TESTING TECHNICAL AND SCALE EFFICIENCY OF KAZAKH BANKS:

EVIDENCE BASED ON DATA ENVELOPMENT ANALYSIS

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Abstract

This paper tests technical and scale efficiency of 20 Kazakh banks using annual data on three inputs (interest expenses, non-interest expenses and deposits) and three outputs (interest income, non-interest income and loans) over the period 2007-2011. Two input-oriented data envelopment analysis models of Charnes et al (1978) and Banker et al (1984), which are based on constant return to scale and variable return to scale respectively, are used to evaluate technical efficiency, whereas scale efficiency is computed by dividing the former efficiency ratio by the latter one. The results obtained show that the average efficiency ratios of individual banks under constant and variable returns to scale range from 0.88 and 1.00 to 0.93 and 1.00 respectively, whereas those of all banks between 0.95 and 0.98 respectively. Only are the five banks (ATFB, Citibank, HSBC bank, KazInvest bank and Exim bank) the most efficient banks in Kazakhstan, since their efficiency ratios have been consistently equal to unity, implying that these banks operate at their optimal levels. The efficiency scores of the remaining 15 banks range from 0.88 to 0.99, and as such the majority of these banks do not seem to operate far more below their optimal level. The results indicate that the performance of the Kazakh banks deteriorated substantially during the global financial crisis of 2008 because the CRS ratio dropped from 0.65 in 2007 to 0.50 in 2008 and to 0.40 in 2009. The results also confirm that most of the foreign banks perform relatively better than domestic banks.

Keywords: Non-parametric method, Data envelopment analysis, commercial banks,

JEL Classification Codes: C14, D24, G21

1. INTRODUCTION

Over the last two and a half decades, the tremendous amount of work has been conducted on the technical efficiency of commercial banks around the world. Different methods have been applied ranging from the simple financial ratio analysis exploiting data on single input and output to stochastic and non-stochastic frontier approaches utilizing data on multiple inputs and outputs to evaluate the technical efficiency of banks. A bank is said to be technically efficient relative to its peer if it produces either the same level of output with fewer inputs (input-oriented) or more output with the same or fewer inputs (output-oriented), whereas it is said to be efficient in scale if it operates at the minimum of its long-run average costs.

This paper aims to test the technical and scale efficiency of 20 Kazakh banks using the annual data on three inputs and three outputs over the period 2007-2011. This is done by employing the non-parametric linear programming frontier approach based on the data envelopment analysis (DEA) developed by Charnes et al (1978) and Banker et al (1984) to test the technical efficiency under constant return to scale (CRS) and variable return to scale (VRS) respectively. The scale efficiency is computed by dividing the former efficiency ratio by the latter one (CRS/VRS). The motivation of this work lies in three studies conducted earlier by Fries and Taci (2005), Peresetsky (2010) and Khbhakar and Peresetsky (2013) who used the parametric stochastic frontier approach to test the efficiency of commercial banks in transition countries including Kazakhstan and Russia. Fries and Taci (2005) examined the efficiency of 289 banks in 15 post-communist countries over the period 1994-2001 and produced results showing that the Estonian and Kazakh banks are the most efficient. It is shown that the average efficiency ratios of Estonian and Kazakh banks range from 0.82 to 0.86 and 0.78 to 0.83 respectively, whereas those of Russian banks range from 0.46 and 0.70. Peresetsky (2010) and Khbhakar and Peresetsky (2013) noted, however, that there was no significant difference between the efficiency of Kazakh and Russian banks over the later period 2002-2006. In this paper, it is shown that although the efficiency deteriorated greatly during the crisis, the Kazakh banks were capable enough to pick up their efficiency significantly in the later periods. This study is different from the above studies in several respects. First, the study includes the banks that dominate Kazakhstan's financial system and play a vital role in affecting the country's financial stability and economic development. As shown in

Table 1, even though their impact on the country's GDP has reduced significantly over time, the percentage of these banks' assets, deposits and liabilities to GDP is still very high. Besides, as shown in Table 2, these banks constitute almost 100% of the total assets, deposits and loans of the banking system over the period 2007-2011. It is evident, however, that the banking sector is highly concentrated because only the first six banks capture around 78% of the share in the banking sector.

