Cost Efficiency and Shareholders' Voting Power in Russian Banking*

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Abstract

The paper investigates the relation between cost efficiency and type of governance in the top-100 Russian commercial banks.

As cost efficiency measures we use **a)** cost efficiency scores obtained by stochastic frontier approach, which takes into account indicators of risks; and **b)** performance index such as interest expense to interest income ratio.

Concerning the governance type, our classification is based on voting power distribution of the banks' shareholders, the idea first developed in Cubbin & Leech (1983). We use the classical Banzhaf and Shapley-Shubik power indices as well as the approach of preference-based power indices from Aleskerov (2006) that assesses power using pairwise preferences of voters to form coalitions.

Our preliminary results indicate that cost efficiency scores of the Russian banks have been decreasing during 2006-2007. We also conjecture that the banks which have a less concentrated distribution of shares are in general more cost efficient than those with a high concentration of shares. We applied several classifications of banks using various power indices. While the results are robust to the choice of a power index, the best explanation is based on the ratio of the normalized Banzhaf power index of the largest shareholder to her share.

1 Introduction

In most large companies nowadays control of daily business operations is separated from ownership. On the one hand, this separation allows for a more efficient and professional governance of the firm that increases the shareholders' value. On the other hand, it also creates incentives for the management team to diverge from the policies that maximize the shareholders' value. The performance of a company thus may be different depending on the ownership structure. We present several estimates of cost efficiency of the top-100 Russian commercial banks (as ranked by total assets value) obtained using the methodology from

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(Berger & Humprey (1997), Aleskerov et al. (2009) and others), and explore the interrelation between cost efficiency, concentration and ownership structure.

The Russian banking sector is unique in terms of ownership and control patterns. Unlike the US and British industrial companies, which commonly express relatively dispersed ownership patterns (Becht & Roell(1999)[3], Leech (2001)), for Russian firms the concentration of equity ownership and control is rather high (Kapelushnikov (2005)). Control of a Russian company may be held not only by a group of insiders, but also by a single shareholder, who is in this case a block holder (Kapelushnikov (2005)).

In addition, Russian banks have concentrated ownership structure. For instance, S&P(2007) while conducting a survey on information transparency of the 30 largest Russian banks[4] pointed out that in the sample there was just one bank with a dispersed ownership structure (i.e., the largest shareholding size is under 25 % of the equity capital). At the same time, about 60% of total banks in the sample had one major shareholder, who acquired more than 50% of the total shares. As in 2006 there was a similar picture in the Russian banking sector, S&P (2007) concluded that the concentration of shares in the 30 largest Russian banks remained still very high.

The link between ownership and performance is still under debate among the scholars. The existing research on ownership structure's impact, voting control and performance may be classified into four different types.

Papers of the first type explored the hypothesis of owner's free-riding when companies have dispersed ownership. However, the underlying hypothesis on lower performance was rejected in almost all papers (Short et al. (2002); Gugler (2001); Leech & Leahy (1991)). The second type of research is based on the approach developed by Stulz (1988) who introduced managerial ownership into the model and explored the hypothesis of harp-shaped or non-monotone relationship between concentrated ownership and market capitalization. The most important problem of endogeneity of ownership structure has been revealed. The third stage of empirical works in this field started with endogeneity tests (Kole (1995)). Some papers of this type showed the reverse causation: corporate performance predetermined the structure of the ownership. The others found no relationship at all (Demsetz & Villalonga (2001)).

Currently, we observe the fourth stage of research on ownership and performance involving some new variables into the models, e.g., the voting rights factor (rights held in excess of cash flow rights).

There are several papers devoted to the relationship between ownership and performance of Russian companies. Kuznetsov & Muravyev (2000) demonstrated the U-shaped relationship between ownership concentration and profitability of Russian companies. Radygin & Entov (2001) discovered the positive influence of ownership concentration on performance. Kapelyushnikov (2001) reports that the

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[3] One should note, however, the big size of the median largest voting block for some European countries as well, as reported in Becht&Roell (1999): table 1, so that the comparison between the ownership structure and control patterns in these countries and Russia can be valid.

[4] The banks were chosen by S&P according to net assets value.

best performance is achieved in the companies with medium-concentrated ownership. Guriev et al. (2003) demonstrated that the level of ownership concentration makes a positive impact on the corporate governance efficiency. Dolgopyatova (2004) shows that the companies with a medium level of concentration are the most efficient, while those with a low level of concentration are the least efficient in the long-run. Kapelyushnikov & Demina (2005) discovered the reverse relation between ownership concentration and profitability indicators. Ivashkovskaya&Stepanova (2008) revealed the direct relation between ownership of investors involved into the process of governance and corporate performance measured by the market-to-book coefficient.

