



BANK OF GREECE
EUROSYSTEM

Working Paper

The evolution of Bulgarian banks'
efficiency during the twenties:
a DEA approach

Nikolay Nenovsky
Martin Ivanov
Gergana Mihaylova

SEEMHN

82

JULY 2008 KINKPAPERWORKKINKPAPERWORKKINKPAPERWORKKINKPAPERWORK

BANK OF GREECE
Economic Research Department – Special Studies Division
21, E. Venizelos Avenue
GR-102 50 Athens
Tel: +30210-320 3610
Fax: +30210-320 2432

www.bankofgreece.gr

*Printed in Athens, Greece
at the Bank of Greece Printing Works.
All rights reserved. Reproduction for educational and non-commercial purposes is permitted provided
that the source is acknowledged.*

ISSN 1109-6691

Editorial

The South-Eastern European Monetary History Network (SEEMHN) is a community of financial historians, economists and statisticians, established in April 2006 at the initiation of the Bulgarian National Bank and the Bank of Greece. Its objective is to spread knowledge on the economic history of the region in the context of European experience with a specific focus on financial, monetary and banking history. The First and the Second Annual Conferences were held in Sofia (BNB) in 2006 and in Vienna (OeNB) in 2007. Additionally, the SEEMHN Data Collection Task Force aims at establishing a historical data base with 19th and 20th century financial and monetary data for countries in the region. A set of data has already been published as an annex to the 2007 conference proceedings, released by the OeNB (2008, Workshops, no 13).

On 13-14 March 2008, the Third Annual Conference was held in Athens, hosted by the Bank of Greece. The conference was dedicated to *Banking and Finance in South-Eastern Europe: Lessons of Historical Experience*. It was attended by representatives of the Albanian, Austrian, Belgian, Bulgarian, German, Greek, Romanian, Russian, Serbian and Turkish central banks, as well as participants from a number of universities and research institutions. Professor Michael Bordo delivered the key note speech on *Growing up to Financial Stability*. The participants presented, reviewed and assessed the experience of SE Europe with financial development, banking and central banking from a comparative and historical perspective.

The 4th Annual SEEMHN Conference will be hosted by the National Serbian Bank on 27th March 2009 in Belgrade. The topic of the Conference will be *Economic and Financial Stability in SE Europe in a Historical and Comparative Perspective*.

The papers presented at the 2008 SEEMHN Conference are being made available to a wider audience in the Working Paper Series of the Bank of Greece. Here we present the ninth of these papers, by Nikolay Nenovsky, Martin Ivanov and Gergana Mihaylova.

July, 2008

Sophia Lazaretou
SEEMHN Coordinator
Member of the Scientific and Organizing Committee

THE EVOLUTION OF BULGARIAN BANKS' EFFICIENCY DURING THE TWENTIES: A DEA APPROACH

Nikolay Nenovsky
Bulgarian National Bank, University of Orleans and ICER

Martin Ivanov
Institute of History, Sofia

Gergana Mihaylova
Agency for Economic Analysis and Forecasting, Sofia

ABSTRACT

This paper studies the dynamics of the bank efficiency in Bulgaria in the years 1923 and 1928. In the course of research several interdependencies were detected, related mainly to the reaction of different types of banks to the financial crisis and the financial stabilization. Official bank balance sheets were used as well as the profit and loss statements of 50 Bulgarian credit institutions. After their classification into sub-groups different variations of DEA (data envelopment analysis), in particular the intermediation approach, were applied to the banks' financial positions. The DEA overcomes several deficiencies in the traditional accounting measurement of bank efficiency, which has made it very popular in latest literature. To our knowledge this method has not been applied so far to historical data.

Keywords: Bulgarian monetary history; Banking system; Banking efficiency; DEA modelling.

JEL classification: N24; G21.

Acknowledgements: We would like to express our gratitude to Joanna Bachovska who helped with the data collection.

Correspondence

Nikolay Nenovsky
Bulgarian National Bank
University of Orleans and ICER
email: nenovsky.n@bnbank.org

1. Introduction

This paper mainly explores the empirical measurement of the Bulgarian banking system's efficiency over the twenties. The period covers an important time span of the Bulgarian monetary stabilization, in particular from the beginning of the monetary stabilization in 1924, going through the official pegging of the lev in 1928, until the eve of the Great Depression. The banks' efficiency has been assessed by applying one of the sophisticated empirical technique (Data Envelopment Approach, DEA), which enables comparison of the efficiency of both individual banks and bank groups based on selected criteria. The calculations relate to the two years – 1923 and 1928, thus allowing some comparison of the results for the banks' efficiency. The results help approbation of a number of theoretical hypotheses and assumptions as well as “discovery” of new, so far neglected or unknown theoretical relationships.

First – insomuch as the banking system (and its structure) was able to play the role of a “substitute institution”, a phrase coined by Alexander Gerschenkron, mobilizing capitals needed for Bulgaria's industrialization. As is well-known, Gerschenkron believes that to catch up with developed economies (or reduce the time for industrialization) backward and undercapitalized peripheral economies need substitute institutions. In Gerschenkron's view such institutions can be universal banks, the state or even ideology (in the case of USSR)¹.

Second, as mentioned above, it would be useful to compare efficiency across various types of banks (grouping of could be based on various criteria like ownership, assets volume, regionality, etc). Over the period, the diversity of banks is conditioned by the fact that the banking market was segmented. Diversity was a response to the need of finding different ways of collecting dispersed savings, or seen from another perspective – of accommodating the various types of informational asymmetry².

Third, the selected years (1923 and 1928) help answer the question as to what extent and in what way bank efficiency is conditioned by different factors such as type of monetary regime (the years 1924-1928 are characterized by stabilization of the lev), capital inflows (1926 Refugee Loan and the 1928 Stabilization Loan), and an

¹ For details see, Sylla and Toniolo (2001), Sylla (2005) and Gershenkron (1962, 1952).

² This is shown in a number of studies; see, for example Karklisiiski (1941), Tugan-Baranovsky (1989, 1915) and Verdier (2001).

institutional factor like the absence of systematically regulated accounting norms of banks and the general lack of information transparency. We need also to mention that the overall financial system safety net, i.e. lender of last resort, deposit insurance, etc., starts functioning in the early thirties, i.e. the years after the Great Depression.

The study can lead us to some other methodological dependencies. As we already mentioned, the 20ies are characterized by lack of information transparency which is reflected in fabricated or misrepresented banks' balance-sheets and profit and loss accounts. A common practice was the so-called "connected or insider lending" (Koshev, 2008). An empirical analysis of efficiency gives important indications about the bad behavior of banks, which is manifested in banks' failures. For instance, a case of discrepancy between a bank's high efficiency (measured based on official records' data) and a subsequent failure of that bank calls for a concrete historical investigation which could reveal the actual reasons for such failure. In other words, a discrepancy like this could take us to new and interesting economic and financial relationships, as well as to a close study of archive records.

The structure of the paper is as follows: first, we give a short overview of the basic facts and events in Bulgaria's monetary and banking history, thus placing bank efficiency into a concrete historical context. The second part describes the methodology fundamentals of measurement as well as the data employed and its sources. The third part discusses the empirical findings and the conclusion examines possible future research studies.

2. Bulgaria (1923-1928): facts from the monetary and banking history

Following a series of political and financial cataclysms, in 1924 Bulgaria re-established the prewar principles of monetary orthodoxy within the context of the Europe-wide dominating gold exchange standard. In 1926 under League of Nations' stabilization program the BNB was granted further autonomy and in 1928 the lev was pegged de jure to the dollar. The stabilization was backed up by a special Stabilization Loan granted by a Consortium of American and British banks under League of Nation auspice (for details on these see, Hristophorov, 1946 and Avramov, 2007).

The financial stabilization achieved boosted up the country's economic recovery. After a few years of severe cataclysms, in 1925 the prewar level of the GNP per capita was exceeded and in the following years a moderate growth of economy achieved (Ivanov, 2006). In the context of this relatively stable environment the banking system played an important role for the economic growth. It was gravely affected by the hyperinflationary spiral in early 20ies with sector incomes going down to half their 1911 level. For comparison, the added value in agriculture and industry in 1921 remained at prewar levels (98% and 112% of the 1911 added value, respectively). However, between 1924 and 1929 the real incomes in the financial services area increased twofold from 1.1 to 2.2 billion levs. A gradual increase of deposits across all sub-segments of the banking sector is a further evidence of restoring confidence in the banking system.

Table 1: Bank deposits, in million levs (1921 prices)

	1921	1923	1925	1929	Real growth in % for the period 1921- 1929
State-owned banks	1935	2662	2975	3366	73.90%
Private banks	2343	2529	2463	3473	48.20%
Building societies	0	0	0	173.2	-
Agricultural co-operations	179.2	222.3	278.8	510.5	184.80%
Popular banks	84.8	124.6	342.6	877.9	935.30%
Total	4542	5538	6059	8916	96.30%

Source: Own estimates, Statistical Annual, *BNB Bulletin*.

The data in the table indicate that those benefiting most from the macro-stabilization were the rural and town co-operations (popular banks), followed by the state-owned banks. The private credit institutions found it hardest to win the public confidence with deposits attracted going up by only 48% - much below the performance of the public financial institutions.

The 1920s deepened the trend of bank market segmentation already started in the first decade of the 20th century. Comfortably sheltered under the protection wing

of the state the rural and town co-operations were able to strengthen their previous grounds and on the eve of the Great Depression the industry expanded to include a new competitor – the so-called building societies. Operating as quasi banking institutions these specialized in long-term mortgage lending. As private initiative was more and more squeezed down in scope, competition among these banks (around 140 at the time) spurred up further. Their priority remained financing of industry and trade while the public and cooperative credit head-offices financed mainly the agricultural sector.

The macroeconomic stabilization and the two external loans granted under the guarantee of the League of Nations (1926 Refugee Loan (7%) and 1928 Stabilization Loan (7.5%)) allowed Bulgaria to find a place on the global investment map. The high interest rate differential between the country's and the external interest rate levels provoked the interest of major international financial institutions such as the French Paribas and the Deutsche bank. The increased capital inflows and the downpour, within a short time, of “gold rain” from the Stabilization Loan resulted in substantial growth of the local financial institutions' lending activities. Only a year after it started, credit inflation exceeded prudent levels and undermined the banking sector stability.

