplete unless an additional sensitivity analysis is executed. Therefore the maximum possible optimization of each one of the inputs is calculated, by holding the rest inputs and outputs unchanged. Subject to the condition that only the evaluated input is changed, results separately show the possible percentage increase of production costs, salaries, total fixed assets, depreciation and investments. Efficiency coefficients of the cooperatives that initially are estimated to belong on the production frontier decrease, while the efficiency of the remaining cooperatives improves.

In the sensitivity analysis of production costs, 10 cooperatives are estimated as the most efficient – achieving technical efficiency coefficient of 1. Their production costs are proportionally increased, in the way that their output decreases and these units become the infeasible solution in the data set. At the same time production costs in the remaining cooperatives are optimized so that the efficiency of these units improves. The change appears only in the production costs – the rest inputs are held constant. The results show that production costs in the less efficient cooperatives have been decreased by 24,1 % and individual technical efficiency on average has increased by 2,57 %.

The same calculations are performed for the rest inputs. The results are presented on the following Table 9:

[8] Golany, B.; Gang Yu (1997) Estimating returns to scale in DEA; European Journal of Operational Research 103, pp. 28-37

Table 9

Sensitivity analysis (2014)

	Average change in the data set (%)	Optimal λ (%)	Increase of the efficiency coefficients (%)
Production costs	98,03	24,1	2,57
Salaries	26,7	18,5	8,7
TFA	36,7	2,16	3,43
Depreciation	33,7	30,6	24,69
Investments	75,6	32,7	25,08

Source: Own calculation.

Redistribution of production and investment cost further significant influence over improvement of technical efficiency of cooperatives. Average redistribution of salary costs equal to 18,5 %, which reflects on 8,7 % increase of efficiency levels achieved by cooperatives in data set. Sensitivity analysis of total assets reveals that while increasing this category in the most efficient cooperatives (17 units), the rest of the cooperatives have improved the average level of their efficiency coefficient with 3,43%. Percentage change in re-allocation of this input equals to 36,7 %. Therefore depreciation costs are also added in the analysis, which initially is difficult to measure, considering the difference that sometimes may occur in terms of their economic and accounting value. Changes in depreciation costs are on average 33,7 % and they have managed to increase the average efficiency level by 24,7 %.

These conclusions are confirmed in the following 2015 year (Table 10). The fixed assets and depreciation costs remain the main source for improvement of the efficiency levels.

Table 10

Sensitivity analysis (2015)

	Average change in the data set (%)	Optimal λ (%)	Increase of the efficiency coefficients (%)
Production costs	97,9	18,11	8,29
Salaries	8,7	31,68	11,8
TFA	34,4	40,0	2,21
Depreciation	32,8	33,7	20,2
Investments	99,7	39,8	30,13

Source: Own calculations.

The most considerable contribution for improvement of efficiency is provided by optimized utilization of investment costs, which on average results in 30 % increase in the total generated efficiency results. Another cost category, which needs to be optimized in order to increase efficiency levels by 11,8 % are the salary expenditures.

As previously estimated, results suggest for necessity in optimization in costs related to maintaining the production process, as well as the payment of the employees. There is also another conclusion that draws attention. Results point to the importance of fixed costs,

which in the agricultural sector is not an isolated case[9] and in the present analysis corroborates to the calculations of depreciation to sales ratio for the period.

III. Slack-based model

As already described DEA calculates input and output slacks for each cooperative that is under evaluation. Input slacks indicate for proportionate reduction of inputs and at the same time preserving the same level of output. Under constant returns to scale estimated results show that there is a possibility to reduce on average up to 33,55 % of the costs related to salaries. Costs related to fixed assets consumption during production period could be reduced up to 23,19 %. The contribution of medium-term investments could be optimized by 39,13 %.

The same calculations are conducted under condition of variable returns to scale. Results indicate that cooperatives could reduce their salary costs by 14,70 %. The share of costs related to fixed assets utilization could be optimized up to 19,70 %, while medium-term investments that contribute to the final output could be redistributed to more profitable areas in cooperatives by 34,19 %.

Output slacks calculated under assumption for constant and variable returns to scale are insignificant. The opportunity to increase production value and sales is less than 1%. The increase of the production value under variable returns to scale is less than 1 percent, while sale could be increased with 2 %.