As a measure of performance in the current paper, we use the cost to income ratio as well as cost efficiency score, obtained by applying the frontier technique.

Concerning the issue of shareholders' control, several approaches were proposed in the literature. Historically, control was defined in *ad hoc* manner, e.g., a firm is assumed to have a certain type of control[5] depending on the size of shares of major shareholders. A number of classic papers in this area (Jensen & Meckling (1976), Leland & Pyle (1977), Morck, Schleifer & Vishny (1988) and others) created a theoretical framework based on agency conflicts. Grossman & Hart (1988) introduced the conflict between minority and majority shareholders, the impact of which on performance is not evident. On the one hand, the larger investors' shareholding in the bank, the stronger the motivation to increase shareholders' value. On the other hand, existence of majority shareholders may lead to minority discrimination and, consequently, to increased agency costs (Holderness (2003)).

Cubbin and Leech (1983) proposed a new approach defining degree of control of a firm taking into account not only the size of the largest shareholding, but also the distribution of shares among smaller shareholders (the dispersion of ownership). The developed methodology is based on voting power theory, resulting in application of voting power indices to measuring degree of control in large British companies (Leech (1988), Leech & Leahy (1991), Leech (2001)) as well as in internationally(see, e.g., Pohjola (1988) for an application to Finnish companies).

The main question of voting power theory is that of the power possessed by members of a voting body. First papers on the subject were published in the 1950-70s (Penrose (1946); Shapley & Shubik (1954); Banzhaf (1965); Coleman (1971)), proposing, among other works, several classes of power measures, which possess some desirable properties or satisfy certain natural axioms, but none being universally applicable.

In this paper we classify the Russian commercial banks by a degree of shareholders' control defined using preference-based power indices from Aleskerov (2006). This approach was used, e.g., to assess the power of the IMF members (Aleskerov, Kalyagin & Pogorelskiy (2008)).

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5 E.g., "managerially controlled", or "owner controlled" (Berle, A. A. and Means, G. C. (I932). The Modern Corporation and Private Property, revised edition I967. New York: Harcourt, Brace and World, referenced in Cubbin & Leech (1983)).

The remainder of the paper is organized as follows. Section 2 describes the data set comprising top-100 Russian banks. Section 3 presents the main theoretical notions and hypotheses to be checked by data analysis. Section 4 describes the results obtained. Section 5 concludes.

2 The Data Set: A sample of Top-100 Russian banks

The banks were chosen according to the book value of their total assets as of the end of 2007. The main source of the ownership structure data was the annual reports of top-120 Russian banks. We've collected all the available information from the banks' annual reports filling in the gaps with the data from the official website of the Bank of Russia, rating agencies' reports and banks' websites when needed. As a result, we've got reliable data for 100 out of 120 banks for the period of 2006-2007.

About one half of the 100 largest Russian banks have a shareholder with more than 50% of the total shares. Therefore, for the cost efficiency estimation we use all banks in the sample, while voting power indices were calculated for 45 banks where no shareholder has absolute control[6]. For the latter the summarized data are presented in Table 1 as a distribution of the largest shareholding size (w_1) vs. second largest (w_2) (cf. Leech (2001)).

Table 1 shows typical ownership concentration patterns of the largest Russian banks. Out of the 45 banks considered, only 2 have a relatively concentrated ownership structure with w_1 higher than 40%. There are also just two banks that have a highly dispersed ownership, i.e., the share of the largest shareholder is less than 10%. Thus in the largest Russian banks the first and second largest stockholders are usually blockholders (shareholders with more than 25% of total shares (S&P (2007)), which allows to veto a number of strategic decisions).

This observation is in agreement with Kapelushnikov(2005), where the Russian enterprises with the similar ownership structure were defined as "friend-based companies" (as a rule, the largest owners with equally sized shareholdings have known each other for a long time and have been working since the foundation of a company, even from the Soviet times (Kapelushnikov (2005)).

Table 1. The Largest Shareholding vs. the Second Largest One

		W_1						
		≤5%	5-10%	10-20%	20-30%	30-40%	40-50%	Total
		1	1	**24**	9	8	2	45
W_2	≤5%	1	1	0	0	0	0	2
	5-10%			0	1	3	0	4
	10-20%			**24**	5	4	0	**33**
	20-30%				3	1	2	6
	≥30%						0	0

[6] We assume a simple majority rule is used for decision making in the shareholders' meetings, hence for all shareholders with more than 50% of total shares power index reaches the maximum value of 1 (or 100% of power).