**Table 2: Volume of banks' loan portfolio
(at current prices, in million levs)**

	1925	1927	1928	Nominal growth for the period 1925-1928
State-owned banks	2654	3689	4622	74%
Private banks	3452	4991	6448	87%
Cooperative banks	313	1449	1961	512%
Total	6419	10128	12986	102%

Source: Own estimates, *Statistical Annual*

The macroeconomic risks of the inflation were further aggravated in the absence of information transparency and the almost entire lack of a state-regulated banking sector. The only tools the BNB could employ were annual examinations of the private financial institutions, credited by the BNB, (the rural credit co-operations

played a role similar to today's Bulgarian Agricultural Bank, while the town banks come closer to the currently operating Bulgarian Central Co-operative Bank) and refinancing through rediscounting of their portfolio. Both instruments however can only roughly tune the system. No matter how thoroughly or scrupulously conducted, examinations are quite an inflexible form of monitoring as they take place long after the end of the financial year with findings normally becoming available not until another eight to ten months. In an environment of easy access to external financing, portfolio rediscounting is also of limited impact. The reduced Central Bank's credit was easily compensated by borrowing from abroad.

The absence of legislative regulation reduced the information transparency of the financial sector to the minimum. The balance sheets published (not always and not by all) were not standardized and so enabled risk players to conceal or show all sorts of accounts under a single item. Misrepresentation and «window-dressing» of balance sheets were public secret; still, counter-actions were taken only in the heat of the crisis in 1931. Even a sketchy overview of historical events in the 30ies allows us to formulate some assumptions and hypotheses.

Without any pretense of exhaustiveness, it could be assumed that with monetary stabilization in place the banks' efficiency in Bulgaria increased. This occurred as a result of the imposed financial discipline and boosted competition in the banking sector. Second, it could be expected that foreign and state-owned banks in general would have higher efficiency than local private institutions. This is both on account of the limited resource and the sharp shortage of capital, as well as the more direct relationship between the private banks' efficiency and the achieved macroeconomic stabilization. Third, the lacking accounting standards, deficient information transparency and imperfect regulatory framework of the banking sector would naturally have an adverse bearing on the banks' efficiency level. Due to the opposite nature of the above two effects (monetary stability and lack of transparency) it is difficult to determine *a priori* which of the effects would outweigh the other; yet overall the expected benefits of the lev stabilization are a weaker than anticipated improvement. Fourth, the capital inflow (capital injection from abroad in the form of the two external loans) in an environment of unclear banking rules brings detriment rather than advantage, hence presumably a decline in efficiency. Of course it is

difficult to evaluate and measure the effects independently; nevertheless an empirical assessment could provide some valuable information.

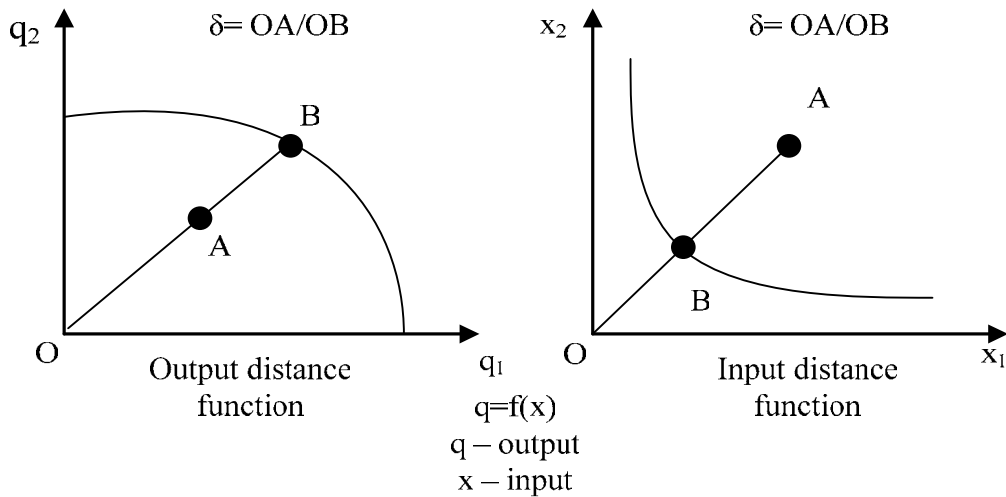
3. Measuring banks' efficiency: theoretical premises and empirical problems

Over the last years a number of new approaches have emerged for measuring the DMU (decision making units') efficiency and productivity, mainly associated with the Data Envelopment Analysis (DEA) and the Stochastic Frontier approach (SFA) (Coelli *et al.*, 2005). These approaches were also applied to the banking systems of most countries, to mention just a few studies by Grigorian and Manole, 2002; Jemric and Vujcic, 2002; Pawlowska, 2005; Fiorentino *et al.*, 2006; Luciano and Regis, 2007; Loukianova 2008, and others, Bulgaria including: Nenovsky *et al.*, 2004; Nenovsky *et al.*, 2007. As far as we know, DEA has not been applied to historical data as it is difficult to compile a database of banks' inputs and outputs in the absence of detailed, standardized or regularly published balance sheets and profit and loss accounts. In such cases it is much easier to use traditional measurements such as ROE and ROA.

In short (in the case of banks) DEA is a method of linear programming to assess the efficiency of individual banks against a defined efficiency frontier (the most efficient banks), which is derived from the model itself. This frontier indicates the maximum efficiency possible, and banks are positioned on or below it with the distance indicating the loss of potential efficiency. DEA is an approach alternative not only to the traditional ROE and ROA indicators, but to regression analysis as well (while regression analysis is based on estimation of average trends, DEA is based on frontier scores measurement). DEA advantage is that it does not involve a pre-formulated format of the production function; its drawbacks however come from the fact that it is highly dependent on extreme findings and can not tell what part of the divergence from the frontier stands for the bank's inefficiency and what – for random error. There are two forms of DEA (Chart 1), one showing the divergence (inefficiency) AB in relation to outputs - frontier (left Chart), and a second one

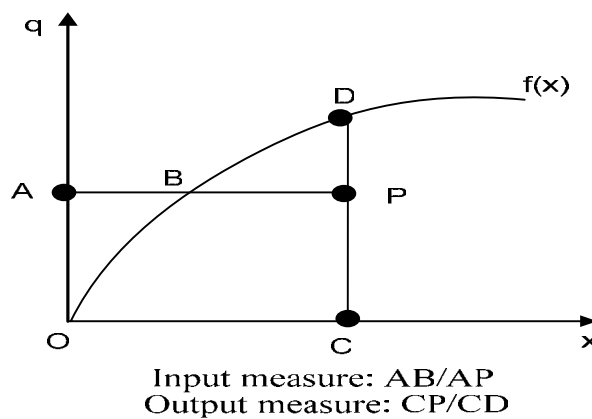
showing the divergence (inefficiency) AB with regard to inputs – frontier (right Chart)³. In this particular case the inefficiency level is measured with $\delta = OA/OB$.

Chart 1. Two DEA forms: output oriented (left) and input oriented (right)



If we show the production function $q = f(x)$ on Chart 2, then the rate of inefficiency input-measured is drawn by AB/AP , and the rate of inefficiency output-measured is drawn by CP/CD .

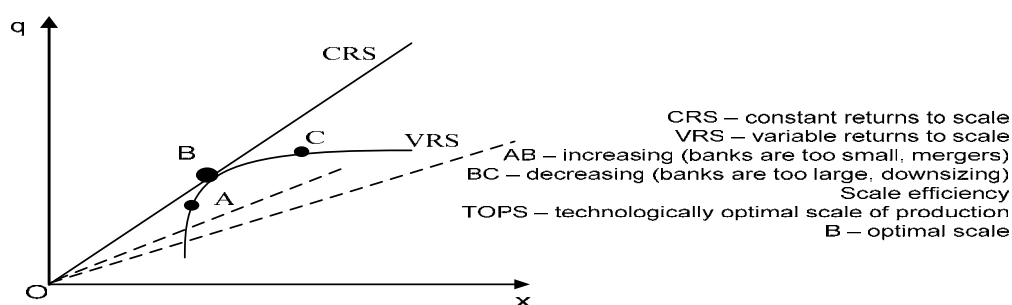
Chart 2. Input-measured and output-measured inefficiency



³ Actually the major microeconomic objectives are being reproduced, namely profit maximization at a given amount of costs or vice versa – minimizing costs at a pre-determined (targeted) profit.

The last element of importance in measuring banks' efficiency or inefficiency respectively is the use of Variable Returns to Scale (VRS) of a bank's production function, which makes up for the unrealistic assumption of Constant Returns to Scale (CRS) (see Chart 3).

Chart 3. Constant Returns to Scale and Variable Returns to Scale



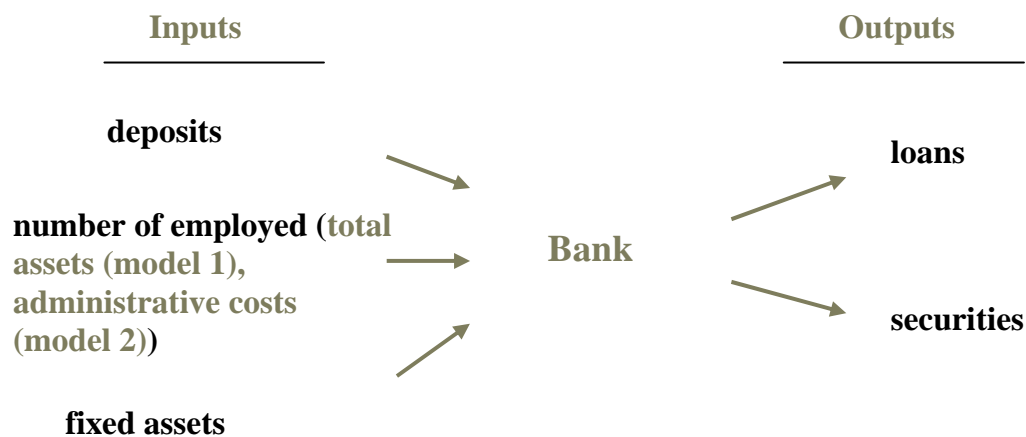
The movement of inefficiency in segment AB in the Chart indicates increasing economy of scale and the logical expectation would be for the banks to merge (because they are very small), while segment BC points to a decreasing economy of scale, hence the expectation that the banks would decentralize their activities into separate production units. Point B is known in economic literature as a point of optimal scale of a given bank which is often referred to as TOPS – technologically optimal scale of production.