For 2015 under variable returns to scale is calculated that 32,23 % of salary costs could be redistributed or utilized for other production purposes. Percentages of total fixed assets' and investments' slacks amount to 40,6 % and 42,43 % respectively. Calculated outputs slacks in terms of achieved production value do not differ from the previous year – the percentage amount to 1,40. An unexpected increase of sales' slack occurs – 11,10 %.

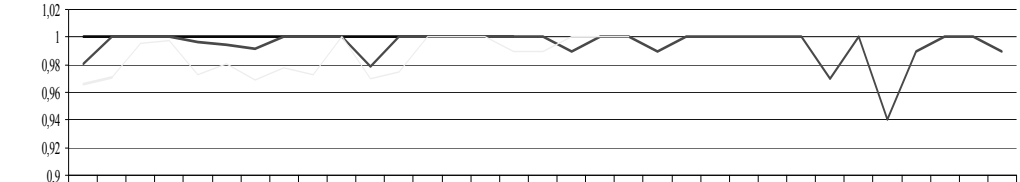
IV. Context-dependent DEA

Context-dependent DEA applied to our dataset for 2014 introduced three levels best-practice frontiers (Graph 10). The range of the efficiency coefficients on the Level 1 range between 0,97 – 1 and includes 20 cooperatives. The second-level frontier allows improving the efficiency of the remaining cooperatives. Estimated efficiency scores vary in between 0,94 – 1 and include 33 cooperatives. The third-level frontier includes the remaining 16 cooperatives with efficiency of 1.

[9] "(…)Silva (2001) found the animal feeding and equipment depreciation in the Azorean dairy farms of great importance, about 27% and 13% of total costs, respectfully", In "An application of data envelopment analysis (DEA) in Azores dairy farms"; Silva, E., A. Azrubi, J. Berbel (2004) New MEDIT, A Mediterranean Journal of Economics, Agriculture and Environment, vol.3, 3, pp.39-43

Graph 10

Context-dependent DEA (2014)



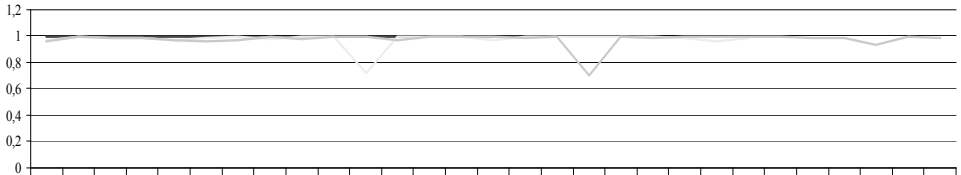
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
Level 3	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1																	
Level 2	0,98	1	1	1	1,00	0,99	0,99	1	1	1	0,98	1	1	1	1	1	1	0,99	1	1	0,99	1	1	1	1	1	0,97	1	0,94	0,99	1	1	0,99
Level 1	0,97	0,97	1	1	0,97	0,98	0,97	0,98	0,97	1	0,97	0,97	1	1	1	0,99	0,99	1	1	1													

Source: Own calculations.

Results for 2015 are presented on Graph 11. The first-level best-practice frontier is represented by 29 cooperatives with efficiency coefficients ranging between 0,70 – 1. Consequently, the algorithm introduces the second best-practice frontier, which includes 23 from the remaining cooperatives in the data set with efficiency coefficients between 0,72 – 1. The third-level best-practice frontier includes 17 cooperatives with higher efficiency estimates 0,99 – 1. Apparently the Level 4 is represented only by one cooperative with technical efficiency of 1.

Graph 11

Context-dependent DEA (2015)



	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
Level 4	1																												
Level 3	1	1	1	1	1	1	1	0,99	1	1	1	1	1	1	1	1	1												
Level 2	0,97	1	0,99	0,99	0,97	0,99	1	0,98	1	1	0,72	1	1	1	0,97	1	1	1	1	1	0,99	0,96	0,99						
Level 1	0,96	1	0,99	0,98	0,97	0,96	0,97	1	0,98	1	1	0,97	1	1	1	0,99	0,99	0,70	1	0,99	1	1	1	1	0,99	0,99	0,93	1	0,99

Source: Own calculations.