Such ownership structure of the Russian banks may be caused by the following reasons (Bennedsen & Wolfenzon (2000); Dyck (2000)). First, due to weak security of property rights a coalition including several large shareholders can be more effective than a single major shareholder because it can restrict expropriated behaviour of each shareholder in a more effective manner. Next, blockholders in a coalition support each other by sharing their experience, competence and social capital. Altogether it allows the shareholders to minimize the total costs with regards to opportunism of both hired management staff and majority shareholders.

3 Notation and Methodology

3.1 Shareholding Concentration Ratios

In order to measure ownership concentration we adopt three concentration ratios widely used to estimate the market power of banks. The first one, CR_3, is the concentration ratio of three largest shareholders in a bank's capital. It is calculated as the stock share of equity capital relating to the top three shareholders in a bank: $CR_3 = \sum_{i=1}^{3} s_i$. The second concentration index, CR_4, is defined analogously as the share of the bank's capital belonging to the top four stockholders of a bank: $CR_4 = \sum_{i=1}^{4} s_i$. Last but not least, we use a more general measure of ownership concentration, the Herfindahl-Hirschman Index. It is constructed as $HHI = \sum_i s_i^2$, where s_i indicates the share of the i-th stock owner the in the bank's equity capital (Heffernan (2005)). The thresholds for concentration indices given in Table 2 are used by the Federal Antimonopoly Service of the Russian Federation as well as the Bank of Russia (the central bank of the Russian Federation) in their work (Bank of Russia (2007)).

Table 2. The Thresholds for Concentration Indices

Concentration index	Low concentration level (free competition)	Moderate concentration level (monopolistic competition)	High concentration level (monopolistic or oligopolistic competition)	Very high concentration level (oligopolistic competition)	Monopoly
CR_3	$CR_3 \leq 45\%$		$45\% < CR_3 \leq 70\%$	$CR_3 > 70\%$	
CR_4	$CR_4 \leq 40\%$	$40\% < CR_4 \leq 60\%$	$60 < CR_4 \leq 80\%$	$CR_4 > 80\%$	
HHI	$HHI \leq 1000$	$1000 \leq HHI \leq 1800$		$1800 < HHI \leq 3000$	$HHI > 3000$

According to the threshold for concentration indices from Table 2, we calculated CR_3, CR_4 and HHI indices. The results are given below (see Fig.1-3). One can see that, mostly, monopoly or duopoly is attributed to the largest Russian banks, i.e. the top-100 Russian banks have a very high level of ownership concentration in banks' capital.

Highly concentrated ownership structure may lead to agency costs which in its turn may affect the performance of a bank. According to Holderness (2003), the blockholders have two factors that motivate them and determine their economic behaviour: private and shared benefits of control. The former refer to the direct

maximization of the company value. The latter factor is based on extraction of any additional monetary and (more often) non-monetary benefits from the company which destroys the company's value. Finally, discrimination of minority shareholders increases risk and thereby contributes to the decrease in the value of the shareholders' capital.

Figure 1. Concentration Ratio of Three Largest Shareholders

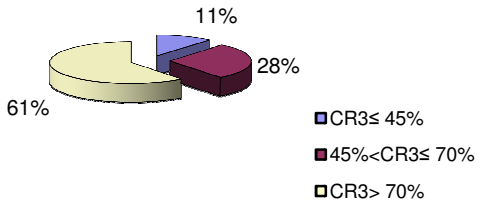


Figure 2. Concentration Ratio of Four Largest Shareholders

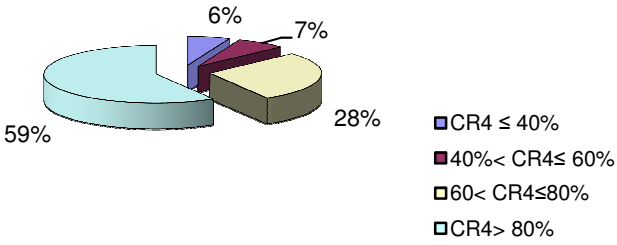
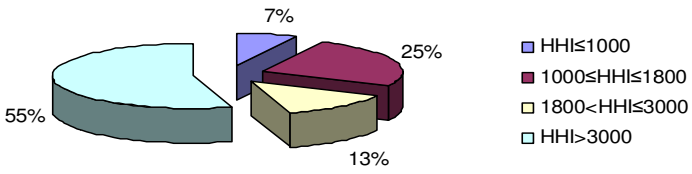


Figure 3. Herfindahl-Hirschman Index



Based on this information, we assume that *banks with more concentrated ownership are less efficient (have worse performance) than those with a more dispersed ownership structure.* We will test this hypothesis in Section 4.

