Angela Roman[1], **Alina Camelia Sargu**[2]

DYNAMICS OF BANKING PRODUCTIVITY IN THE PRE- AND POST-EU ACCESSION PERIOD: EMPIRICAL EVIDENCE FROM BULGARIA AND ROMANIA

The EU has undergone major changes in the last 20 years, expanding its membership from 15 countries in 1995 to 27 countries in 2007, experiencing at the same time the deepening of banking integration. In this context, the aim of our research is to underline the changes occurred in the productivity of banks operating in Bulgaria and Romania, the countries that have joined the EU in 2007. The analysed period is 2003–2011, providing an overall look on the before and after accession progress. We have employed a non-parametric approach based on two stages. In the first stage we have estimated the efficiency scores of banks from our sample using the data envelopment analysis, while at the second stage we have estimated the changes occurred in the productivity of those banks using the Malmquist indices. Afterwards, we have employed a correlation analysis using the obtained results from the two stages, thus being able to better understand the evolution of banks in Bulgaria and Romania before and after the EU membership accession.

Keywords: *productivity; DEA; Malmquist index; integration process; banks; Romania; Bulgaria; EU membership.*

JEL Classification: C33, G14, G20, G21, P52.

Ангєла Роман, Аліна Камелія Саргу

ДИНАМІКА ПРОДУКТИВНОСТИ БАНКУ ДО І ПІСЛЯ ВХОДЖЕННЯ КРАЇНИ ДО ЄС: ЗА ДАНИМИ БОЛГАРІЇ ТА РУМУНІЇ

У статті продемонстровано найголовніші економічні зміни у ЄС за останні 20 років в контексті збільшення Союзу з 15 країн у 1995 р. до 27 країн у 2007 р. за одночасного поглиблення банківської інтеграції. Відстежено зміни продуктивності банків у Румунії та Болгарії, країн, які пізніше за всіх приєднались до ЄС, у 2007 році. Для аналізу обрано період з 2003 по 2011 рр., що дозволяє відстежити динаміку змін до і після євроінтеграції даних країн. Аналіз проведено у два етапи. На першому – ефективність банків проаналізовано методом аналізу середовища функціонування. На другому – для аналізу змін продуктивності використано індекс Малмквіста. Результати обох етапів порівняно за допомогою кореляційного аналізу.

Ключові слова: *продуктивність; аналіз середовища функціонування; індекс Малмквіста; інтеграційний процес; банки; Румунія; Болгарія; членство в ЄС.*

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Ангела Роман, Алина Камелия Саргу

ДИНАМИКА ПРОДУКТИВНОСТИ БАНКА ДО И ПОСЛЕ ВХОЖДЕНИЯ СТРАНЫ В ЕС: ПО ДАННЫМ БОЛГАРИИ И РУМЫНИИ

В статье показаны главнейшие экономические изменения в ЕС за последние 20 лет, в контексте расширения с 15 стран в 1995 г. до 27 стран в 2007 г. с одновременным углублением банковской интеграции. Отслежены изменения в продуктивности банков, работающих в Болгарии и Румынии, странах позже всех примкнувших к ЕС в 2007 году. Для анализа выбран период с 2003 по 2011 гг., что позволяет отследить динамику

[1] Department of Finance, Money and Public Administration, Faculty of Economics and Business Administration, Alexandru Ioan Cuza University of Iasi, Romania.

[2] Department of Finance, Money and Public Administration, Faculty of Economics and Business Administration, Alexandru Ioan Cuza University of Iasi, Romania.

изменения состояний до и после евроинтеграции данных стран. Анализ проведён в два этапа. На первом – эффективность банков проанализирована методом анализа среды функционирования. На втором – для анализа изменения продуктивности использован индекс Малмквиста. Результаты обоих этапов сравнены при помощи корреляционного анализа.