V. Malmquist Index

One of the advantages of the DEA is the possibility to measure the change of the efficiency over time, as well as the change in the efficient frontier. This is provided by a methodology which as an example of comparative statistics allows for estimating the dynamics in the data set. The *"catch up"* effect calculates the degree to which the decision-making unit improves or worsens over time. The progress or regress of the frontier technology between

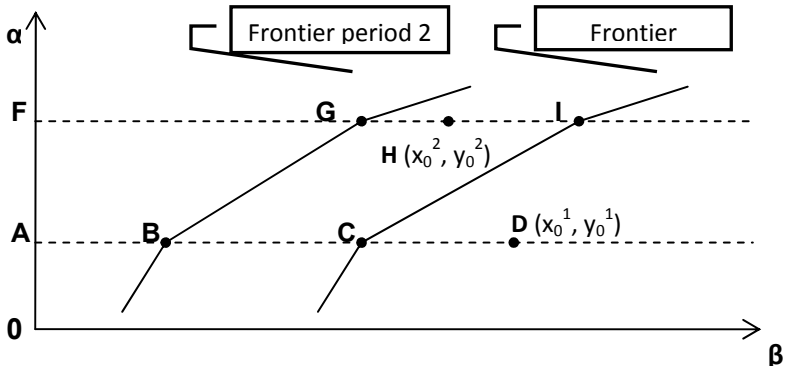
two periods of time under the multiple inputs and outputs is addressed by the *"frontier shift"* effect. The so-called Malmquist index represents the Total Factor Productivity (TFP) and is computed as a product of the "catch up" and the "frontier effect".

The Graph 9 is transformed in Graph 10 to represent these effects in terms of their calculations in our analysis. The production possibility set is defined by:

$$(X, Y)^t = \{ (x, y) | \; x \geq \sum_{j=1}^{n} \lambda_j x_j^t, \; 0 \leq y \leq \sum_{j=1}^{n} \lambda_j y_j^t, \; L \leq e\lambda \leq U, \; \lambda \geq 0 \}$$

Graph 10

Malmquist index



The catch-up effect is represented by the ratio of efficiency estimates for the second period to the efficiency estimates for the first period, or:

Catch up effect = Efficiency of (x_0^2, y_0^2) with respect to period 2 frontier

Efficiency of (x_0^1, y_0^1) with respect to period 1 frontier

Progress in the relative estimated efficiency is proven when the coefficient of representing the catch-up effect is higher than 1. In the cases when this coefficient is equal to or less than 1 the conclusion points out no change or regress in the efficiency frontier.

Furthermore to evaluate fully productivity change the frontier-shift effect is calculated. According to Cooper et al. (2007) this effect is addressed also as an innovation effect. Considering Graph 17 the frontier-shift effect is represented by:

φ_1 = AC/AD : AB/AD

φ_2 = FI/FH : FG/FH

Respectfully *frontier shift effect* for the two periods is defined by $\varphi = \sqrt{\varphi_1 \varphi_2}$. In the cases when $\varphi > 1$, there is a progress in the frontier technology, while $\varphi = 1$ or $\varphi < 1$ indicate for status quo and regress in the frontier technology.