3.2 Cost Efficiency Assessment

3.2.1Overview

The literature on Russian banks cost efficiency or X-efficiency estimation is quite scarce (Yildirim & Philippatos (2002); Fries & Taci (2005); Styrin (2005); Golovan, Karminsky & Peresetsky (2008); Aleskerov, Martynova & Solodkov (2008); Karas, Schoors & Weill (2008); Aleskerov et al. (2009)). To the best of our knowledge, there are just four papers that take into account Russian banks' risk profiles in cost frontier using stochastic frontier approach (Styrin (2005), Golovan , Karminsky & Peresetsky (2008); Aleskerov, Martynova & Solodkov (2008); Aleskerov et al.(2009)).

Two main approaches are usually described in the literature on methodologies for estimation of banks' efficiency: parametric and nonparametric ones (Heffernan (2005); Coelli et al. (2005)). According to these methodologies, inefficiency increases, when a bank cannot minimize its costs (or maximize its profit) at a given output level and input price or maximize its output sets at a given input. Both methods are based on frontier analysis. A measure of efficiency for each bank is defined by how close a bank is to the efficiency frontier. The latter

can be constructed in different ways according to the method used. In parametric approach, the efficiency frontier is an accurate functional form of production, cost or profit functions.

Parametric methods include Stochastic Frontier Approach (SFA), Distribution – Free Approach (DFA), Thick Frontier Approach (TFA) (Heffernan (2005), Coelli et al. (2005)). All these techniques allow researchers to construct the efficiency frontier and measure banks' efficiency with regard to this frontier, which could be written in an analytical form and be a theoretic ideal (Green (2000), Aigner, Lovell & Schmidt (1977)). The efficient frontier is then econometrically evaluated; deviation from the theoretic frontier includes a random error and an inefficiency component.

Nonparametric methods do not require precise specification of functional dependence and are based on assessment of piecewise efficiency frontier obtained by the most efficient banks in the sample (Heffernan (2005); Coelli et al. (2005)). In particular, Data Envelopment Analysis (DEA) and Free Disposal Hull (FDH) approaches (Heffernan (2005), Coelli et al.(2005)) assume that the set of best-practice observations are 100%-efficient and thus they form a nonparametric efficient frontier. The efficiency scores are obtained using linear programming techniques.

Several papers, devoted to the analysis of banks' efficiency across different approaches (Fiorentino, Karmann & Koetter (2006), Bauer et al. (1998), Resti (1997) and others), show that sometimes the estimates produced by parametric and nonparametric approaches differ substantially. The difference exist because the results obtained by DEA (and, therefore, FDH) are very sensitive to the data, i.e., banks' characteristics. In the case of DEA and FDH usage, any deviation from the efficiency frontier is immediately interpreted as an inefficiency term. Thus, the estimates obtained will not be "purged from a noise component" (a random error).

The major advantage of parametric approach is related to its stochastic nature. It helps isolate the operating efficiency from a random error. However, when used, there can be errors in specifications, multicollinearity problems. Besides, the prior assumptions about error distribution in this approach may be not satisfied, while parametric method allows us to verify hypotheses about the coefficient significance, construct confidence intervals, etc.

In order to evaluate banks' cost efficiency we use stochastic frontier analysis. The reasons for choosing parametric method are the following. First of all, the Russian banks are heterogeneous, that is, there is a significant variation of balance indicators in the Russian banks data (Styrin (2005), Aleskerov et al. (2009)). Secondly, the Russian banks may have incentives to manipulate with reported data in order to reduce profit taxation (Styrin (2005), Golovan, Karminsky & Peresetsky (2008)).

These reasons increase sensitivity of the results, which can be obtained by using nonparametric approaches DEA and FDH thus, predetermine SFA usage. In order to obtain operating efficiency scores in this paper stochastic cost frontier methodology with risk factors is applied.