Ключевые слова: *продуктивность; анализ среды функционирования; индекс Малмквиста; интеграционный процесс; банки; Румыния; Болгария; членство в ЕС.*

1. Introduction

In the academic literature the researches focused on the analysis of banks efficiency and their productivity played an important role, presenting a high interest of both academia and also of decision-makers. This is underlined by the growing number of studies focused on this subject and different measurement methods developed in the last 4 decades. The increased interest in this field of research is determined by: a) the central role that banks have in the financing contemporary economies; b) the changes that have taken place in the last 20 years in banking as a result of the financial globalisation process and the adoption in practice of financial innovations; c) high competitiveness at the banking market. Another central element is represented by the fact that the development and innovation possibilities of banking institutions are directly linked to the performances registered.

The aim of our research is to underline the changes occurred in the productivity of the banks operating in Romania and Bulgaria, the countries which have joined the EU in 2007. We focused the research on these countries as they have registered the biggest gap in macroeconomic development as compared with the EU average and thus present the best premises for the improvement of the overall efficiency and productivity in banking. The analysed period is 2003–2011, providing an overall look on the before and after the accession status. In order to achieve this we have employed a non-parametric approach based on two stages. At the first stage we have estimated the efficiency scores of banks from our sample using the data envelopment analysis, while at the second stage we have estimated the changes occurred in the productivity of those banks using the Malmquist indices.

The reminder of the paper is structured as follows: the second part is dedicated to the review of academic literature, the third part presents the methodological considerations, the fourth part underlines the data used, the fifth part highlights the obtained empirical results while the sixth part contains the concluding remarks.

2. Literature review

In the academic literature there is a series of studies focused on the scale economies that can be achieved in banking and also on the dynamics of bank efficiency (Glass, McKillop, 1991; Berg et al., 1992; Elyasiani, Mehdian, 1995; Fukuyama, 1995; Dietsch, 1997; Jackson et al., 1998; Morttinen, 2002).

Tortosa-Ausina et al. (2002) study the productivity and efficiency growth for the saving banks operating in Spain for the period 1992–1998. The obtained results underline that the improvement of productivity has been achieved especially as a result of the improvement of production possibilities, while the estimated efficiency of the banks from the sample has remained relatively constant during the analysed period.

Fries and Taci (2005) estimate the cost efficiency in the case of 15 ex-communist European countries for the period 1994–2001, using a parametric approach based on SFA and two alternative models – with and without country-specific factors. The authors underline the fact that foreign banks are more cost efficient than their domestic peers and at the same time tend to provide better services, especially if they are part of a multinational banking group.

Dardac and Boitan (2008) employ DEA in order to underline the role of the executive board in designing a viable and coherent business strategy and defining the risk profile of a banking institution in the case of the top 5 Romanian banks for the period 2003–2006.

Chudy et al. (2012) assess productivity changes registered by the biggest 27 banks operating in Poland during the period 1996–2007. The level of productivity has been estimated using a two stage non-parametric approach based on DEA and the Malmquist index, with a focus on productivity changes that occur based on the profile of the activity undertaken by a banking institution (universal banks, retail banks, corporate banks). The obtained results have not found significant statistically differences between the efficiency and the productivity scores estimated at the beginning and the end of the period.

Taking into account that the number of researches focused on the case on the new EU member states is rather small, we consider that our paper can complete this gap by underlining the changes occurred in the productivity of the banks operating in Romania and Bulgaria in the pre- and post-EU accession period.

3. Methodological considerations

The data envelopment analysis has been developed by Charnes et al. (1978) and represents a non-parametric analysis method for the estimation of the efficiency score of a banking institution. Since its development and until today this method has become very popular among researches and professionals, being used to estimate the technical and cost efficiency in many sectors of the economy.

Employing a basic approach, the productivity of a banking institution can be defined as representing the comparison between the results registered by that institution and the ones that could be achieved through the optimal usage of the existing inputs. The difficulty in the case of this method reside in the definition of the production function that correlates to the level of the investments performed with the optimal production level, more exactly the way in which the maximal efficiency frontier is defined and compounded. Contrary to the parametric analysis methods, like the stochastic frontier analysis, that require in a preliminary phase the definition of a production function, in the case of DEA the efficiency frontier is determined by the position of efficiency scores for the analysed entities, more exactly by the highest efficiency scores achieved as a result of the undertaken analysis.