Table 11

Malmquist productivity index – results

No.	Technical efficiency change			Malmquist index	Efficiency change 2014-2015	Frontier shift
	Total	Pure efficiency	Scale efficiency			
1	0,9006	0,9664	0,9319	0,8747	1,0476	0,8349
2	0,9514	0,9709	0,9800	0,9735	1,0041	0,9696
3	0,9070	0,9959	0,9107	0,8972	1,0745	0,8350
4	0,9087	0,9977	0,9108	0,9011	1,0623	0,8483
5	0,9036	0,9727	0,9289	0,8932	1,0556	0,8461
6	0,9135	0,9804	0,9318	0,8506	1,0288	0,8268
7	0,9285	0,9688	0,9583	0,8869	1,0167	0,8723
8	0,9167	0,9780	0,9373	1,0283	1,0908	0,9426
9	0,9062	0,9725	0,9319	0,8746	1,0428	0,8387
10	0,9790	1	0,9790	0,9344	0,9791	0,9543
11	0,9227	0,9699	0,9513	0,9500	1,0433	0,9106
12	0,8845	0,9746	0,9075	0,9023	1,0747	0,8396
13	0,9933	1	0,9933	1,0164	1,0067	1,0096
14	0,9387	1	0,9387	0,9387	1,0065	0,9327
15	1	1	1	0,9981	0,9962	1,0019
16	0,9956	0,9971	0,9984	0,9956	1,0004	0,9951
17	0,9939	0,9952	0,9987	0,9933	1,0005	0,9928
18	1	1	1	0,4423	0,6863	0,6445
19	1	1	1	1,0031	1	1,0031
20	1	1	1	0,9847	0,9816	1,0032
21	0,9953	0,9968	0,9985	1,0052	1,0048	1,0004
22	0,9410	0,9995	0,9415	0,9420	0,9974	0,9444
23	1	1	1	0,8780	1	0,8780
24	0,8897	0,9984	0,8911	0,9240	1,0884	0,8489
25	0,9825	1	0,9825	0,9877	1,0045	0,9832
26	0,9751	0,9989	0,9762	0,9700	1,0038	0,9664
27	0,9257	0,9489	0,9755	0,9119	1,0079	0,9048
28	0,9402	0,9797	0,9597	0,9375	1,0057	0,9322
29	0,9582	0,9797	0,9780	0,9406	1,0406	0,9039
30	1	1	1	0,9964	0,9949	1,0015
31	1	1	1	1,6584	1	1,6584
32	0,9127	0,9835	0,9280	0,9488	1,0255	0,9252
33	0,5204	0,5232	0,9946	0,6463	1,7440	0,3706
34	0,9876	0,9911	0,9965	0,9898	1,0021	0,9877
35	0,9790	0,9892	0,9897	0,9777	0,9971	0,9805
36	0,9976	1	0,9976	0,9882	1,0024	0,9858
37	0,9955	1	0,9955	0,9884	0,9911	0,9973
38	1	1	1	1,3798	1	1,3798
39	0,9849	0,9870	0,9978	0,9840	0,9996	0,9844
40	0,9932	1	0,9932	0,9950	1,0020	0,9930
41	0,9933	0,9987	0,9946	0,9316	0,9375	0,9937
42	0,9175	0,9311	0,9854	0,9298	1,0195	0,9120
43	0,9989	1	0,9989	1,0032	1,0011	1,0020
44	0,9135	0,9238	0,9889	0,9442	1,0433	0,9050
45	0,9057	0,9086	0,9968	0,9294	1,0465	0,8881
46	0,8119	0,9095	0,8927	1,0116	1,2317	0,8213
47	0,9945	0,9968	0,9978	0,9919	0,9845	1,0075
48	0,9732	0,9843	0,9887	0,9772	1,0047	0,9727
49	0,9544	0,9679	0,9860	0,9430	0,9991	0,9439
50	0,9606	0,9713	0,9890	0,9656	0,9999	0,9658
51	0,9204	0,9985	0,9218	0,8220	0,8924	0,9211
52	0,9934	0,9958	0,9976	0,9551	0,9620	0,9929
53	0,8459	0,8535	0,9912	0,9754	1,1367	0,8580
54	0,9462	0,9533	0,9925	0,9305	1,0010	0,9296
55	0,9340	0,9504	0,9828	0,9386	1,0108	0,9285
56	0,9360	0,9500	0,9852	0,9451	1,0176	0,9288
57	0,8922	0,9716	0,9183	0,9480	1,0805	0,8773