Depending on the particular bank's functions we wish to examine, we can discriminate among a number of DEA constructions (operating approach, intermediation approach, production approach, value added approach, user cost approach, asset approach)⁴. The discrimination actually results from the choice of input and output variables. We use the intermediation approach, which treats a bank as a mediator transforming funds between depositors and investors. In this case and

⁴ See, for details, Jemric and Vujcic (2002); Pawlowska (2005).

based on the construction of banks' balance sheets in the '20s we have the following configuration (see Chart 4):

Chart 4: Intermediation DEA – inputs and outputs involved



The inputs involved in the intermediation approach are the labor and capital which a bank has and uses for the production of its outputs. Since there are no available data for measuring labor (the number of employed per banks), we use variables that indirectly reflect the labor in an individual bank unit. For this purpose we take two variables – the total value of a bank's assets and the bank's administrative costs. The bank's assets can be used as an approximator of labor in so far as the bank's size determines the amount of labor needed for the functioning of the bank. If, however, the labor of a bank at an initial point of time is more productive than the labor of another bank of the same size, then at a next point the first bank will have accumulated larger amount of assets. It is also possible that banks of equal size have different number of employed. This is in the case where a bank with less human resources needs to put additional workload on the existing ones (therefore the value of total assets of a bank is not a perfect measure for labor).

A bank's administrative costs can also be used since they reflect labor costs. We need to have in mind that administrative costs also include rental and electricity costs, etc., but the available data do not allow for their disaggregation by type. Although the administrative costs, as defined in the Profit&Loss account, cover other costs as well, this is a better indicator of the banks' inputs than assets are, since during the reference period most of the banks were small production units and so, for instance, did not have their own buildings to carry out their activities. Thus, they incurred rental costs reflected in the administrative costs, i.e. capital expenses are taken into account (for those of the banks that did not own real property).

We use for inputs also the banks' fixed assets and the attracted deposits that serve as a source of financing of their principal activities, i.e. lending to economic agents and securities investments, which are the basic outputs. Since for the purpose of measuring labor two variables are used (a bank's total assets and its administrative costs), calculations are made for the two variations in order to compare the results. Due to more serious disadvantages of using a bank's total assets as an indicator of labor, we give priority to the results of the model employing administrative costs. The results from the models should nevertheless outline the same dependencies in spite of some quantitative differences.

As stated above, the banks' balance sheets over the reference period were not standardized, which necessitated processing of data to isolate the variables used in the model. While not pretending to exhaustiveness, the balance sheet (Table 3) given below is an aggregation of almost all items that can be found in the individual balance sheets of the bank units. The Profit&Loss account (Table 4) also indicates more than a few differences in the way it is presented, but overall the impression is that costs and incomes are not shown on a more disaggregated level.

Table 3: Bank balance sheet

Assets	Liabilities
Enterprises	Capital
Cash in banks	Different reserve funds (pension funds, foresights funds, etc.)
Securities	Bank deposits
Portfolio	Current creditor accounts
Current debtor accounts	Other liabilities
Commodities	Profit & Loss
Fixed assets	
Protested bills	
Discounted bills	
Furniture	
Other assets	

Table 4: Profit and Loss Statement

Losses	Profits
Costs (wages, rents, heating, lighting, amortisation, etc.)	From interests, commissions, securities, commodities, etc.
Profit for the current year	

The banks' efficiency is calculated for the years 1923 and 1928. The data used in the various calculation models were published in the State Gazette (see data sources at the end of the paper). As the publication of banks' balance sheets in the State Gazette was not a requirement at that time, not all existing banks disclosed their performance to the public. The group of banks included in the efficiency calculation were determined in the following manner: from the available balance sheets promulgated in the State Gazette for the two years (1923 and 1928) the banks singled out are among those operating in both these years, of which the fifty largest were taken. In the model using administrative costs as an indicator of labour (Model 2) the number of banks in the group is forty-six because four large banks from the group of fifty banks did not publish their Profit&Loss accounts.

For the purpose of this research and for validating the hypotheses the banks are grouped in terms of their ownership as well as based on whether they merged or went bankrupt as a result of the crisis. Thus, the following groups of banks are

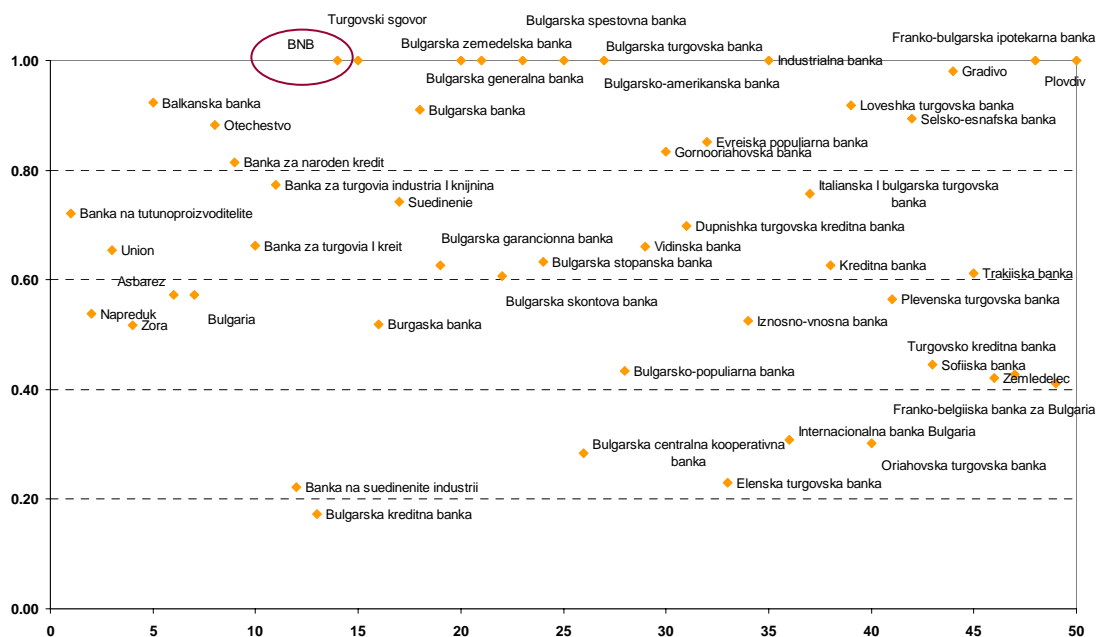
examined: private Bulgarian banks, private foreign banks, state-owned banks, merged banks or banks that went bankrupt as a result of the crisis.

4. Discussing the findings

The banks' efficiency is estimated using the models of constant returns to scale and variable returns to scale (CCR-model and BCC-model). The CCR-model was developed by Charnes *et al.* (1978), while the BCC-model was defined by Banker *et al.* (1984). The efficiency scores calculated under the BCC-model are higher than the efficiency scores under the CCR-model. The BCC-model compares DMUs with the DMUs, operating in the same region of returns to scale, while the CCR-model compares DMUs in the whole sample. To determine the efficiency scores we use the software DEA Frontier developed by Joe Zhu. The results presented below are based on the BCC-model, i.e. the assumption of variable returns to scale has been applied. We consider this model as the most appropriate one since normally the units operate under variable returns to scale. This has been also confirmed by the model calculations.

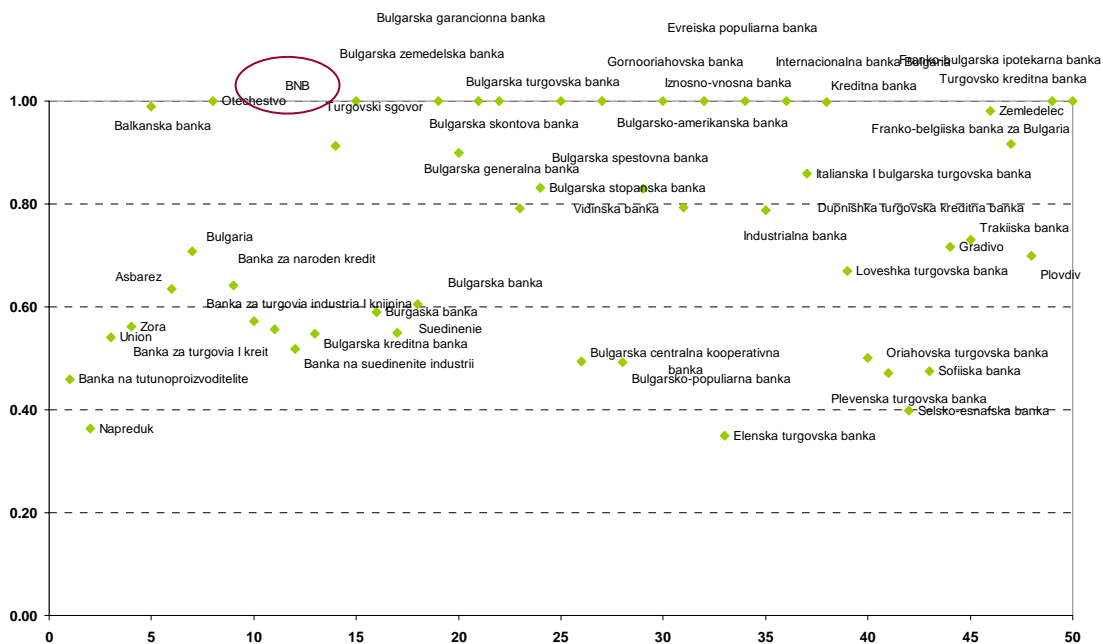
The first model (Model 1), which uses as inputs the value of *total assets*, fixed assets and deposits, and as outputs – securities and loans, indicates some decrease in the efficiency across individual bank units and a greater number of banks forming the efficiency frontier (in 1923 the number of efficient banks is 10, while in 1928 they are 13). In addition, the comparison of results indicates equalization of the banking system, i.e. most of the banks that were far from the efficiency frontier in 1923 came closer to it in 1928. This is also confirmed by the decreased standard deviation over the reference years.