3.2.2 Methodology

In this paper, following Sealey & Lindley (1977), the intermediation approach is used (Styrin (2005); Golovan, Karminsky & Peresetsky (2008); Aleskerov, Martynova & Solodkov (2008); Karas, Schoors & Weill (2008); Aleskerov et al. (2009)). This means that deposits and purchased funds are considered as a source of banks' funding, not as a bank product (Heffernan (2005)). Suppose we have the data of M banks over the T-quarter period (in our case, T=4, M=100). The cost frontier is then given by

$$\ln TC_{it} = \ln TC(q, w, z)_{it} + \varepsilon_{it}, \qquad (1)$$

where $i = 1,2..,M;\ t = 1,..,T$; and

- TC is operating costs (interest and personnel expenses);
- q is a vector of outputs (average value of loans minus loan loss provision in order to take into account credit risk like Styrin (2005) and average securities value);
- w is a vector of input prices (the price of labor, deposits and purchased funds);
- z is a vector of environmental characteristics (dummy variable for quarters in order to introduce seasonal effect).

We also include financial capital as a fixed input due to different risk preferences attributed to the banks' management (Mester (1996), Zajc (2006)). Operating costs and all the outputs are normalized by financial capital level in order to eliminate problems arising from heteroscedasticity. To take into account input price linear homogeneity the price of labor and the price of deposits are divided by the price of purchased funds.

Cumulative error in equation (1) includes (Coelli et al. (2005)):

- random error (v);
- X-inefficiency[7] (u):

$$\varepsilon_{it} = u_{it} + v_{it}; u_{it} \geq 0. \qquad (2)$$

We assume that random error has a normal distribution.

For the balanced panel data we use a stochastic frontier approach with time-varying decay model first proposed by Battese & Coelli (1992). Following that work, we model the inefficiency term as a truncated-normal random variable multiplied by a specific function of time:

$$u_{it} = e^{-\eta(t-T)}\, u_i, \qquad (3)$$

where u_i is the generalized truncated normal random variable, η is an unknown scalar parameter for estimation.

In order to construct inputs and outputs variables we use quarterly balance sheet data and profit and loss account data for the time period from I quarter of 2006 to II quarter of 2007. The banks' data come from the official web-site of the Central Bank of Russia (www.cbr.ru).

Vnesheconombank is excluded from the sample due to its incomparability with other banks in terms of its legal status and operations, consequently, cost efficiency.

[7] X-efficiency presents minimal cost to actual cost ratio (Berger A. (1997)).

3.3 Degree of control using power indices

Cubbin & Leech (1983) defined the degree of control as the probability of the controlling shareholder (or bloc) securing majority support assuming a probabilistic voting model. Depending on the model, either the Banzhaf (Banzhaf (1965), the so called "absolute version" of which was originally introduced in Penrose (1946)) or Shapley-Shubik (Shapley & Shubik (1954)) index is used[8].

Let us briefly outline the notation from voting power theory that will be used here.

A *coalition S* is any subset of *N* players, |*N*|=*n*, with the set of all possible coalitions 2^N. For the purpose of shareholders' voting power analysis it makes sense to consider only weighted voting games, which form a subset of a broader domain of simple games. In a weighted voting game, each player *i* has $w_i$votes. A *quota q* is the least number of votes required to pass a collective decision, and a coalition $S \in 2^N$ is *winning* iff $\sum_{i \in S} w_i \geq q$. Similarly, a *losing* coalition lacks enough votes for a decision to pass.

Let the payoff of a coalition *S* be *v(S)*; define *v(S)*=1 iff *S* is winning and *v(S)*=0 iff *S* is losing. A player $i \in S$ is said to be *pivotal* in a coalition *S* if *S* is winning, while *S\{i}* is losing. A dual notion of *swing* is also useful: a coalition $S : i \notin S$ is a swing for player *i* if *S* is losing, while *S∪{i}* is winning . We denote the set of coalitions in which player i is pivotal (resp., swing) by $\mathcal{P}_i$ (resp., $\mathcal{S}_i$).

The Banzhaf index β (Banzhaf (1965)) shows the relative proportion of winning coalitions in which player i is pivotal with regards to all other players,

$$\beta_i = \frac{\sum_{S \subseteq N}(v(S) - v(S \setminus \{i\})}{\sum_{i=1}^{N} \sum_{S \subseteq N}(v(S) - v(S \setminus \{i\})} \qquad (4)$$

A family of preference-based power indices introduced in Aleskerov (2006) can be defined in a similar manner.