There is a multitude of ways for the mathematical formalisation of a DEA model. Assume that there is data on K inputs and M outputs for each of N banks. For i bank these are represented by the vectors x_i and y_i, respectively. Let us call the $K \times N$ input matrix – X, and the $M \times N$ output matrix – Y. To measure the cost efficiency for each bank we calculate a ratio of all outputs over all inputs, such as $(u'y_i/v'x_i)$ where u is an $M \times 1$ vector of output weights and v is a $K \times 1$ vector of input weights. To select optimal weights we specify the following mathematical programming problem:

$$\max_{u,v}(u^{|}y_i/v^{|}x_i) \tag{1}$$

$u^{|}y_j / v^{|}x_j \le 1, j = 1,2,\ldots,N, u,v \ge 0.$

The above formula has a problem of infinite solutions and therefore we impose the constraint $v^{|}x_i = 1$, which leads to:

$$\max_{\mu,\rho}(u^{|}y_i/v^{|}x_i) \tag{2}$$

$\rho^{|}x_i = 1, \mu^{|}y_i - \rho^{|}x_j \le 0, j = 1,2,\ldots,N, \mu,\rho \ge 0,$
where we change notation from u and v to μ and ρ, respectively, in order to reflect transformation.

Using the duality in linear programming, an equivalent envelopment form of this problem can be derived:

$$\min_{\theta,\lambda}\lambda \tag{3}$$

$-y_i + Y\lambda \ge 0, \theta x_i - X\lambda \ge 0, \lambda \ge 0,$
where θ is a scalar and λ is a vector of N x 1 constants. The value of θ obtained will be the efficiency score for the i bank, which will range between 0 and 1. It should be noted that the problem is be solved N times, one for each bank.

Our research is based on the two-stage approach that will help us better understand the changes occurred in the efficiency scores estimated for the banks in our sample. Thus, at the first stage we have used a cross-time data set (42 banks in 9 years) constructing a single sample composed from 42 x 9 entities to be analysed. This approach uses the maximum efficiency frontier for all the banks in our sample for the analysed period. Using this approach we are able to compare the estimated efficiency scores on a year-to-year basis. Still these results do not confirm the impact that a series of factors, like technological progress have on the evolution of the estimated efficiency scores. In order to solve this problem, at the second stage of our research we have used the Malmquist index in order to measure the changes that have taken place in the estimated efficiency scores for two successive periods of time (t and $t+1$).

$$M_{t,t-1}(A) = \underbrace{\frac{E^{t+1}(A_{t+1})}{E^{t}(A_t)}}_{Efficiency\ Change} x \underbrace{\sqrt{\frac{E^{t}(A_t)}{E^{t+1}(A_t)} x \frac{E^{t}(A_{t+1})}{E^{t+1}(A_{t+1})}}}_{Technological\ Change} \tag{4}$$

The presented formula for the Malmquist index allows us easily distinguish between the two components of the index. The technological change factor defines how many times bank A can reduce its inputs without diminishing its outputs (in the case of the input-oriented model), while the efficiency change factor defines the efficiency of bank A in a similar way with the reference to the production possibilities defined by the results of other banks during the period $t+1$.

4. Data

Our research is focused on Bulgaria and Romania, two new EU member states, the chosen sample being composed of 17 banks that operate in Bulgaria and 25 banks that operate in Romania, during 2003–2011. The value of the assets owned together by these banks is approximately 6466 mln euros, representing 92.8% of the total bank

assets in Bulgaria and 89.3% of the total bank assets in Romania. In order to ensure the comparability of the data we have converted all the sums from national currencies into euro using for this the official annual exchange rate provided by the ECB for each of the analysed years, this approach being used in similar researches (e.g., Berg et al., 1993; Stavarek, 2006). All the data used in our research have been obtained from Bureau Van Dijke Bankscope database and from the unconsolidated annual financial reports of the banks in our sample.