Chart 5: Bank efficiency in 1923 - Model 1



Note: The banks with efficiency score 1 form the efficiency frontier. The maximum efficiency a bank can reach is 1, and the minimum efficiency is 0.

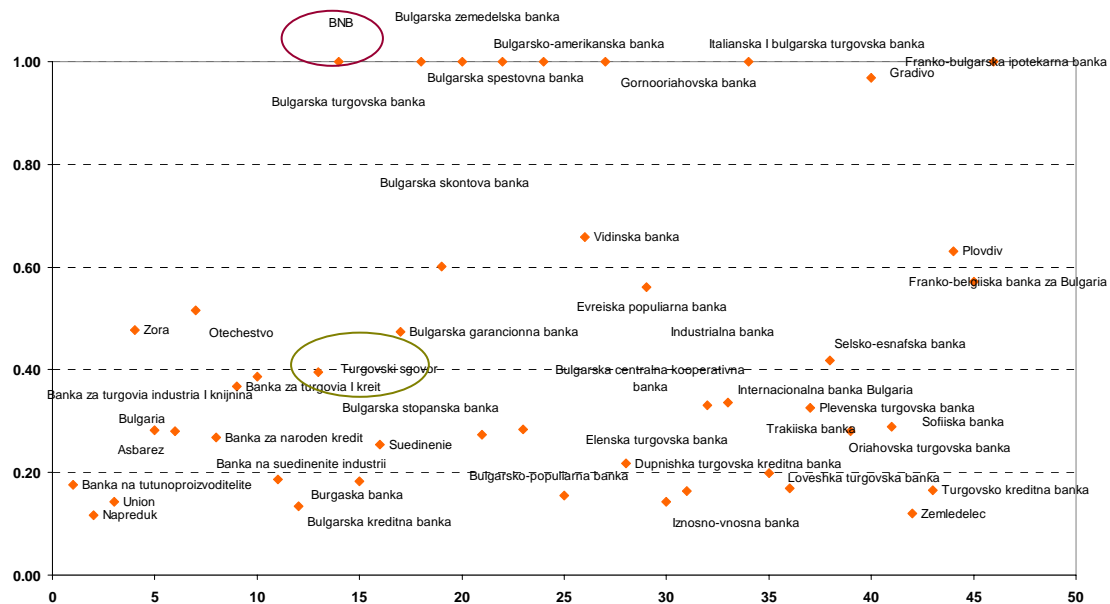
Chart 6: Bank efficiency in 1928 - Model 1



Note: The banks with efficiency score 1 form the efficiency frontier. The maximum efficiency a bank can reach is 1, and the minimum efficiency is 0.

The second model (Model 2), which uses *administrative costs*, fixed assets and deposits as inputs, and securities and loans as outputs, also indicates an increase in efficiency across the bank units, with some of the banks showing substantial efficiency (see, for example, *Turgovski sgovor*⁵). This Model also shows an equalization of the banking system.

Chart 7: Bank efficiency in 1923 - Model 2



Note: The banks with efficiency score 1 form the efficiency frontier. The maximum efficiency a bank can reach is 1, and the minimum efficiency is 0.

⁵ Further down we have given a comment on this significant increase in the efficiency of this small provincial bank.

Chart 8: Bank efficiency in 1928 - Model 2



Note: The banks with efficiency score 1 form the efficiency frontier. The maximum efficiency a bank can get is 1, and the minimum is 0.

The aggregated results for the group of banks as a whole indicate a significant improvement in the efficiency in the reference years under all models. The increase in efficiency is higher in Model 2 where administrative costs are used as an indicator of labour. This is possibly due to a better optimization of administrative costs in 1928 when the banks managed their inputs better. A possible reason for the significant improvement is the banks' re-orientation to banking activities proper at the expense of untypical activities⁶.

⁶ Over the period, a great number of these banks conducted not only banking but 'real' economic activities, as well.

Table 5: Banks' efficiency (all banks)

	1923	1928	1923	1928	1923	1928
	Model 1: Assets_VRS	Model 1: Assets_VRS	Model 1.1: Assets_VRS	Model 1.1: Assets_VRS	Model 2: Administrative costs_VRS	Model 2: Administrative costs_VRS
<i>STDEV</i>	0.24903	0.21776	0.25021	0.21885	0.30874	0.25373
<i>MEDIAN</i>	0.66139	0.75914	0.65725	0.72405	0.32851	0.74350
<i>AVERAGE</i>	0.68499	0.74866	0.66934	0.73786	0.44573	0.73101
<i>MIN</i>	0.17284	0.34891	0.17284	0.34891	0.11733	0.14321
<i>MAX</i>	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000
<i>Count</i>	50	50	46	46	46	46
<i>number of efficient banks</i>	10	13	8	12	17	19

Note: In Model 1 the results of the whole group of fifty banks are shown, while in Model 1.1 the results of the forty-six banks included in the calculation of efficiency as per Model 2. Model 1 and Model 1.1 use as inputs the amount of banks' total assets, their fixed assets and deposits, while Model 2 employs administrative costs, fixed assets and deposits.

The improved efficiency of the group of banks is a result of the growing competition which is also evidenced by the reduced concentration measured with the share of the four largest banks in total assets, loans and deposits.

Table 6: Concentration ratio (the four largest banks)

	1923	1928
Banks' assets	79.3%	75.0%
Credits, provided to banks' clients	87.8%	80.1%
Deposits of banks' clients	74.5%	71.1%

The efficiency analysis by bank groups – private Bulgarian banks, state-owned banks and foreign banks confirms the hypothesis that the foreign banks are the most efficient as they are equipped with more sophisticated technological resources, and therefore they manage better their administrative costs. We should have in mind that the foreign banks which are basically set up with external funds and foreign ownership, pose higher requirements when managing their resources for better production utilization.

Table 7: Banks' efficiency (private foreign banks)

	1923	1928	1923	1928	1923	1928
Private foreign banks	Model 1: Assets_VRS	Model 1: Assets_VRS	Model 1.1: Assets_VRS	Model 1.1: Assets_VRS	Model 2: Administrative costs_VRS	Model 2: Administrative costs_VRS
<i>STDEV</i>	0.22951	0.05884	0.27842	0.07038	0.21471	0.00000
<i>MEDIAN</i>	0.92296	0.99739	0.87838	1.00000	1.00000	1.00000
<i>AVERAGE</i>	0.81682	0.96363	0.79206	0.96481	0.89265	1.00000
<i>MIN</i>	0.41149	0.85923	0.41149	0.85923	0.57058	1.00000
<i>MAX</i>	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000
<i>Count</i>	7	7	4	4	4	4
<i>number of efficient banks</i>	3	3	2	3	3	4

Note: In Model 1 the results of the whole group of fifty banks are shown, while in Model 1.1 the results of the forty-six banks included in the calculation of efficiency as per Model 2. Model 1 and Model 1.1 use as inputs the amount of banks' total assets, their fixed assets and deposits, while Model 2 employs administrative costs, fixed assets and deposits.

The most significant improvement of efficiency in the reference years is observed with the private Bulgarian banks. Nevertheless, their efficiency level is quite low due to their limited resource. Their intra-group equalization is the highest; i.e. the banks with a very low efficiency score move faster to the efficiency frontier possibly because they are more dependent on monetary stabilization. The unregulated increase of their credit portfolio as a result of substantial insider lending leads to serious improvement of their efficiency score; the results however should be cautiously interpreted. The accelerated growth of credit portfolios and the widening of exposures to special persons put these bank units at risk (for details see, *Turgovski sgovor*).

Table 8: Banks' efficiency (private Bulgarian banks)

	1923	1928	1923	1928	1923	1928
Private Bulgarian banks	Model 1: Assets_VRS	Model 1: Assets_VRS	Model 1.1: Assets_VRS	Model 1.1: Assets_VRS	Model 2: Administrative costs_VRS	Model 2: Administrative costs_VRS
<i>STDEV</i>	0.23532	0.20323	0.23478	0.20555	0.26265	0.24956
<i>MEDIAN</i>	0.64331	0.65547	0.63303	0.66883	0.28026	0.68646
<i>AVERAGE</i>	0.66019	0.68930	0.65342	0.69156	0.37166	0.68380
<i>MIN</i>	0.17284	0.34891	0.17284	0.34891	0.11733	0.14321
<i>MAX</i>	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000
<i>Count</i>	38	38	37	37	37	37
<i>number of efficient Banks</i>	5	6	4	5	3	3

Note: In Model 1 the results of the whole group of fifty banks are shown, while in Model 1.1 the results of the forty-six banks included in the calculation of efficiency as per Model 2. Model 1 and Model 1.1 use as inputs the amount of banks' total assets, their fixed assets and deposits, while Model 2 employs administrative costs, fixed assets and deposits.

The state-owned banks are more efficient than the local Bulgarian banks and less efficient than the foreign banks. The group of state-owned banks includes the Bulgarian National Bank (BNB), which during the first of the investigated years plays the role of a commercial bank accumulating considerable resources channeled gradually to increasingly longer-term investment projects. It is among the banks forming the efficiency frontier. The policy of the state aimed to provide incentives to the state-owned banks brings these banks to the foreground, thereby distorting competition in the banking system.

Table 9: Banks' efficiency (state-owned banks)

	1923	1928	1923	1928	1923	1928
State-owned banks	Model 1: Assets_VRS	Model 1: Assets_VRS	Model 1.1: Assets_VRS	Model 1.1: Assets_VRS	Model 2: Administrative costs_VRS	Model 2: Administrative costs_VRS
<i>STDEV</i>	0.40642	0.25270	0.40642	0.25270	0.39881	0.25270
<i>MEDIAN</i>	0.65437	1.00000	0.65437	1.00000	0.66835	1.00000
<i>AVERAGE</i>	0.64814	0.87365	0.64814	0.87365	0.65513	0.87365
<i>MIN</i>	0.28382	0.49460	0.28382	0.49460	0.28382	0.49460
<i>MAX</i>	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000
<i>Count</i>	4	4	4	4	4	4.00000
<i>number of efficient banks</i>	2	3	2	3	2	3

Note: In Model 1 the results of the whole group of fifty banks are shown, while in Model 1.1 the results of the forty-six banks included in the calculation of efficiency as per Model 2. Model 1 and Model 1.1 use as inputs the amount of banks' total assets, their fixed assets and deposits, while Model 2 employs administrative costs, fixed assets and deposits.