Let the function $f_i(S)$ be the *intensity of connections* between a player $i \in N$ and a coalition $S \subseteq N$, $f_i(S)$: $2^N \to \mathbb{R}$. For each player *i*, let $\chi_i = \sum_{S \in \mathcal{S}_i} f_i(S)$ be the sum of intensities of connections of player i over all those losing coalitions which are swings for i (alternatively, this definition may be stated in terms of coalitions in which i is pivotal). Then define the voting power index of the agent i as

$$\alpha_i = \frac{\chi_i}{\sum_{j \in N} \chi_j} = \frac{\sum_{S \in \mathcal{S}_i} f_i(S)}{\sum_{j \in N} \sum_{S \in \mathcal{S}_j} f_j(S)} \qquad (5)$$

It is clear that α_i is similar to the Banzhaf index. An analogous modification leads to ϕ_i, a preference-based version of the Shapley-Shubik power index:

[8] For more details on the developments of voting power theory, see Felsenthal&Machover (1998))

$$\phi_i = \frac{\sum_{S \in \mathcal{P}_i} \frac{(|S|-1)!\,(n-|S|)!}{n!} f_i(S)}{\sum_{j \in N} \sum_{S \in \mathcal{P}_i} \frac{(|S|-1)!\,(n-|S|)!}{n!} f_j(S)} = \frac{\xi_i}{\sum_{j \in N} \xi_j} \qquad (6)$$

The main question remaining is how to construct intensity functions $f_i(S)$.

Assume that the desire of the agent i to coalesce with j is given by a real number $p_{ij}, i, j = 1, \ldots, n$. Consider the following intensity functions (out of a number of other forms defined in Aleskerov (2006)):

a. Mean intensity of i's connection with other members of S:

$$f_i^+(S) = \frac{\sum_{j \in S \setminus \{i\}} p_{ij}}{|S| - 1} \qquad (7)$$

b. Mean intensity of connection of other members of S with i:

$$f_i^-(S) = \frac{\sum_{j \in S \setminus \{i\}} p_{ji}}{|S| - 1} \qquad (8)$$

c. Mean intensity of connections within a coalition S:

$$\bar{f}(S) = \frac{\sum_{i \in S} \frac{1}{2}\left(f_i^+(S) + f_i^-(S)\right)}{|S|} \qquad (9)$$

Depending upon the intensity function, two versions of the α indices (using the f^+ and $\bar{f}$ intensity functions) and one version of the ϕ index (using the f^+ intensity function) as well as the Penrose, Banzhaf and Shapley-Shubik indices were employed for determination of the banks' degree of control. The results are reported in Section 4. Note that as the ownership is highly concentrated, the normalized versions of the aforementioned indices were used as well as the absolute ones.

In order to apply the preference-based power indices, we developed a unified model of the pairwise preferences of all banks' shareholders as follows. We assumed that shareholders compete for control, and consider several possible cases for a pair of them:

1. Two shareholders, *i* and *j*, are neither blockholders nor have absolute control, but jointly can form a block (25% of the total shares). In this case we presume that their preferences towards each other are equally strong.
2. Shareholder *i* is a blockholder while *j* is not, and jointly they either get absolute or almost absolute (47% of the total shares) control. In this case we presume that shareholder *i* likes *j* less strongly than in the previous case. As for shareholder *j*, if there is no alternative of forming a block with yet another shareholder and together with *i* they can get absolute control, the preference p_{ji} is as strong as in case 1; if *i* and *j* can get together almost absolute control (as defined above), p_{ji} is almost as strong (but weaker) as in case 1. If there is an alternative possibility for *j* of creating a block with some other shareholder, then p_{ji} is less strongly than in case 1.
3. Both shareholders *i* and *j* are blockholders. Then we assume their preferences towards each other are maximal.

4. Any other possible combination. In this case we assign p_{ji} and p_{ij} the same value of 1, meaning neutral preferences to coalesce.