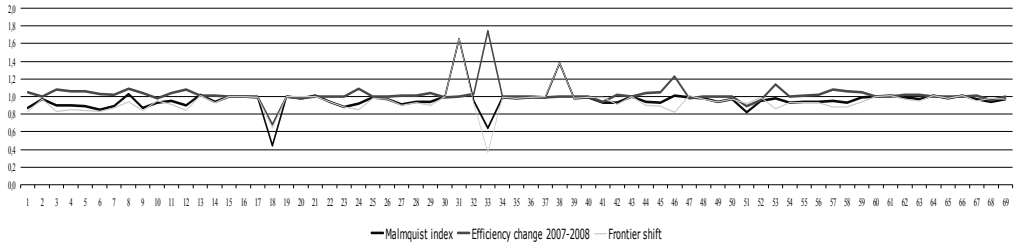
Source: Own calculations

Table 11 represents calculated Malmquist indices, as well as the decomposition into indices of efficiency change and frontier shift over the period 2014-2015. As already mentioned, the values of Malmquist index which are higher than 1 signify for improvement, while in contrary when these values are less than 1 there is regress in productivity observed. Efficiency coefficients and their change are decomposed into pure and scale efficiency. Calculated results show an increase in productivity, but do not favour innovation effect. The catch-up effect signifies that there is an increase in the relative efficiency, proven by the average coefficient of efficiency change – 1,023. Results show that the percentage of cooperatives that have managed to improve their relative efficiency is significantly high – 65,2 %. Among all decision-making units in the data set 24,6 % have shown regress in efficiency, while 10,2 % have kept their relatively stable position and signify for no change in the efficiency. The rest 24,6 % have registered regress in their efficiency.

The analysis by sectors shows that the biggest improvement is in the winery sector where the productivity increases by 1,04 %, followed by the dairy sector 1,03 %, fruit and vegetable sector (1,01 %) and services (1 %).

Graph 12

Total factor productivity (2014-2015)



Source: Own calculations.

The answer to the question of whether the progress in efficiency is due to improvement in production technology is negative. The calculated frontier-shift effect signifies for regress in frontier technology, as its value is 0,945. Only 18,84 % from the total number of cooperatives have indicated for progress in the production technology. Cooperatives in the wine sectors are mostly acknowledged as market stable with more advanced technology although the results show an interesting turn. Only in the fruit and vegetable sector the increase of the productivity is due to the positive change in their pure efficiency. Of their total number 43,8 % have registered an increase in pure efficiency coefficient.

The average value of the Malmquist index is 0,98 that is close to unity, but still according to the theoretical explanations signifies for the deterioration in the total factor productivity. This result is mostly justified by the regress in the frontier technology.

Conclusion

Data envelopment approach is applied to the input and output variables to reveal the efficiency levels of cooperatives included in the dataset. Besides these results, the analysis is developed in sensitivity analysis and slack-based model, which aim at estimating input utilization and changes that might occur in terms of their optimizations toward achieving higher level output. The context-dependent DEA reveals an algorithm that structures new frontiers by allowing for the inefficient decision-making units to become relatively efficient by gradually removing the efficient ones. Calculated Malmquist index measures the total factor productivity of the cooperatives for the period 2014-2015.

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SUMMARIES

Samir Amine
Sylvain Baumann
Pedro Lages Dos Santos

BARGAINING SOLUTIONS AND PUBLIC POLICIES IN MATCHING MODELS

The aim of this paper is to show that usually the literature under or overestimate the effect of public policies on the labor market by using systematically a symmetric Nash bargaining solution to share the surplus between worker and firm. Indeed, using a matching model framework, we compare and analyze Nash, Egalitarian, Kalai-Smorodinsky and Equal-Sacrifice solutions. We show that the effects of public policies, as minimum wage or unemployment benefits, would be more or less significative depending on the bargaining solution. It appears that Nash and egalitarian solutions are less inclined to study the impacts of the introduction of the minimum wage.
JEL: C78; J64; J68

Anna Schmeleva
Nina Goridko

OPERATING EFFICIENCY OF QUALITY MANAGEMENT SYSTEM OF STATE EXECUTIVE AUTHORITIES

This paper is aimed at justifying the application of the methodology for evaluation and improvement of the operating efficiency of the quality management system (QMS) for state executive bodies. The term "operating efficiency of QMS" is considered by the authors as a ratio between the effectiveness of the group of QMS processes "Management responsibility" and the resources used for their development, implementation and improvement. The term "management responsibility" means "the responsibility of officials implementing powers of the authority". The relevance of the article is dictated by the fact that on the one hand, the normative legal acts issued by the Government of the Russian Federation declare the primacy of the problems of life quality improving, health preservation and increasing of citizens' life expectancy, on the other hand, they initiate an increase of the retirement age and practically a "lifelong" need of citizens labor activity. This problem stirred the Russian public and pointed once again to the low quality of the country social management and the need to assess the responsibility of officials implementing powers of the authority.
JEL: O11; O21; O43; P11