Table 1: The Contribution of 20 Banks to GDP

	2007	**2008**	**2009**	**2010**	**2011**
GDP (bln.KZT)	12 849.8	15 936.5	17 007.6	19 303.6	27 334.1
% of Assets to GDP	89.5%	73.1%	66.2%	60.8%	44.7%
% of Loans to GDP	68.4%	57.3%	56.2%	46.5%	37.4%
% of Deposits to GDP	49.1%	42.1%	44.8%	34.6%	27.3%

Table 2: The Relative Position of 20 Banks over the Period 2007-2011

Name	**Assets**	**Loans**	**Deposits**
Kazkommertsbank	20.53%	24.00%	21.79%
BTA Bank	18.58%	22.64%	15.82%
Halyk Bank Kazakhstan	15.70%	12.98%	17.98%
Bank CenterCredit	8.76%	7.44%	9.32%
ATFBank	8.38%	8.74%	6.35%
Alliance Bank	6.30%	6.60%	5.68%
Savings bank of Russian Federation	1.92%	1.58%	2.21%
Tsesnabank	1.89%	1.73%	2.35%
KASPI BANK	2.65%	2.72%	2.70%
Eurasian Bank	2.51%	1.99%	2.57%
Nurbank	2.21%	2.23%	2.13%
Temirbank	2.08%	2.59%	2.14%
Citibank Kazakhstan	1.55%	0.48%	2.14%
HSBC Bank Kazakhstan	1.21%	0.72%	1.35%
Housing Construction Savings Bank of Kazakhstan	0.77%	0.55%	0.48%
KazInvestBank	0.57%	0.55%	0.68%
Eximbank Kazakhstan	0.55%	0.55%	0.40%
Alfa-bank	0.51%	0.29%	0.47%
Delta Bank	0.36%	0.36%	0.40%

Second, unlike earlier studies which employ the parametric stochastic approach, this study uses the non-parametric linear programming approach of DEA to test whether the average efficiency of Kazakh banks is different and higher than that found in earlier studies. Third, the data set used here covers the latter period over which the Kazakh banks are thought to have become financially more viable and efficient and hence the average efficiency scores of individual and all banks are likely to be higher than before. A number of studies (e.g. Hoelscher, 1998; Akimov and Dollery, 2007; and Peresetsky, 2010) have noted that restructuring measures undertaken in Kazakhstan have made the Kazakh banks relatively more efficient and profitable than previously. This is because Kazakhstan has adopted the more advanced banking regulations and supervision requirements including the International Accounting System (IAS) and Basel II norms, which have made the Kazakh banks more advanced than those in other CIS countries. Fourth, the sample includes the crisis period to determine the impact of the crisis on the average efficiency scores of the Kazakh banks. It is also shown whether the performance of foreign banks (which are considered to be generally more efficient than domestic ones) was affected more adversely than domestic banks during the crisis period.

The organization of the rest of the paper is as follows. Section 2 provides a brief account of the evolution the Kazakh banks and bank restructuring reforms, while section 3 presents a review of some selected studies on bank efficiency in transition countries. Section 4 discusses the data used, methodology employed and results obtained about the technical and scale efficiency of the Kazakh banks. The final section concludes the results.