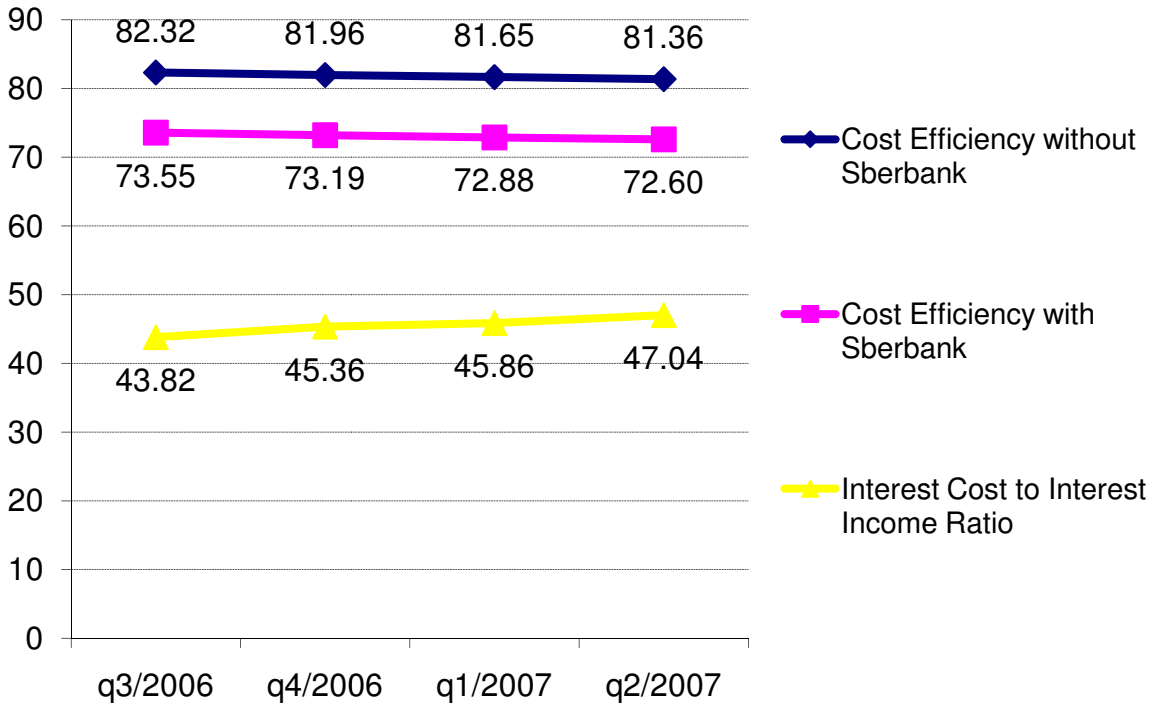
The definitions of the strength of pairwise preferences to coalesce, written above, were transformed into integer numbers from the scale [1, 9].

Concerning the computation of power indices it should be noted that the exact number of shareholders is not usually known, therefore some assumptions must be made. We used the approach from Leech (1988), called "most concentrated distribution", in which all but one non-observed holdings are assumed to coincide with the last observed share with an obvious correction for a single remaining shareholder so that the total sum of the shares is 100%. This assumption is justified, because the ownership of the Russian banks in the sample is highly concentrated (see Fig.1-3).

4 Main Results

With regards to the banks' cost efficiency, we have found that the scores obtained in the group with Sberbank, the largest commercial bank, excluded are higher than those we get in the case of its inclusion into the frontier (see Fig.4).

Figure 4. Cost Efficiency



Notes. Cost efficiency is estimated using two different methods, namely, SFA and traditional indicators such as Interest Cost to Interest Income Ratio.

This finding confirms our hypothesis that separation of commercial banks into homogeneous groups is required for the purpose of getting more sustainable efficiency scores. This procedure also allows us to take into account the differences in the level of quality of banking service and access to the most advanced

technologies that is consistent with the results of Mester (1996), Bernstein (1996), Li et al. (2008), Fiorentino, Karmann & Koetter (2006), Aleskerov et al.(2009).

In addition, Figure 4 also demonstrates that the cost efficiency score has been decreasing during 2006-2007 years. This can be interpreted as an increase in operating risks in the Russian banking sector, since the level of X-efficiency of commercial banks can be considered as indicating the risk of banks' failure (Berger & Humphrey (1997), Cebenoyan et al. (2004)). Some authors found a statistically significant relationship between the decline in cost efficiency score and the growth of problem loans, negative cash flow, poor quality of management, and among all, the probability of banks' failure (Berger & Humphrey (1997), Cebenoyan et al.(2004)). In particular, for the Russian banks Konstandina (2007) found that higher deposits and liquid assets as well as lower efficiency score were significant for the probability of banks' failure during 1999-2004.

Our next point is that the main factor that leads to higher cost level and, consequently, to lower X-efficiency, is an increase of nominal salary for bank employees, i.e., the growth of those costs associated with the economy overheating (see Table 3). Note that η has a positive sign, meaning that the inefficiency effect decreases as time increases. However, this time parameter is not statistically significant even at 10% level. High level of γ (close to 1) indicates that the banks are far from the efficiency frontier due to the cost inefficiency term rather than the noise effect.