Nataliia Parkhomenko
Iryna Otenko

MECHANISM OF DETERMINING COMPETITIVE ADVANTAGES OF BUSINESS SYSTEMS IN GLOBAL ENVIRONMENT

In a global environment, it is impossible to apply national principles of business and the requirements of the laws of an individual state, business systems develop and interact with each other, which requires constant monitoring and forecasting of possible directions of development, therefore, the purpose of the research is to create a mechanism for the identification and evaluation of the competitive advantages of international business entities. Particular importance is the ability of

business systems to gain combined competitive advantages in international and local markets, which uses methods of comparative, factor and system-structural analysis, expert evaluations. As a result of the research, the process of ensuring the implementation of competitive advantages of international business entities was formed, which will allow the firm to hold a competitive advantage longer, since the sources of competitive advantage are determined. Advantages of a low level, such as cheap labor or raw materials, can easily be obtained by competitors. Advantages of a higher order are proprietary technology, differentiation based on unique goods or services, reputation of a firm based on enhanced marketing activities, or close customer relationships require more elaboration and resources. Determination of competitive advantages becomes the basis for the formation of information for planning the activities of subjects of international business in conditions of disintegration of the economy. The formed mechanism for identifying competitive advantages has been adapted to the peculiarities of the activities of international business entities, which has made it possible to consistently identify, analyze and exploit competitive advantages in the relevant markets. In the process of implementing the mechanism, it is proposed to use an integral indicator of the assessment of the competitive advantages of subsystems of international business entities, which is adapted at the enterprises of machine building of Ukraine.
JEL: D41; F23; M16

Ani Stoykova
Mariya Paskaleva

CORRELATION DYNAMICS BETWEEN SOUTHEAST EUROPEAN CAPITAL MARKETS

This study examines the linkages between eight South East European emerging stock markets and three reference ones during the period 2005-2015 In this study we prove that there is a weak or moderate positive correlation between the reference capital markets of Turkey, Greece and Croatia and the other examined markets. All things considered, it seems reasonable to assume that there is a strong relationship between SEE capital markets. What is more, the degree of the development of the SEE capital markets determines the linkages between them, while the reference capital markets are with weaker correlation in the group than the developing markets. The developing capital markets of the explored group are strongly determined by country-specific factors, but five of them are strongly influenced by the Greek innovations. However, the market integration is anticipated to strengthen, as a result of EU expansion, as the implementation of Strategy 2020. These countries will take profit if their capital markets are more accessible to foreign investors, reorganizing them in conditions to international law in order to defend foreign investors.
JEL: C32; E27; G15

Jelena Andrašić
Nada Milenković
Kristina Mijić
Vera Mirović
Branimir Kalaš

THE IMPACT OF ACQUISITIONS ON PROFITABILITY: EVIDENCE FROM THE BANKING SECTOR IN SERBIA

The paper presents the results of a study of the state and dynamics of the foreign trade of Bulgaria with some of the commodities of the country's trade list – the ones from class “Ores and Concentrates”. It covers the period 2000-2016. Foreign trade situation is defined on the basis of

processing and analyzing data published by national and international organizations. State and trends of Bulgaria's foreign trade with these strategic products of the mining industry are assessed in the context of the rapidly changing national, European and global market situation. The geographic concentration and sustainability of exports and imports are determined by developing specific coefficients. On this methodological basis, summaries have been made about the current foreign trade situation.
JEL: F14; F16; F50; L70