In the academic literature there are several ways in which the definition of inputs and outputs is interpreted in the case of a banking institution. The production approach (Sherman, Gold, 1985) considers banking institutions as producers of deposits and loans, the outputs being considered the total value of the attracted deposits and of the granted loans. The inputs are in this case represented by the total number of employees and the fixed assets expenditures. The approach proposed by Sealey and Lindley (1977) is based on the traditional role that banking institution are having in an economy, that of intermediaries between the agents that are registering a surplus of liquidity and the agents that have a liquidity deficit. In this case the inputs are considered to be the operating costs and the interest expenses while the outputs are considered to be the interest revenues, total loans value and the non-interest revenues.

Thus, taking into account the arguments provided previously and that the value and number of added value deposits is small in Bulgarian and Romanian banking systems, we have chosen our inputs and outputs for the research based on the intermediation approach, similar to the one proposed by Sealey and Lindley (1977), considering that banks attract deposits in order to make a series of added value investments (Casu, Molyneux, 2001; Freixas, Rochet, 1997). The academic literature based on the intermediation approach (Kraft, Tirtiroglu, 1998; Rezvanian, Mehdian, 2002; Grigorian, Manole, 2002; Isik, Hassan, 2002; Bonin et al., 2005; Stavarek, 2005; Toci, 2009) considers deposits as being inputs, while the added value assets (like loans and certain types of financial instruments) are considered the results of these operations (outputs).

The selected inputs for our research are represented by: fixed assets, deposits and operating costs, while the chosen outputs are: loans, securities and the net commissions income (Table 1).

5. Empirical results

Employing the DEA input-oriented model we have estimated the efficiency scores for all the banks from our sample for the period 2003–2011, for both the constant return to scale (CRS) and the variable return to scale (VRS) approaches, using a common frontier for the whole period.

Table 2 provides the average efficiency scores registered by the banks in our sample during the analysed period. We have employed also the non-parametric Wilcoxon test, in order to underline the statistical importance of the changes that have been registered during the analysed period employing a year-to-year analysis.

The obtained average efficiency score for the period 2003–2011, in the case of the CRS and VRS models, evidence that there were no major changes during the analysed period. In the year-to-year analysis we can observe that the most significant changes in the efficiency scores took place between 2007 and 2008, when, after 5 years of steady increase, the estimated efficiency declined sharply in 2008.

Table 1. **Summary statistics of the inputs used in the given research**

	Inputs								
	Fixed Assets			Deposits			Operating costs		
	c25	median	c75	c25	median	c75	c25	median	c75
2004	2,598	8,788	22,205	69,450	163,458	569,549	4,270	12,008	36,447
2005	3,360	13,339	29,770	108,654	248,683	1053,744	5,509	17,427	44,076
2006	5,418	17,627	36,765	124,589	376,089	1484,716	7,171	24,353	48,224
2007	7,068	23,086	55,411	177,560	657,242	2335,655	12,016	31,880	77,725
2008	7,067	24,914	63,067	202,011	713,212	3116,372	14,161	37,376	97,782
2009	5,677	25,636	55,272	173,731	648,459	3161,722	13,839	36,711	90,144
2010	7,299	24,128	52,522	187,958	722,441	2996,035	13,140	39,219	92,688
2011	6,609	22,163	50,301	237,875	629,379	2730,839	11,848	37,131	91,420
	Outputs								
	Loans			Securities			Net commission income		
	c25	median	c75	c25	median	c75	c25	median	c75
2004	54,012	101,736	448,276	2,767	13,541	70,360	1,539	3,129	11,281
2005	60,944	145,444	689,263	5,365	26,923	105,084	1,761	4,143	11,972
2006	81,009	233,742	1015,138	4,824	22,809	84,901	2,978	4,581	19,038
2007	134,433	385,462	2156,800	6,297	36,293	130,995	3,464	9,382	24,038
2008	166,133	574,829	2295,240	6,879	44,915	188,820	4,243	10,699	31,216
2009	181,435	568,337	1984,952	21,613	87,947	329,678	3,909	8,450	29,435
2010	176,583	615,554	2187,188	17,212	106,683	367,629	3,620	9,242	30,364
2011	172,127	677,814	2226,322	19,603	95,587	362,168	2,884	9,745	26,497

Note: c25 – lower quartile; c75 – upper quartile.
Source: Authors' calculations based on the annual reports of the banks and Bureau Van Dijk Bankscope data (https://bankscope2.bvdep.com).