The results for the banks that failed after the Great Depression indicate (see Tables 10 and 11) that most of them operated increasing returns to scale. For the production units, to function at increasing returns to scale and operate more efficiently, they could have merged as normally these were small units, in which any further employment would lead to higher specialization of labour. The fact that they did not merge and did not benefit from the scale could be a reason for their greater vulnerability during the crisis, and subsequently for their failure. What also makes an impression is that some of the banks, although on the efficiency frontier or very close to it, also failed after the crisis. This could as well be as a result of their accumulation of considerable amount of loans that led to increased efficiency in 1928. Still, the value of bad loans in the banks' portfolios need also be considered. An attempt was

made to measure the impact of bad loans; however, the calculations showed no change in the results. The reason for this is that with no regulations in place the banks did not state correctly the amount of their bad loans in their balance sheets, which leads to underestimation of this effect. In order to establish how much some of the banks owe their high efficiency to credit expansion, they will have to be studied individually.

Table 10: Bankrupt banks (Model 1.1)

Bank's Name	1923	Return of (to) scale	1928	Return of (to) scale
Banka na tutunoproizvoditelite	0.7212	Decreasing	0.4586	Increasing
Napreduk	0.5389	Decreasing	0.3631	Increasing
Union	0.6536	Increasing	0.5405	Increasing
Zora	0.5175	Increasing	0.5619	Increasing
Asbarez	0.5727	Increasing	0.6346	Increasing
Otechestvo	0.8818	Decreasing	1.0000	Increasing
Banka za turgovia i kreit	0.6619	Decreasing	0.5723	Increasing
Banka za turgovia industria I knijnina	0.7736	Decreasing	0.5563	Increasing
Banka na suedinenite industrii	0.2217	Increasing	0.5190	Increasing
Bulgarska kreditna banka	0.1728	Increasing	0.5471	Increasing
Turgovski sgovor	1.0000	Decreasing	0.9135	Increasing
Burgaska banka	0.5181	Decreasing	0.5904	Increasing
Suedinenie	0.7422	Decreasing	0.5503	Increasing
Bulgarska garancionna banka	0.6270	Increasing	1.0000	Increasing
Bulgarska spetovna banka	1.0000	Increasing	0.7905	Increasing
Bulgarska stopanska banka	0.6330	Increasing	0.8311	Increasing
Bulgarsko-amerikanska banka	1.0000	Decreasing	1.0000	Constant
Bulgarsko-populiarna banka	0.4333	Decreasing	0.4915	Increasing
Vidinska banka	0.6609	Increasing	0.8302	Increasing
Gornooriahovska banka	0.8343	Increasing	1.0000	Increasing
Dupnishka turgovska kreditna banka	0.6988	Increasing	0.7924	Increasing
Evreiska populiarna banka	0.8520	Increasing	1.0000	Increasing
Elenska turgovska banka	0.2300	Increasing	0.3489	Increasing
Iznosno-vnosna banka	0.5246	Increasing	1.0000	Increasing
Industrialna banka	1.0000	Decreasing	0.7872	Decreasing
Loveshka turgovska banka	0.9188	Decreasing	0.6688	Increasing
Oriahovska turgovska banka	0.3021	Increasing	0.5015	Increasing
Plevenska turgovska banka	0.5650	Decreasing	0.4722	Increasing
Selsko-esnafska banka	0.8946	Increasing	0.3982	Increasing
Sofiiska banka	0.4459	Decreasing	0.4739	Increasing
Trakiiska banka	0.6112	Decreasing	0.7311	Increasing
Zemledelec	0.4210	Increasing	0.9806	Increasing
Turgovsko kreditna banka	0.4270	Decreasing	0.9164	Increasing
Plovdiv	1.0000	Increasing	0.6994	Increasing

Table 11: Bankrupt banks (Model 2)

Bank's Name	1923	Return of scale	1928	Return of scale
Banka na tutunoproizvoditelite	0.1757	Increasing	0.6601	Increasing
Napreduk	0.1173	Decreasing	0.4425	Decreasing
Union	0.1430	Increasing	0.5920	Increasing
Zora	0.4782	Increasing	0.3529	Increasing
Asbarez	0.2816	Increasing	0.6105	Increasing
Otechestvo	0.5157	Increasing	1.0000	Increasing
Banka za turgovia I kreit	0.3671	Increasing	0.5152	Increasing
Banka za turgovia industria I knijnina	0.3861	Decreasing	0.7549	Increasing
Banka na suedinenite industrii	0.1866	Increasing	0.1432	Increasing
Bulgarska kreditna banka	0.1334	Increasing	0.4297	Increasing
Turgovski sgovor	0.3957	Increasing	0.9502	Increasing
Burgaska banka	0.1833	Increasing	0.7097	Increasing
Suedinenie	0.2535	Increasing	0.2413	Increasing
Bulgarska garancionna banka	0.4734	Increasing	1.0000	Increasing
Bulgarska spetovna banka	1.0000	Increasing	1.0000	Increasing
Bulgarska stopanska banka	0.2729	Increasing	0.6865	Increasing
Bulgarsko-amerikanska banka	1.0000	Constant	1.0000	Constant
Bulgarsko-populiarna banka	0.1556	Increasing	0.3439	Increasing
Vidinska banka	0.6588	Increasing	0.7359	Increasing
Gornooriahovska banka	1.0000	Increasing	1.0000	Increasing
Dupnishka turgovska kreditna banka	0.2179	Increasing	0.7511	Increasing
Evreiska populiarna banka	0.5610	Increasing	0.8316	Increasing
Elenska turgovska banka	0.1423	Increasing	1.0000	Increasing
Iznosno-vnosna banka	0.1646	Increasing	0.8899	Increasing
Industrialna banka	0.3308	Increasing	1.0000	Constant
Loveshka turgovska banka	0.1993	Increasing	0.8745	Increasing
Oriahovska turgovska banka	0.1684	Increasing	0.7016	Increasing
Plevenska turgovska banka	0.3262	Increasing	0.4698	Increasing
Selsko-esnafska banka	0.4177	Increasing	0.9734	Increasing
Sofiiska banka	0.2803	Decreasing	0.4994	Increasing
Trakiiska banka	0.2894	Increasing	0.6851	Increasing
Zemledelec	0.1208	Increasing	0.2906	Increasing
Turgovsko kreditna banka	0.1657	Increasing	0.9453	Increasing
Plovdiv	0.6309	Increasing	0.5411	Increasing

The banks that merged reveal that they operated at decreasing returns to scale and their logical policy would have been to split up. This is also as a result of the state policy. This policy, however, was unwarranted.

Table 12: Merged banks

	1923	1928	1923	1928
	Model 1.1: Assets	Model 1.1: Assets	Return of scale	
Balkanska banka*	0.9230	0.9893	Decreasing	Decreasing
Bulgaria	0.5729	0.7071	Increasing	Increasing
Banka za narodni kredit	0.8132	0.6421	Decreasing	Decreasing
Bulgarska banka*	0.9107	0.6056	Decreasing	Decreasing
Bulgarska zemedelska banka	1.0000	1.0000	Decreasing	Decreasing
Bulgarska centralna kooperativna banka	0.2838	0.4946	Decreasing	Decreasing
Internacionalna banka Bulgaria	0.3087	1.0000	Increasing	Decreasing
Kreditna banka*	0.6265	0.9974	Decreasing	Decreasing
Gradivo	0.9797	0.7170	Increasing	Increasing
Franko-belgijska banka za Bulgaria	0.4115	1.0000	Decreasing	Decreasing
Franko-bulgarska ipotekarna banka	1.0000	1.0000	Decreasing	Decreasing

	1923	1928	1923	1928
	Model 2: Administrative costs	Model 2: Administrative costs	Return of scale	
Balkanska banka*				
Bulgaria	0.27975	0.57079	Increasing	Increasing
Banka za narodni kredit	0.26879	0.87064	Decreasing	Decreasing
Bulgarska banka*				
Bulgarska zemedelska banka	1.00000	1.00000	Decreasing	Decreasing
Bulgarska centralna kooperativna banka	0.28382	0.4946	Decreasing	Decreasing
Internacionalna banka Bulgaria	0.33671	1.00000	Increasing	Decreasing
Kreditna banka*				
Gradivo	0.96936	0.55728	Increasing	Increasing
Franko-belgijska banka za Bulgaria	0.57058	1.00000	Decreasing	Decreasing
Franko-bulgarska ipotekarna banka	1.00000	1.00000	Decreasing	Decreasing

The significant improvement of efficiency of some of the banks requires studying their archive records with a view to come to the actual reasons for this, hence

to some new economic and financial dependencies. Such is the case with the small provincial bank *Turgovski sgovor* whose archives have revealed interesting facts.

The bank was established in 1919 by a group of local merchants and producers of rice in Pazardjik. In parallel with their financial operations until 1925 the company was also engaged in trading and ran their own shop in the town. The serious difficulties were not long in coming and around 1926 – 1927 *Turgovski sgovor* was “in possession” of 1179 thousand levs in judicially protested portfolio out of a total of 1732 thousand levs in extended loans. Overstated as these audit data might seem (circa 70% non-performing loans) it is more than clear that the bank was in deep crisis. The newly appointed management in 1927 was received with high hopes by the BNB local branch in Pazardjik. In the words of the bank clerk the new Management Board had a chance to clear away the “bad heritage” as its members possessed “high morals” and the bank’s director was “very energetic”.