2. BANK RESTRUCTURING IN KAZAKHSTAN

Since independence from the Soviet Union in 1992, the banking system in Kazakhstan has undergone the process of tremendous expansion, contraction, consolidation and restructuring. Immediately after its independence, Kazakhstan adopted a very liberal policy to expand its banking system, and consequently 184 banks had already been established by the end of 1993. Notwithstanding rapid expansion in the banking system, a severe financial disintermediation arose when the private money holdings denominated in the Russian ruble were converted into foreign currencies, and held outside the domestic banks to hedge against

accelerated inflation[1]. As a result, the deposit base fell dramatically from 96% of GDP in 1991 to 20% in 1993. From 1992 to mid-1993, Kazakhstan continued using the Russian ruble as its national currency and as such monetary policy remained primarily the responsibility of the central bank of the Russian Republic[2]. Following the collapse of the ruble area in the mid-1993 and completion of the resource transfer from Russia, the tenge was launched as the national currency. The national bank of Kazakhstan (NBK) became fully independent to carry out the country's monetary policy, hence switching its stance from managing credit for state-owned enterprises to controlling the monetary aggregates and regulating the banking operations. The NBK faced several challenges regarding restructuring, modernizing and stabilizing the country's financial system, in particular the banking system. First, the liberal bank licensing policy, which led to establishment of a large number of undercapitalized banks in the country, was required to be changed and tightened. Second, the enormous amount of bank nonperforming loans inherited from the Soviet Union, which constituted around 11% of GDP, need to be managed. Because these loans remained unclassified, they overstated the net worth of many banks. Third, the solvency of the state-owned banks (in which the majority of the deposits were held) created a great potential threat for a generalized collapse of the banking system in Kazakhstan. Thus the NBK had to assign a top priority not only to tighten its bank licensing policy and improve the profitability of its state-owned banks but also to enforce and implement fully prudential regulations and supervision requirements. Besides, it had to undertake appropriate measures to help banks manage their non-performing loans to avoid a generalized collapse of the banking system. For these objectives, the NBK introduced wide-ranging financial sector reforms over the period 1992-2002[3], these can be summarized as follows.

First, measures were undertaken to tighten the bank licensing policy, increasing the total number of banks (184) by just 7 to 191 by the end of 1994. Second, prudential requirements were implemented strictly to ensure stability in the banking system. In 1993, the minimum legal capital requirement for the existing and new banks was increased from 5 million ruble for all banks to 200 million

[1]See Hoelscher (1998).
[2]See Balino et al (1997).
[3]See Jermakwicz and Arishev (1996) and Hoelscher (1998) for a detailed analysis of the evolution, development and restructuring of the banking system in Kazakhstan, and Akimov and Dollery (2007) for the evaluation of the financial system reforms in Kazakhstan.

ruble (approximately U$200,000) and for a joint venture banks to U$ 1 million. In April 1994, to conduct general banking transactions the minimum capital requirement was set at U$500,000 and U$1.5 million to obtain a license for carrying out foreign currency transactions. Besides, strict actions were taken against poorly capitalized non-viable banks. As a consequence, of 130 registered banks 60 were liquidated, reducing the total number of banks to just 130 in 1995 and 83 in 1997. Moreover, of 130 registered banks only 37 banks were granted the license to conduct general banking transactions and 48 to conduct foreign currency transactions. Third, a centralized approach[4] was adopted to manage non-performing loans, thereby shifting a portion of loan to each of the three newly created debt resolution institutions: (i) the Rehabilitation Bank (RB), the Agricultural Support Fund (ASF) and Exim Bank[5]. Fourth, in 1995 the NBK adopted prudential norms, establishing regulations for banks' liquidity, lending limits, insider transactions and reserve requirements. In 1996, requirements were introduced for loan reclassification, loan loss reserves and capital adequacy. During 1995-1996, the NBK undertook several measures to improve the supervision of banks: (i) the staff size for the Banking Supervision Department was increased from 16 to 112 to conduct on-site inspections to evaluate banks' financial position, management quality, risk management capability and compliance with prudential regulations, (ii) off-site inspection was enhanced by introducing a standardized reporting form making banks financial reports more informative and allowing the results of the off-site analysis to be linked with those of the on-site examinations, (iii) actions were taken against banks which were identified as unsafe and unsound, (iv) banks were required to resubmit their business plans, detailing their present financial condition, compliance with