Oksana Omelchenko
Oleksandr Dorokhov
Oleg Kolodiziev
Liudmyla Dorokhova

FUZZY MODELING OF THE CREDITWORTHINESS ASSESSMENTS OF BANK'S POTENTIAL BORROWERS IN UKRAINE

The work is aimed at defining the directions of credit activity intensification of the economic entities through critical analysis of banks as a powerful leverage of raising additional resources and ensuring sufficient conditions for the development of entrepreneurship. The system of management of quality credit portfolio has considered as the basis for increasing the capacity of the banking system and development the credit relations in a country. It is proved that the issue of complex automation of processing indicators in the face of rising systemic risk, forecasting the results based on the analysis of their dynamics is an increasingly urgent task for the modern banking system. Authors have proposed modern analytical tools to provide the necessary quality of credit activity of the structural units of banks by grounded assessment of the creditworthiness of potential borrowers. The paper presents the model of assessing the creditworthiness of potential borrowers of the bank based on fuzzy logic regarding selected qualitative and quantitative indicators that are fully characterizing the client.
JEL: G21; C61; C45

Miroslav Nedelchev

BIBLIOMETRIC REVIEW OF CORPORATE GOVERNANCE THEORIES AND METHODS

The aim of the paper is to carry out a bibliometric review of corporate governance theories and methods. The bibliometric review covers 2322 titles and 11598 keywords for the period 1999-2016. The data were extracted from the SSRN's electronic library.
The paper identifies Top 10 corporate governance theories and methods. The results of bibliometric review define the Agency theory and evidence as a most common theory and method respectively. The Top 10 theories in corporate governance are taken from close scientific fields and the methods used are universal for all sciences.
JEL: C89; G34

Trayan Yosifov
Gergana Taneva

A MODEL FOR ASSESSING ECONOMIC RISK IN FINANCING INNOVATION PROJECTS OF VENTURE CAPITAL FUNDS

In regard to the content, each business venture carries an element of risk, which includes both threats and favorable opportunities.
Risk assessment makes it possible to manage the business more effectively, which is a prerequisite for avoiding unwanted or unexpected events. Moreover, it enables the enterprise to operate more closely to the unforeseen costs limits. It also makes possible the release of resources for developing the activity and assessing the opportunities for profitable investments.
The aim of this study is to present a model for economic risk assessment using some methods developed by the author. In order to achieve this aim, the author has applied the model for risk assessment to a real innovation project related to the production of drones, which is the subject of research in the present paper.
The results of the study will show the practical suitability of the model presented. Applying an adaptive model for risk assessment to innovation projects is an important condition for the increase in risk financing in Bulgaria in the context of the need for increasing competitiveness of the Bulgarian economy.
JEL: G24; O31; O35

Harshi Gunawardana
Dammika A Tantrigoda
U Anura Kumara

POST-CONFLICT ECONOMIC DEVELOPMENT: A WAY FORWARD

In times of persistent violent military conflicts and in post-conflict contexts, water resources and infrastructure are often destroyed or become inaccessible. This has been confirmed both in the literature and in practice. This research has shown effective water management is vital for mitigating new tensions over water resources. Otherwise it will be a major obstacle in the development of economy in post-conflict society. Early intervention in the water sector can help societies set the foundation for more equitable and sustainable water use and in turn support better economic recovery in post conflict areas.
A qualitative research approach with a fieldwork was applied in Northern Sri Lanka where an economic recovery deemed necessary at the end of the three-decade long civil war, opening up communities to reconstruction and economic rehabilitation. Semi-structured interviews and observations were applied to derive findings on current challenges in the water sector in post clearance areas. Main findings from this research lead to the conclusion that the lack of water supply and water sources are primary challenges for land users. They are not aware of sustainable land management (SLM) strategies to improve water use efficiency and productivity. The study proposes a framework to integrate SLM for post-conflict economic development.
JEL: O1; Q1

Darina Zaimova
George Zheliazkov
Julia Doitchinova

EFFICIENCY ANALYSIS OF AGRICULTURAL COOPERATIVES IN TRENTINO-ALTO ADIGE

Collective organization of agricultural production is assumed to be a sufficient choice taking into a consideration a several reasons why mergers of existing farms promote efficiency, such as: increase in optimal scale from reduced duplication; reduced transaction costs; synergies from complementary activities; and improved management and coordination.
Data envelopment approach (DEA) is applied to the input and output variables to reveal the efficiency levels of cooperatives in Trentino-Alto Adige in Italy. The analysis is also developed to estimate input utilization and changes that might occur in terms of their optimizations and higher level output.
JEL: D61; P32; Q13; P13; C14