In 1928 the fixed capital of *Turgovski sgovor* increased from 1 to 2 million levs. Attempts were made to cut down administrative costs with the director assuming the functions of cashier as well after the position was closed. The situation however, as evident by the last audit (if we can rely on the last audit findings), remains “not really good” and after 1927 dividend payment was not resumed. The new examination report prepared in 1931, however, paints a bleak picture. The report no longer mentions the Management Board’s “high morals”, or the director’s enthusiasm. This time the new BNB auditor points out that “the members of the Management Board show little interest in the company’s activities” as they were engulfed in their private business. The management was actually in the hands of the director, Assen G. Petrov, a son-in-law of one of the major shareholders, Nikola Ivanov. The bank was rusted by insider loans: “The Management Board and the key shareholders have used the bank’s funds widely for their own needs; yet another portion they have granted to closely related persons”. The loans to connected persons amount to 2663 thousand levs, with deposits being only 1380 thousand levs. Of equal concern is the conclusion that “the bank’s trade turnover over the last three years can not be estimated due to constant transformation of accounts and their keeping jointly (on a disaggregated basis) with other accounts”. Some idea about the size of impaired assets could be obtained by the figures in the table below:

Table 13: Adjusted asset of *Turgovski sgovor* for the years 1927 – 1931, in thousand levs

	1927	1929	1930	1931
Balance-sheet asset*	3992.9	5104.7	7827.2	6995.9
Adjusted asset**	3600.3	4619.6	6273.9	4716.3
Percentage of impairment	-9.83	-9.50	-19.84	-32.58

Source: Central State Archives

Note:* Based on publications in the State Gazette, ** Based on the BNB audit

The in-depth study of *Turgovski sgovor* in Pazardjik reveals problems that can be found at an individual level: (i) Financial institutions do not show truthfully their bad loans in their published balance sheets. They swell their portfolios by including non-performing loans, i.e. empty assets to puff up phony efficiency; (ii) Opaque account keeping. If we cite once again the audit report for the year 1931: “constant transformation of accounts and their keeping jointly with other accounts (on a disaggregated basis)”. (iii) Even the BNB is not always a reliable external auditor. Often, the case depends on local involvements and/or lack of professional skills locally. Thus, the change of the auditor (in 1931) led to a radical revision of the assessment of the bank’s financial position.

The above findings and problems indicate that the DEA results need to be cautiously interpreted. The data on input and output variables verified on a bank-by-bank basis especially for the smaller banks whose results given below the models point to high efficiency whereas they actually did not perform so efficiently. An investigation of these banks at an individual level will be carried out at a later stage of studying the banks’ efficiency in past periods. When handling historical data, researchers inevitably face this kind of difficulties, which necessitates additional studying of archive records to overcome them.

5. Conclusions and directions for further research

The attempt to apply DEA to historical data on the Bulgarian banking system is broadly successful both technically and as a possibility to formulate a number of

theoretical dependencies. In general, it confirms the basic hypotheses from economic literature about the role of the banking system in peripheral countries: the banks' efficiency increases with the development of monetary stabilization; the private foreign banks and the state-owned banks demonstrate the highest efficiency while the Bulgarian private institutions are the least efficient. In spite of the existing differences one can observe an equalization of efficiency in the late 1920s, in comparison with the initial date in the analysis (1923), which points to a higher competition. Nevertheless, the BNB is one of the most efficient banks as it is almost always on the efficiency frontier, which is in a sense an illustration of violating the principles of free competition. In spite of our endeavors to have a model clear of any "bad loans" in order to see the impact of "credit inflation" resulting from the two external loans, the findings as a whole are not very satisfactory due to undisclosed data on accumulated bad receivables. The case of *Turgovski sgovor* is a vivid illustration of the lack of transparency concerning balance-sheet reporting. As to the returns to scale analysis, it largely confirms the relationship that the banks performing on the frontier of increasing returns to scale subsequently go bankrupt, while those performing at decreasing returns to scale subsequently merge.

Some new directions for analysis within the above approach can be mapped out. First, a different type of efficiency estimation techniques can be employed – the stochastic frontier for instance. Second, the factors conditioning the dynamics of efficiency need be identified which could be achieved by using a panel econometric model where efficiency is regressed with a number of variables – economic and other. Normally, this type of analysis - the so-called regression analysis - comprises the second stage of the modern research of bank's efficiency (once the efficiency has been measured). These two options relate to the technical sophistications. With regard to expanding the scope of research, it would be well to have a comparative analysis done of the banking efficiency in the Balkan countries between the two World Wars including the other credit institutions such as credit co-operations, popular banks, etc. Of course, empirical measurements must be complemented by "in-depth" historical and sociological investigations of individual banks and credit institutions, as these carry information that is lost with econometric and statistical analyses.

References

- Avramov, R. (2007). Communal Capitalism. From the Bulgarian Economic Past, in 3 Volumes, Bulgarian Science and Culture Foundation Publishing House [Sofia Аврамов, Р. (2007). Комуналният капитализъм. Из Българското стопанско минало, в 3 тома, изд. Фондация българска наука и куртура, София].
- Banker, R., A. Charnes, W. Cooper (1984), Some Model for Estimating Technical and Scale Inefficiencies in a Data Envelopment Analysis, *Management Science*, No 30.
- Battilossi, S. (2006). The Determinants of Multinational Banking during the First Globalization, 1870-1914, *Oesterreichische Nationalbank Working Paper* No 114.
- Berger, A.N, D. Humphrey (1997), Efficiency of Financial Institutions: International Survey and Directions for Future Research, *European Journal of Operational Research*, vol. 98.
- Briones, I., A. Villela (2006). European Banks and their Impact on the Banking Industry in Chile and Brazil: 1862-1913, *Oesterreichische Nationalbank Working Paper* No 108.
- Caner, S., V. Kontorovich (2004). Efficiency of the Banking Sector in the Russian Federation with International Comparison, *Экономический журнал (HSE Economic Journal)*, том 8, No 3, с. 357-376.
- Chakalov, A. (1931). Agricultural Credit Problems in Bulgaria, *Journal of the Bulgarian Economic Society*, year XXX, issue 3, p. 139-169. Чакалов, А. (1931). [Проблемите на земеделския кредит в България, Списание на Българското Икономическо Дружество, год. XXX, кн. 3, с. 139-169].
- Charnes, A., W. Cooper, A. Rhodes (1978), "Measuring the Efficiency of Decision Making Units", *European Journal of Operational Research*, No 2.
- Coelli, T., D. Prasada Rao, Ch. O'Donnell, G. Battese (2005). An Introduction to Efficiency and Productivity Analysis, Second Edition, Springer.
- Cooper, W., L. Seiford, J. Zhu (2004). Data Envelopment Analysis: Models and Interpretations, Chapter 1, 1-39, in W.W. Cooper, L.M. Seiford and J. Zhu (eds), *Handbook on Data Envelopment Analysis*, Kluwer Academic Publisher, Boston, 2004
- Ferraton, C. (2007). Associations et Coopératives. Une Autre Histoire Economique, éd. Eres, Ramonville Saint-Agne.
- Fiorentino, E., A. Karmann, M. Koetter (2006). The Cost Efficiency of German Banks: A Comparison of SFA and DEA, University of Dresden.

- Ganev, H. (2006). *My Life Path. Development of the Co-operative Movement in Bulgaria between the two World Wars*, Zahari Stoyanov Publishing House, Sofia
 Ганев, Х. (2006), [Моят жизнен път. Развитие на кооперативното движение в България между двете световни войни, изд. Захарий Стоянов, София].
- Grigorian, D., V. Manole (2002), “Determinants of Commercial Bank Performance in Transition: An Application of Data Envelopment Analysis, *IMF Working Paper* No. 146.
- Hristophorov, A. (1946). *A course in Bulgarian Banking, in 2 Volumes*, Publication of the General Student Support Fund, Sofia [Христофоров, А. (1946). Курс по българско банково дело, в 2 тома, Издание на „Общия фонд за подпомагане на студентите”, София].
- Hristophorov, A. (1939). *Development of the Conjuncture Cycle in Bulgaria, 1934-1939*, Sofia Royal Printing Office [Христофоров, А. (1939). Развитие на конюнктурния цикъл в България 1934-1939, Придворна печатница, София].
- Ivanov, M. (2006). *Bulgaria’s National Income, 1892–1924. – BNB Discussion Papers No 54* Иванов, М. (2006) [Националният доход на България, 1892-1924, Дискусионни материали, БНБ, № 54].
- Jemric I. and B. Vujcic (2002), “Efficiency of Banks in Croatia: a DEA Approach”, Croatian National Bank.
- Karklisiiski, N. (1941). *Findings about the Banking Institutions’ Credit Activities from the Perspective of their Impact on the Key Economic Sectors in Bulgaria*, Sofia
 Кърклиясийски, Н. (1941) [Констатации върху кредитната дейност на банковите институти с оглед на въздействието им върху по-важните отрасли на българското народно стопанство, София].
- Koshev, K. (2008). *The Banking Sector and the Great Depression in Bulgaria, 1924-1938: Interlocking and Financial Sector Profitability*, paper presented at the 3rd SEEMHN conference, Athens, March.
- Loukianova, E. (2008). *Analysis of the Efficiency and Profitability of the Japanese banking System*, *IMF Working Paper* WP/08/63.
- Luciano, E., Regis, L. (2007). *Bank Efficiency and Banking Sector Development: the Case of Italy*, *ICER Working Paper* No 5.
- Matousek, R., Taci, A. (2004). *Efficiency in Banking and Empirical Evidence from the Czech Republic*, *Economics of Planning*, vol. 37, pp. 225-244.
- Nagy, D. (2006). *Bank Efficiency in the Enlarged European Union*, *Magyar Nemzeti Bank Working Papers*, No 3.