[4]Three approaches can be used to restructure bad loans: (i) the centralized approach, which is usually strongly supported by the World Bank and which requires the creation of such a separate financial institutions as the Consolidation Bank (in Czech Republic) or the Rehabilitation Bank (in Kazakhstan), (ii) the decentralized approach (in Poland) placing the main responsibility for bad loan restructuring with commercial banks by classifying loans into performing (standard) and non-performing loans and creating a new organization units, workout departments, to manage the bad loan portfolio and (iii) the laissez-faire approach (in Russia), the market conforming approach (in which no government action is required), requiring dissolution of banks with bad loans and emergence of new banks not burdened with old loans and old management practices. For a detailed discussion, see Jemkowicz and Irishev (1996; pp. 35-36).

[5]According to this policy, the RB took over the loan of 45 of the largest insolvent enterprises, and gave priority to rehabilitation rather liquidation, developing comprehensive downsizing activities such severance pay and social asset disposal. By the end of 1996, 28 enterprise of a total of 42 had either been privatized (22) or liquidated (6).

prudential standards and programs for meeting all prudential requirements within the next five years. In 1995, actions were taken against 37 banks engaged in unsound banking practices and as such 33 banks were liquidated with a paid-in capital of less than KZT5 billion, with no loan loss provisioning, and mergers were encouraged of weaker banks with stronger ones. Liquidation proceedings were initiated against the banks which failed to develop a satisfactory business plan, while those fulfilling the requirements were asked to shorten the transition period from five to three years to benefit from such incentives as having the privilege (i) to own stocks in investment companies, (ii) participate in the NBK's credit auctions, (iii) to conduct international operations (iv) to issue bonds, certificates and checks and (v) to act as a custodian of corporate securities. In sum, Kazakhstan has been very successful in laying down the foundations for a strong and efficient banking system by initiating structural reforms and ensuring consistency in the implementation of these reforms.

3. EXISTING EVIDENCE ON BANK EFFICIENCY

A few studies have been undertaken to evaluate the restructuring reforms and technical efficiency of commercial banks in Kazakhstan. Jermakowicz and Irishev (1996) were the first to analyze the evolution and restructuring of commercial banks in Kazakhstan. A conclusion that emerges from this study is that although significant progress has been achieved by banking reforms in Kazakhstan, yet there are still some weaknesses in the financial system that need to be addressed. Hoelscher (1998) evaluates the financial sector restructuring reforms in Kazakhstan and the financial conditions that prevailed in the country during the period following its independence. The major lessons that are drawn from this study include the following. First, the financial sector reforms (of slowing bank licensing, tightening prudential regulations and dealing with nonperforming loans) were largely successful in establishing an efficient financial system in Kazakhstan. Second, the authorities were successful in preventing a generalized collapse of the banking system. The shrinking of the system in the second half of the restructuring period, including the failure of one of the top five banks in the system, did not provoke a general run on the banking system.

Fries and Taci (2005) were the first test the technical efficiency of 289 banks in 15 post-communist East European countries – 19 banks in Bulgaria, 35 in Croatia,