Table 2. **Comparison between the average efficiency of the banks from the research sample, year to year, for the period 2003–2011 (p-value for the Wilcoxon in brackets)**

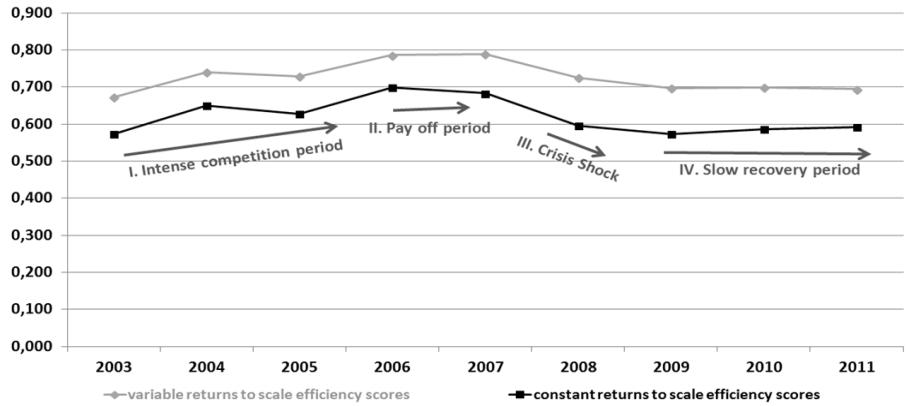
	CRS model		VRS model	
2003	0,573		0,673	
2004	0,650	(0,253)	0,740	(0,255)
2005	0,628	(0,273)	0,730	(0,249)
2006	0,699	(0,001)**	0,786	(0,008)**
2007	0,683	(0,095)	0,789	(0,614)
2008	0,596	(0,001)**	0,725	(0,018)*
2009	0,573	(0,112)	0,697	(0,285)
2010	0,587	(0,641)	0,699	(0,888)
2011	0,592	(0,285)	0,694	(0,433)

* – p-value for the Wilcoxon test less than 0.05.
** – p-value for the Wilcoxon test less than 0.01.
Source: Authors calculations based on the annual reports of the banks and Bureau Van Dijk Bankscope data (https://bankscope2.bvdep.com).

Another quick remark is that the evolution of the estimated efficiency scores reflects the macroeconomic evolutions that took place as a result of the global financial crisis. The highest positive change in the estimated efficiency scores was registered in 2006, while the highest negative change was registered in 2009. In both cases the results have been statistically significant according to the results of the Wilcoxon test, for both VRS and CRS models.

The obtained results through DEA, are graphically represented in Figure 1, and underline the existence during the analysed period of 4 distinctive stages in the development and evolution of the estimated efficiency scores. Thus, the first episode took

place between 2003 and 2006, the estimated efficiency for the banks in our sample registering a steady increase, as a result of the relaxation of the loans granting criteria, the entering of new pan-European banks on the markets in an effort to establish a foot-hold in these countries before the EU accession (e.g., Erste Group in Romania) and the general positive evolution of the macroeconomic environment. During this period the analysed banks expanded their territorial networks, doubled or even tripled their customer bases and implemented new banking technologies in an effort to acquire greater market shares. These considerations were enforced by the average estimated efficiency score obtained in 2006, that is 0.699, and represented the highest estimated efficiency score obtained for the analysed period in the case of the CRS model.



Source: Authors' calculations.