- Nenovsky, N., P. Chobanov, D. Koleva, G. Mihaylova (2007). Efficiency of the Bulgarian Banking System: Traditional Approach and DEA, Agency for Economic Programming and Forecasting, Ministry of Finance, Sofia.
- Nenovsky, N. (2005). Exchange Rate Inflation: France and Bulgaria in the Interwar Period. The Contribution of Albert Aftalion (1874-1956), Edition of Bulgarian National Bank.
- Nenovsky, N., M. Tomova, T. Naneva (2004), The Efficiency of Banking System in CEE. Inequality and Convergence to the EU, in *Financial markets in CEE, Stability and Efficiency Perspectives*, (Balling, M., F.Lierman, A. Mullineux, eds.), Routledge, London, pp. 225 – 251.
- Pawlowska M. (2005), Competition, Concentration, Efficiency and their Relationship in the Polish Banking Sector, National Bank of Poland, Working Paper No 32.
- Société des Nations (1931). Mémoire sur les banques commerciales, 1913-1929, Genève.
- Sylla, R., G. Toniolo (2001). Eds., Patterns of European Industrialization: The Nineteenth Century, Routledge, New York.
- Sylla, R. (2005). The Origins of National Financial Systems: Alexander Gershenkron Reconsidered, Book reviews, EH.Net.
- Toshev, D. (1948). Monetary and Banking Activities (lectures), Varna University Press
Тошев, Д. (1948). [Парично и банково дело (лекции), Университетска печатница, Варна].
- Tugan-Baranovsky, M. (1989, [1915]). Social Premises of Co-operation, Economics (Экономика) Publishing House, Moscow, [Туган-Барановский, М. (1989, [1915]), Социальные основы кооперации, изд. Экономика, Москва].
- Verdier, D. (2001). How and Why Financial Systems Differ: A Survey of the Literature, European University Institute.

Data sources:

State Gazette: 1923, Number 1, 2, 3, 7, 9, 11, 14, 19, 20, 30, 36, 55, 63, 231, 241, 246, 252, 255, 257, 264, 267, 270, 271, 273, 274, 275, 276, 277, 278, 280, 281, 282, 285, 287, 290, 291

State Gazette: 1928, Number 3, 13, 19, 31, 32, 34, 35, 36, 39, 53, 55, 58, 85, 232, 235, 237, 243, 246, 247, 251, 254, 256, 258, 261, 263, 264, 265, 266, 267, 269, 271, 272, 275, 277, 278, 279, 284, 285, 294

Appendix I: Individual results of the banks – Model 1, Model 1.1, Model 2

Model 1

Bank No.	Bank's Name	1923	1928	1923	1928
		Input-Oriented CRS Efficiency	Input-Oriented CRS Efficiency	Input-Oriented VRS Efficiency	Input-Oriented VRS Efficiency
1	Banka na tutunoproizvoditelite	0.70795	0.34550	0.72119	0.45856
2	Napreduk	0.51104	0.36199	0.53891	0.36306
3	Union	0.63034	0.52180	0.65358	0.54051
4	Zora	0.43812	0.43349	0.51752	0.56189
5	Balkanska banka	0.91788	0.88901	0.92296	0.98926
6	Asbarez	0.54852	0.49531	0.57267	0.63462
7	Bulgaria	0.56061	0.62683	0.57288	0.70707
8	Otechestvo	0.86130	0.72680	0.88178	1.00000
9	Banka za naroden kredit	0.76602	0.58502	0.81323	0.64210
10	Banka za turgovia i kredit	0.65267	0.54127	0.66188	0.57230
11	Banka za turgovia industria i knijnina	0.74913	0.55217	0.77361	0.55629
12	Banka na suedinenite industrii	0.17264	0.24137	0.22167	0.51903
13	Bulgarska kreditna banka	0.17240	0.54312	0.17284	0.54705
14	Turgovski sgovor	1.00000	0.66600	1.00000	0.91354
15	BNB	1.00000	0.52983	1.00000	1.00000
16	Burgaska banka	0.49489	0.57928	0.51810	0.59038
17	Suedinenie	0.72704	0.51802	0.74221	0.55030
18	Bulgarska banka AD	0.86081	0.40678	0.91073	0.60561
19	Bulgarska garancionna banka	0.59421	0.56983	0.62698	1.00000
20	Bulgarska generalna banka	0.28596	0.81889	1.00000	0.89952
21	Bulgarska zemedelska banka	0.69490	0.88041	1.00000	1.00000
22	Bulgarska skontova banka	0.45383	0.85086	0.60745	1.00000
23	Bulgarska spestovna banka	0.78490	0.69653	1.00000	0.79049
24	Bulgarska stopanska banka	0.62726	0.79131	0.63303	0.83106
25	Bulgarska turgovska banka	0.88441	1.00000	1.00000	1.00000
26	Bulgarska centralna banka	0.21781	0.16043	0.28382	0.49460
27	Bulgarsko-amerikanska banka	1.00000	1.00000	1.00000	1.00000
28	Bulgarsko-palestinska banka	0.41545	0.48345	0.43331	0.49152
29	Vidinska banka	0.64367	0.82038	0.66091	0.83018
30	Gornooriahovska banka	0.81051	0.63734	0.83433	1.00000
31	Dupnishka turgovska kredita banka	0.67519	0.71979	0.69881	0.79240

32	Evreiska popularna banka	0.83810	0.70634	0.85200	1.00000
33	Elenska turgovska banka	0.15752	0.17906	0.23001	0.34891
34	Iznosno-vnosna banka	0.50615	0.19177	0.52460	1.00000
35	Industrialna banka	1.00000	0.73801	1.00000	0.78718
36	Internacionalna banka Bulgaria	0.08847	0.49708	0.30873	1.00000
37	Italianska i Bulgarska turgovska banka	0.71257	0.50440	0.75676	0.85923
38	Kreditna banka	0.59037	0.89235	0.62651	0.99739
39	Loveshka turgovska akcionerna banka	0.88626	0.59424	0.91882	0.66883
40	Oriahovska turgovska banka	0.27861	0.38517	0.30205	0.50150
41	Plevenska turgovska banka	0.56147	0.42801	0.56498	0.47216
42	Selsko-esnafska banka	0.86799	0.38626	0.89458	0.39818
43	Sofiiska banka	0.42191	0.47294	0.44585	0.47394
44	Gradivo	0.96936	0.05751	0.97967	0.71699
45	Trakiiska banka	0.59661	0.67791	0.61120	0.73110
46	Zemledelec	0.41608	0.78843	0.42098	0.98061
47	Turgovsko kreditna banka	0.41153	0.89152	0.42702	0.91642
48	Plovdiv	0.22894	0.08115	1.00000	0.69944
49	Franko-belgiiska banka za Bulgaria	0.40232	0.20626	0.41149	1.00000
50	Franko-bulgarska ipotekarna banka	1.00000	1.00000	1.00000	1.00000

Model 1.1

Bank No.	Bank's Name	1923	1928	1923	1928
		Input-Oriented CRS Efficiency	Input-Oriented CRS Efficiency	Input-Oriented VRS Efficiency	Input-Oriented VRS Efficiency
1	Banka na tutunopriozvoditelite	0.70795	0.34550	0.72119	0.45856
2	Napreduk	0.51104	0.36199	0.53891	0.36306
3	Union	0.63034	0.52180	0.65358	0.54051
4	Zora	0.43812	0.43349	0.51752	0.56189
5	Balkanska banka				
6	Asbarez	0.54852	0.49531	0.57267	0.63462
7	Bulgaria	0.56061	0.62683	0.57288	0.70707
8	Otechestvo	0.86130	0.72680	0.88178	1.00000
9	Banka za naroden kredit	0.76602	0.58502	0.81323	0.64210
10	Banka za turgovia i kredit	0.65267	0.54127	0.66188	0.57230
11	Banka za turgovia industria i knijnina	0.74913	0.55217	0.77361	0.55629
12	Banka na suedinenite industrii	0.17264	0.24137	0.22167	0.51903
13	Bulgarska kreditna banka	0.17240	0.54312	0.17284	0.54705
14	Turgovski sgovor	1.00000	0.66600	1.00000	0.91354
15	BNB	1.00000	0.52983	1.00000	1.00000
16	Burgaska banka	0.49489	0.57928	0.51810	0.59038
17	Suedinenie	0.72704	0.51802	0.74221	0.55030
18	Bulgarka banka AD				
19	Bulgarska garancionna banka	0.59421	0.56983	0.62698	1.00000
20	Bulgarska generalna banka				
21	Bulgarska zemedelska banka	0.69490	0.88041	1.00000	1.00000
22	Bulgarska skontova banka	0.45383	0.85086	0.60745	1.00000
23	Bulgariska spestovna banka	0.78490	0.69653	1.00000	0.79049
24	Bulgarska stopanska banka	0.62726	0.79131	0.63303	0.83106
25	Bulgarska turgovska banka	0.88441	1.00000	1.00000	1.00000
26	Bulgarska centralna kooperativna banka	0.21781	0.16043	0.28382	0.49460
27	Bulgarsko-amerikanska banka	1.00000	1.00000	1.00000	1.00000
28	Bulgarsko-palestinska banka	0.41545	0.48345	0.43331	0.49152
29	Vidinska banka	0.64367	0.82038	0.66091	0.83018
30	Gornooriahovska banka	0.81051	0.63734	0.83433	1.00000
31	Dupnishka turgovska kreditna banka	0.67519	0.71979	0.69881	0.79240
32	Evreiska popularna banka	0.83810	0.70634	0.85200	1.00000
33	Elenska turgovska banka	0.15752	0.17906	0.23001	0.34891
34	Iznosno-vnosna banka	0.50615	0.19177	0.52460	1.00000
35	Industrialna banka	1.00000	0.73801	1.00000	0.78718
36	Internacionalna banka Bulgaria	0.08847	0.49708	0.30873	1.00000

37	Italianska i Bulgarska turgovska banka	0.71257	0.50440	0.75676	0.85923
38	Kreditna banka				
39	Loveshka turgovska banka akcionerna banka	0.88626	0.59424	0.91882	0.66883
40	Oriahovska turgovska banka	0.27861	0.38517	0.30205	0.50150
41	Plevenska turgovska banka	0.56147	0.42801	0.56498	0.47216
42	Selsko-esnafska banka	0.86799	0.38626	0.89458	0.39818
43	Sofiiska banka	0.42191	0.47294	0.44585	0.47394
44	Gradivo	0.96936	0.05751	0.97967	0.71699
45	Trakiiska banka	0.59661	0.67791	0.61120	0.73110
46	Zemledelec	0.41608	0.78843	0.42098	0.98061
47	Turgovsko kreditna banka	0.41153	0.89152	0.42702	0.91642
48	Plovdiv	0.22894	0.08115	1.00000	0.69944
49	Franko-belgiiska banka za Bulgaria	0.40232	0.20626	0.41149	1.00000
50	Franko-belgiiska ipotekarna banka	1.00000	1.00000	1.00000	1.00000