23 in the Czech Republic, 4 in Estonia, 8 in Macedonia, 24 in Hungary, 10 in Kazakhstan, 19 Latvia, 10 in Lithuania, 36 in Poland, 7 in 48 in Russia, 5 in the Slovak Republic, 17 in Slovenia and 14 in Ukraine – over the period of 1994-2001. Employing the translog specification of the cost function and using the intermediation approach to determining the inputs and outputs, together with their relevant prices[6], they obtained results indicating that commercial banks in such countries as Estonia, Kazakhstan, Latvia, Lithuania, Slovakia, and Slovenia are the most efficient. The average efficiency scores of 10 Kazakh banks with and without country-level factors range from 0.78 to 0.83 respectively, whereas those of 48 Russian banks range from 0.46 and 0.70. This implies that the Kazakh banks were much more efficient than Russian banks. However, results were obtained in sharp contrast with these findings by Peresetsky (2010) who compared the relative cost efficiency of 16 Kazakh and 78 Russian banks over the period 2002-2006. He was skeptical of the findings obtained by Fries and Taci (2005) because they examined efficiency over the period 1994-2001 including the period of global financial crisis (2008), which is likely to cause an outlier in the data and hence bias in the estimates. It is shown that the effect of higher efficiency of the Kazakh banks disappears when this outlier in the data is properly taken into account. Besides, Fries and Taci (2005) employed a model with two inputs (deposits and loans) and one price (the ratio of operation expenditures to total assets) neglecting borrowings of the Kazakh banks, which were especially higher during the crisis period and affected favorably the efficiency estimates. It is argued that the effect of higher efficiency of the Kazakh banks disappears when the country-level variables allowing such differences as taxes, interest rates, legislation and borrowings are incorporated in the cost function. Peresetsky (2010) employs two models to test the efficiency of the Kazakh and Russian banks. The first model uses loans as single output and the prices such three factors as labor, fixed capital and funds. The second model uses three outputs such as loans, deposits and borrowings and two prices such as labor and fixed capital. The results based on both models show no significant difference in the efficiency of banks between the two countries. The results also show that most banks in the two countries are cost inefficient. However, the banks seem to be more costs efficient when the model with three outputs is used rather than when the model with a single output is used. These results are also supported by Khbhakar and Peresetsky (2013) who confirm that there is no any significant difference in the efficiency of banks in Kazakhstan

[6]The authors used two outputs (deposits and loans) and the ratio of operation expenditures to total assets as a single price.

and Russia, and that many of the banks in both the countries operate below their optimal size.

3. DATA, METHODOLOGY AND EMPIRICAL RESULTS

Technical and scale efficiency of 20 Kazakh banks is tested using annual data on three inputs (interest expenses, non-interest expenses and deposits) and three outputs (interest income, non-interest income and loans) over the period 2007-2011. The data are obtained from the National Bank of Kazakhstan.

The technical and scale efficiency of the 20 Kazakh banks is tested using the DEA methods of Charnes et al (1978) and Banker et al (1984). Results, as reported in Table 3 and Table 4, show that five banks such as ATFB, Citibank, HSBC bank, KazInvest bank and Exim bank are the most efficient banks, since their efficiency ratios are consistently equal to unity over the sample period.

Table 3: Average Technical and Scale Efficiency over the Period 2007-2011.

Banks	**CRS**	**VRS**	**SE**
Kazkommertsbank	0.95	1.00	0.95
BTA Bank	0.98	1.00	0.98
Halyk Bank Kazakhstan	0.90	1.00	0.90
Bank CenterCredit	0.91	1.00	0.91
ATFBank	**1.00**	**1.00**	**1.00**
Alliance Bank	0.88	0.94	0.94
Savings bank of Russian Federation	0.94	1.00	0.94
Tsesnabank	0.90	0.93	0.97
KASPI BANK	0.98	1.00	0.98
Eurasian Bank	0.86	0.97	0.89
Nurbank	0.96	0.97	0.99
Temirbank	0.92	0.98	0.94
S Citibank Kazakhstan	**1.00**	**1.00**	**1.00**
HSBC Bank Kazakhstan	**1.00**	**1.00**	**1.00**
Housing Construction Savings Bank	0.93	1.00	0.93
KazInvestBank	**1.00**	**1.00**	**1.00**
Eximbank Kazakhstan	**1.00**	**1.00**	**1.00**
Alfa-bank	0.93	0.93	1.00
Delta Bank	0.94	0.96	0.97
SenimBank	0.99	1.00	0.99
Percentage of Efficient Banks	25%	65%	25%

Although the average efficiency ratios of the remaining 15 banks are below the unity value (indicating that they are relatively inefficient than their peers), yet they tend to operate at a level which is not very far from the efficiency level since their efficiency ratios are very close to one, ranging between 0.86 and 0.98. The results indicate that the performance of the Kazakh banks deteriorated substantially during the global financial crisis of 2008 because CCR ratio dropped from 0.65 in 2007 to 0.50 in 2008 and to 0.40 in 2009. The results also show that most of the foreign banks perform relatively better than domestic banks, evidence which is consistent with those of previous studies.