Figure 1. **Distribution of the efficiency scores obtained through the CRS and VRS model for the banks in the research sample, 2003 to 2011**

As the first signs of the international financial turbulences appeared in 2007, the banks operating in Bulgaria and Romania changed their development strategy, adopting a more precautionary attitude. This is demonstrated by the evolution of the efficiency scores that remained almost unchanged in 2007 as compared to 2006, a "paying off episode" being underlined here. Starting with 2008, the macroeconomic environment both internationally and nationally deteriorated sharply, manifested by the increasing volume of non-performing loans, both in Bulgaria and Romania. The situation continued to deteriorate also in 2009, being exacerbated also by the fact that the analysed banks were forced to increase their interest rates for deposits in order to comply with the new prudential regulations enforced by the national authorities. The evolution of the estimated efficiency scores confirm these, as the lowest level for the estimated efficiency scores was obtained in 2009 in the case of the CRS model, of just 0.573. Taking into account these evolutions the banks operating in Bulgaria and Romania have reconsidered their development strategies, readjusting their territorial networks and workforce size and refocusing their business strategy on managing the existing loans portfolios. The results of this strategy shift have been demonstrated by the efficiency scores for the period 2010–2011, as the trend has been stabilised, announcing the start of a "slow recovery episode" after the shock of the international financial, economic and sovereign debt crisis.

At the second stage of our research we have undertaken an analysis on the productivity of the banks from our sample for the period 2003–2011 based on the Malmquist index. The obtained results are on the year-to-year basis and reveal that between 2005–2006, 2006–2007, 2009–2010 and 2010–2011 there was an increase of the estimated productivity as shown in Table 3, while in the rest of the periods the productivity has decreased. The highest increase of productivity was been registered in 2005–2006.

The score obtained for the Malmquist index show a certain linear evolution during the analyzed period for the banks from our panel as to their productivity and a slight decrease of their technological possibilities.

Table 3. **The average values for the Malmquist index and its components obtained for the banks from the research sample for the period 2003–2011, year to year values**

	Malmquist index	Technological possibilities	Efficiency change
2003-2004	0,884	0,904	1,035
2004-2005	0,995	0,983	1,030
2005-2006	1,079	1,090	0,995
2006-2007	1,013	1,013	0,972
2007-2008	0,838	0,808	1,007
2008-2009	0,975	0,994	0,978
2009-2010	1,046	1,041	0,996
2010-2011	1,007	1,056	0,989
Average	0,977	0,982	1,000

Source: Authors' calculations based on the annual reports of the banks and Bureau Van Dijk Bankscope data (https://bankscope2.bvdep.com).

Table 4. **The correlations between the Malmquist index and the estimated efficiency scores for the period 2003–2011, for the CRS efficiency model**

Pearson Correlation						
CRS Model						
	Malmquist index		Technological possibilities		Efficiency change	
2003-2004	0,8175	(0,0000)**	0,3411	(0,0270)*	0,6429	(0,0000)**
2004-2005	0,8423	(0,0000)**	0,2770	(0,0757)	0,2770	(0,0757)
2005-2006	0,7286	(0,0000)**	0,2079	(0,1864)	0,2079	(0,1864)
2006-2007	0,9623	(0,0000)**	0,2955	(0,0574)	0,2955	(0,0574)
2007-2008	0,8853	(0,0000)**	0,4939	(0,0009)**	0,4939	(0,0009)**
2008-2009	0,8620	(0,0000)**	0,3087	(0,0467)*	0,3087	(0,0467)*
2009-2010	0,7169	(0,0000)**	0,5872	(0,0000)**	0,5872	(0,0000)**
2010-2011	0,7847	(0,0000)**	0,4516	(0,0027)**	0,4516	(0,0027)**
Spearman Correlation						
CRS Model						
	Malmquist index		Technological possibilities		Efficiency change	
2003-2004	0,8356	(0,0000)**	0,5429	(0,0002)**	0,4945	(0,0009)**
2004-2005	0,8977	(0,0000)**	0,4086	(0,0072)**	0,4086	(0,0072)**
2005-2006	0,7067	(0,0000)**	0,1380	(0,3836)	0,1380	(0,3836)
2006-2007	0,6060	(0,0000)**	0,3727	(0,0151)*	0,3727	(0,0151)*
2007-2008	0,9101	(0,0000)**	0,4337	(0,0041)**	0,4337	(0,0041)**
2008-2009	0,8277	(0,0000)**	0,3059	(0,0488)*	0,3059	(0,0488)*
2009-2010	0,8259	(0,0000)**	0,5800	(0,0001)**	0,5800	(0,0001)**
2010-2011	0,7384	(0,0000)**	0,2635	(0,0918)	0,2635	(0,0918)