Model 2

Bank No.	Bank's Name	1923	1928	1923	1928
		Input-Oriented CRS Efficiency	Input-Oriented CRS Efficiency	Input-Oriented VRS Efficiency	Input-Oriented VRS Efficiency
1	Banka na tutunoproizvoditelite	0.11425	0.23972	0.17567	0.66005
2	Napreduk	0.11581	0.39560	0.11733	0.44245
3	Union	0.10704	0.53712	0.14297	0.59201
4	Zora	0.43812	0.13918	0.47822	0.35289
5	Balkanska banka				
6	Asbarez	0.22736	0.33163	0.28160	0.61047
7	Bulgaria	0.23063	0.44066	0.27975	0.57079
8	Otechestvo	0.50937	0.41276	0.51566	1.00000
9	Banka za naroden kredit	0.18305	0.61517	0.26879	0.87064
10	Banka za turgovia i kredit	0.33633	0.44075	0.36706	0.51520
11	Banka za turgovia industria i knijnina	0.38613	0.75373	0.38613	0.75490
12	Banka na suedinenite industrii	0.17264	0.02535	0.18664	0.14321
13	Bulgarska kreditna banka	0.12819	0.42224	0.13336	0.42968
14	Turgovski sgovor	0.21341	0.31897	0.39572	0.95020
15	BNB	0.62873	0.39742	1.00000	1.00000
16	Burgaska banka	0.17646	0.67170	0.18329	0.70972
17	Suedinenie	0.23354	0.21067	0.25351	0.24134
18	Bulgarska banka AD				
19	Bulgarska garancionna banka	0.36445	0.35474	0.47338	1.00000
20	Bulgarska generalna banka				
21	Bulgarska zemedelska banka	0.10261	0.16902	1.00000	1.00000
22	Bulgarska skontova banka	0.41451	0.23229	0.60160	0.51152
23	Bulgarska spestovna banka	0.67260	0.73367	1.00000	1.00000
24	Bulgarska stopanska banka	0.15907	0.57314	0.27288	0.68646
25	Bulhgarska turgovska banka	0.17367	0.63749	1.00000	1.00000
26	Bulgarska centralna kooperativna banka	0.18087	0.18099	0.28382	0.49460
27	Bulgarsko-amerikanska banka	1.00000	1.00000	1.00000	1.00000
28	Bulgarsko-palestinska banka	0.13867	0.32488	0.15556	0.34388
29	Vidinska banka	0.64367	0.70957	0.65877	0.73593
30	Gornooriahovska banka	1.00000	0.85251	1.00000	1.00000
31	Dupnishka turgovska kreditna banka	0.16877	0.60032	0.21789	0.75108
32	Evreiska popularna banka	0.49687	0.23478	0.56099	0.83159
33	Elenska turgovska banka	0.03564	0.21787	0.14226	1.00000
34	Iznosno-vnosna banka	0.12485	0.18914	0.16456	0.88986

35	Industrialna banka	0.30161	1.00000	0.33083	1.00000
36	Internacionalna banka Bulgaria	0.10057	0.69658	0.33671	1.00000
37	Italianska i Bulgarska turgovska banka	0.48201	0.71312	1.00000	1.00000
38	Kreditna banka				
39	Loveshka turgovska akcionerna banka	0.16109	0.59977	0.19927	0.87451
40	Oriahovska turgovska banka	0.09079	0.36899	0.16838	0.70163
41	Plevenska turgovska banka	0.26838	0.35255	0.32620	0.46981
42	Selsko-esnafska banka	0.29967	0.90727	0.41771	0.97344
43	Sofiiska banka	0.23104	0.48705	0.28026	0.49941
44	Gradivo	0.96936	0.01746	0.96936	0.55728
45	Trakiiska banka	0.24411	0.57190	0.28941	0.68514
46	Zemledelec	0.09696	0.26646	0.12078	0.29061
47	Turgovsko kreditna banka	0.14741	0.41916	0.16568	0.94529
48	Plovdiv	0.22894	0.08115	0.63090	0.54108
49	Franko-belgiiska banka za Bulgaria	0.30326	0.33067	0.57058	1.00000
50	Franko-bulgarska ipotekarna banka	1.00000	1.00000	1.00000	1.00000

Appendix II: Data Envelopment Analysis – a basic presentation

In case of multiple input and output factors the efficiency score⁷ is defined as:

$$\text{Efficiency} = \frac{\text{Weighted sum of outputs}}{\text{Weighted sum of inputs}}$$

The efficiency scores of the separate decision making units (DMUs), calculated by using the data envelopment analysis (DEA), obtains values between 0 and 1. When the DMU receives efficiency score of 1, then it forms the efficiency frontier and lies on it.

The optimal weights are obtained by solving the presented mathematical programming problem:

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

$$\text{Subject to } u' y_j / v' x_j \leq 1 \quad j = 1, 2, \dots, I \\ u, v \geq 0$$

For each of I firms there are N inputs and M outputs. In that case the column vectors x_i and y_i represent the set of inputs and outputs respectively for the i -th firm, while the data for all I firms is represented by the $N \times I$ input matrix, X , and the $M \times I$ output matrix, Y .

The following *multiplier form* avoids the problem of obtaining an infinite number of solutions by imposing a new constraint:

$$\max_{u,v} (u' y_i) \tag{2}$$

$$\text{Subject to } v' x_i = 1 \\ u' y_j - v' x_j \leq 0 \quad j = 1, 2, \dots, j_0, \dots, I \\ u, v \geq 0$$

The equivalent *envelopment form* of this linear programming problem is the preferred one to solve, as it involves fewer constraints than the multiplier form (AII.2):

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

$$\text{Subject to } -y_i + Y\lambda \geq 0 \\ \theta x_i - X\lambda \geq 0 \\ \lambda \geq 0$$

Here θ is a scalar, and λ is an $I \times 1$ vector of constants (i.e. weights). The value of θ obtained is the efficiency score of the i -th firm and it satisfies $\theta \leq 1$, where a value of 1 indicates a point on the frontier, i.e. a technically efficient firm. To obtain the value

⁷ The presented specifications of the DEA models are based on Coelli *et al.* (2005), where more detailed information on efficiency measurement models could be found.

of θ for each firm, the linear programming model must be solved I times. The presented approach to the linear programming problem (AII.2) assumes constant returns to scale (CRS). The CRS problem can be easily modified to account for VRS by adding a convexity constraint, which allows to envelope the data points more tightly than under the CRS specification and thus provides technical efficiency scores that are greater than or equal to those obtained using the CRS model. The VRS linear programming problem is:

$$\min_{\theta, \lambda} \theta \tag{4}$$

$$\begin{aligned} \text{Subject to } & -y_I + Y\lambda \geq 0 \\ & \theta x_I - X\lambda \geq 0 \\ & \Pi^1 = 1 \\ & \lambda \geq 0 \end{aligned}$$

BANK OF GREECE WORKING PAPERS

61. Hall, S. G., G. Hondroyiannis, P.A.V.B. Swamy and G. S. Tavlás, “A Portfolio Balance Approach to Euro-area Money Demand in a Time-Varying Environment”, October 2007.
62. Brissimis, S. N. and I. Skotida, “Optimal Monetary Policy in the Euro Area in the Presence of Heterogeneity”, November 2007.
63. Gibson, H. D. and J. Malley, “The Contribution of Sector Productivity Differentials to Inflation in Greece”, November 2007.
64. Sideris, D., “Wagner’s Law in 19th Century Greece: A Cointegration and Causality Analysis”, November 2007.
65. Kalyvitis, S. and I. Skotida, “Some Empirical Evidence on the Effects of U.S. Monetary Policy Shocks on Cross Exchange Rates”, January 2008.
66. Sideris, D., “Real Exchange Rates over a Century: The Case of Drachma/Sterling Rate”, January 2008.
67. Petroulas, P. and S. G. Hall, “Spatial Interdependencies of FDI Locations: A Lessening of the Tyranny of Distance?”, February 2008.
68. Matsaganis, M., T. Mitrakos and P. Tsakloglou, “Modelling Household Expenditure on Health Care in Greece”, March 2008.
69. Athanasoglou, P. P. and I. C. Bardaka, “Price and Non-Price Competitiveness of Exports of Manufactures”, April 2008.
70. Tavlás, G., “The Benefits and Costs of Monetary Union in Southern Africa: A Critical Survey of the Literature”, April 2008.
71. Chronis, P. and A. Strantzalou, “Monetary and Fiscal Policy Interaction: What is the Role of the Transaction Cost of the Tax System in Stabilisation Policies?”, May 2008.
72. Balfoussia, H., “An Affine Factor Model of the Greek Term Structure”, May 2008.
73. Brissimis, S. N., D. D. Delis and N. I Papanikolaou “Exploring the Nexus between Banking Sector Reform and Performance: Evidence from Newly Acceded EU Countries”, June 2008.
74. Bernholz, P., “Government Bankruptcy of Balkan Nations and their Consequences for Money and Inflation before 1914: A Comparative Analysis”, June 2008.
75. Oosterlinck, K. and U. R. Loredana “Multiple Potential Payers and Sovereign Bond Prices”, June 2008.

76. Kossev, K. D., “The Banking Sector and the Great Depression in Bulgaria, 1924-1938: Interlocking and Financial Sector Profitability”, June 2008.
77. Buyst, E. and I. Maes, “The Regulation and Supervision of the Belgian Financial System (1830-2005)”, June 2008.
78. Barisitz, S. “Banking Transformation (1989-2006) in Central and Eastern Europe – with Special Reference to Balkans”, June 2008.
79. Lazarević, Ž., “Banking Performance in South-Eastern Europe during the Interwar Period”, July 2008.
80. Apostolides, A., “How Similar to South-Eastern Europe were the Islands of Cyprus and Malta in terms of Agricultural Output and Credit? Evidence during the Interwar Period”, July 2008.
81. Avramov, R. and D. Gnjatović, “Stabilization Policies in Bulgaria and Yugoslavia during Communism’s Terminal Years: 1980s Economic Visions in Retrospect”, July 2008.