Table 3: Technical and Scale of Efficiency Scores of Individual Banks

			2007			2008			2009			2010		2011	
Banks	CRS	VRS	SE	CRS	VRS	SE	CRS	VRS	SE	CRS	VRS	SE	CRS	VRS	SE
Kazkommertsbank	0.87	1.00	0.87	0.86	1.00	0.86	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
BTA Bank	1.00	1.00	1.00	0.97	1.00	0.97	0.92	1.00	0.92	1.00	1.00	1.00	1.00	1.00	1.00
Halyk Bank Kazakhstan	0.89	1.00	0.89	0.85	1.00	0.85	0.89	1.00	0.89	0.91	1.00	0.91	0.97	1.00	0.97
Bank CenterCredit	0.94	1.00	0.94	0.99	1.00	0.99	0.93	1.00	0.93	0.68	1.00	0.68	1.00	1.00	1.00
ATFBank	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.98	1.00	0.98	1.00	1.00	1.00
Alliance Bank	1.00	1.00	1.00	1.00	1.00	1.00	0.40	0.70	0.57	1.00	1.00	1.00	1.00	1.00	1.00
Savings bank of Russian Federation	1.00	1.00	1.00	1.00	1.00	1.00	0.82	1.00	0.82	0.88	1.00	0.88	1.00	1.00	1.00
Tsesnabank	0.82	0.84	0.98	0.71	0.79	0.90	0.97	1.00	0.97	0.97	1.00	0.97	1.00	1.00	1.00
KASPI BANK	1.00	1.00	1.00	0.95	1.00	0.95	0.96	1.00	0.96	1.00	1.00	1.00	1.00	1.00	1.00
Eurasian Bank	0.95	0.95	1.00	0.92	0.98	0.94	0.68	0.94	0.72	0.77	0.98	0.77	1.00	1.00	1.00
Nurbank	1.00	1.00	1.00	0.97	1.00	0.97	0.96	1.00	0.96	0.90	0.90	0.90	0.96	0.96	0.96
Temirbank	1.00	1.00	1.00	0.94	1.00	0.94	0.64	0.89	0.73	1.00	1.00	1.00	1.00	1.00	1.00
Citibank Kazakhstan	0.98	1.00	0.98	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
HSBC Bank Kazakhstan	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Housing Construction Savings Bank	0.64	1.00	0.64	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
KazInvestBank	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Eximbank Kazakhstan	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Alfa-bank	1.00	1.00	1.00	1.00	1.00	1.00	0.91	0.92	0.99	0.75	0.76	0.75	1.00	1.00	1.00
Delta Bank	0.93	0.93	1.00	0.92	0.95	0.97	0.86	0.94	0.91	1.00	1.00	1.00	0.99	1.00	0.99
SenimBank	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.97	1.00	0.97
Mean	0.95	0.99	0.96	0.95	0.99	0.97	0.90	0.97	0.93	0.94	0.98	0.94	0.99	1.00	0.99
Standard Deviation	0.09	0.04	0.09	0.07	0.05	0.05	0.16	0.07	0.12	0.10	0.06	0.10	0.01	0.01	0.01
Percentage of Efficient Banks	60%	85%	65%	50%	85%	50%	40%	75%	40%	60%	85%	60%	80%	95%	80%

5. CONCLUSION

This paper has evaluated the technical and scale efficiency of 20 Kazakh banks over the period 2007-2011. Results based on DEA show that of 20 banks only 5 banks have been consistently efficient even during the global financial crisis period of 2008. Thus on average 25% of the Kazakh banks have been the most efficient. Although the average efficiency ratios of the remaining 15 banks are below the unity value (indicating that they are relatively inefficient than their

peers), most of these banks operate at a level which is not very far from efficiency since their efficiency ratios are very close to one (that is, they range from 0.86 to 0.99).

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