* – p-value < 0.05.
** – p-value < 0.01.
Source: Authors' calculations.

In order to have a better understanding of the obtained results we have considered appropriate to combine the two analyses on the efficiency and productivity of the banks in our sample. Thus, we carried out a correlation analysis between the two estimated efficiency and productivity scores obtained, using the Spearman and Pearson correlation indices. The non-parametric Spearman correlation index demonstrates how significant the relationship between Malmquist index and the efficiency scores obtained through DEA is, while the Pearson correlation index suggests the strength of the link between the Malmquist index and the efficiency scores.

The obtained results underline the existence of a strong correlation between the productivity scores (Malmquist index scores) and the efficiency scores (DEA efficiency scores) and most cases also have a statistically relevant correlation. Likewise, the results displayed in Table 4 suggest there is a convergence between the Pearson and Spearman correlations results.

Table 5. **The relationship between the Malmquist index and the DEA efficiency scores for the banks in the research sample, between 2003 and 2011**

	Number of bank	% of the total sample, %
2003-2004	31	74
2004-2005	39	93
2005-2006	35	83
2006-2007	26	62
2007-2008	39	93
2008-2009	35	83
2009-2010	35	83
2010-2011	31	74

Source: Authors' calculations.

However, the existence of such a strong correlation does not exclude the possibility that a banking institution can experience simultaneously an increase of the estimated efficiency and a decrease of the estimated productivity. In this context we have considered the opportunity to analyse the evolution of the banks in our sample during the period estimated according to the registered productivity and efficiency scores calculated with the help of the Malmquist index and the DEA CRS model (Table 5). Due to the paper size restrictions the detailed results can be obtained from the authors upon request.

We can observe that most banks in our sample are registering a synchronised evolution of the two performance indicators in the periods: 2004–2005, 2005–2006, 2007–2008, 2008–2009 and 2009–2010. This evolution confirms the previous considerations regarding the 4 stages registered by the banking sectors in Bulgaria and Romania during the analysed period.

6. Concluding remarks

Taking into account the obtained results for the two stages of our analysis we can conclude that the banks operating in Bulgaria and Romania, the two new EU members have registered a linear evolution during the analysed period of 2003–2011. In regard to the estimated efficiency scores for the banks in our sample, we can note that during the analysed period there has not been a significant overall improvement. Also, we have not registered critical statistical differences between the efficiency scores estimated at the beginning of the analysed period of time and the ones registered at the end.

Focusing on the estimated productivity scores obtained with the help of the Malmquist index we can observe that during the analyzed period the average productivity of banking institutions in our sample has decreased by 2.3%, because, in the same period of time, the technological possibilities of the banks have decreased by 1.8%. The existence of a strong correlation between the DEA efficiency scores and the Malmquist index scores provides us with the incentive to carefully conclude that in practice the two approaches to banks performance, namely their efficiency and productivity, may be considered similar. Also we can conclude taking into account the results of the Wilcoxon test that the productivity and efficiency scores of the banks in our sample have been influenced by a series of exogenous factors like the increased competition before the crisis and the EU accession or the impact that the international financial and economic crisis had on Bulgarian and Romanian macroeconomics. In order to deepen the analysis undertaken so far in future studies, we consider appropriate the usage of a regression analysis that will explore the relationship between the joining the EU and the preparations for the adoption of the euro and the enhancement of the overall estimated efficiency and productivity of the banks operating in Bulgaria and Romania.

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