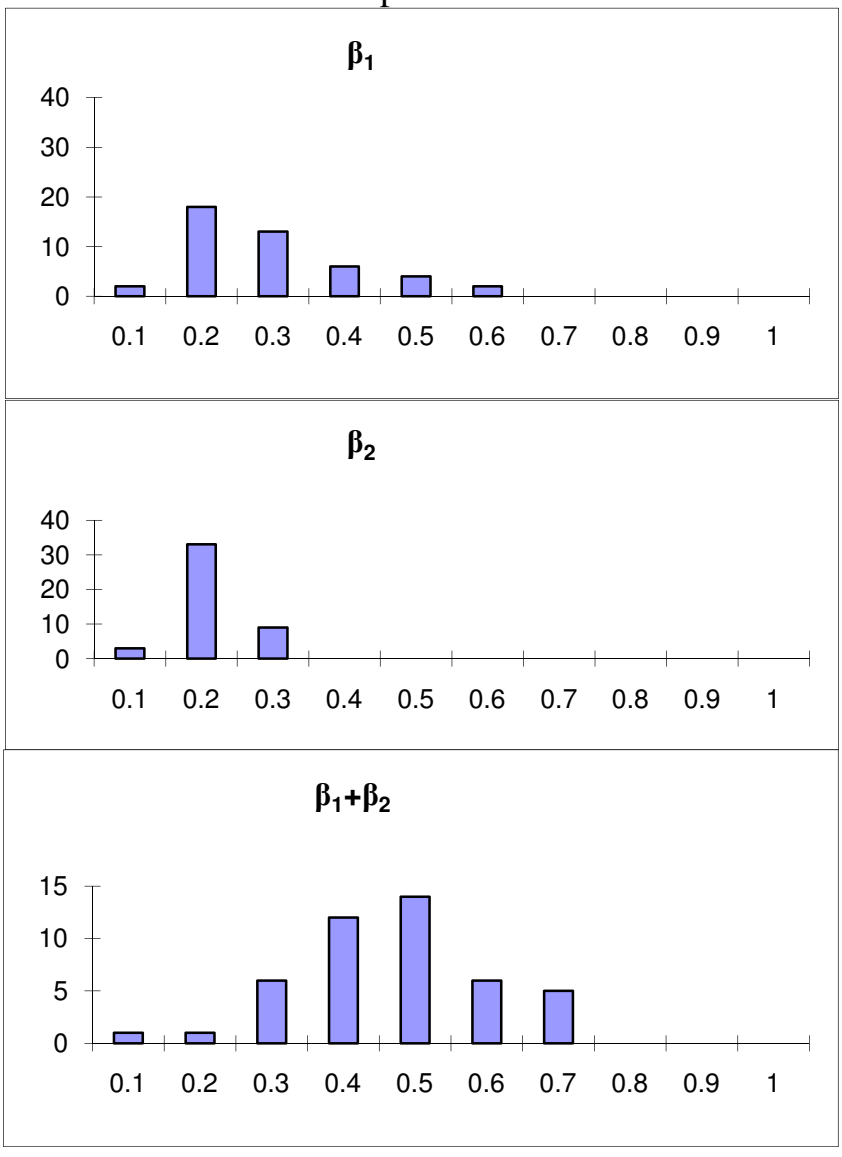
Table 3. Maximum Likelihood Estimates of Parameters of the Stochastic Cost Frontier

Variable	**Parameter**	**Coefficient (Sberbank is included into the sample)**	**Coefficient (Sberbank is excluded from the sample)**
Dependent variable: Cost/Capital			
Constant	$ß_0$	-74.937 (134.596)	-83.716 (180.334)
Price of deposits/Price of purchased funds	$ß_1$	1.229*** (0.099)	1.228*** (0.010)
Price of labour/Price of purchased funds	$ß_2$	3.531*** (0.257)	3.530*** (0.259)
Loans/Capital	$ß_3$	0.606*** (0.052)	0.608*** (0.053)
Securities/Capital	$ß_4$	0.114** (0.049)	0.116*** (0.050)
Season dummy-variable (for the second quarter)	$ß_5$	-0.320*** (0.104)	-0.321*** (0.104)
Season dummy-variable (for the third quarter)	$ß_6$	-0.678*** (0.206)	-0.681*** (0.206)
Season dummy-variable (for the fourth quarter)	$ß_7$	0.304*** (0.103)	0.306*** (0.104)
Mu (sample average cost efficiency)	μ	73.906 (134.581)	82.680 (180.323)
Eta	η	0.004 (0.008)	0.004 (0.009)
Variance parameters			
Sigma Squared	σ^2	0.091 (0.014)	0.0913 (0.014)
Gamma	γ	0.852 (0.027)	0.851 (0.027)

Variable	Parameter	Coefficient (Sberbank is included into the sample)	Coefficient (Sberbank is excluded from the sample)
Log-Likelihood		111.672	108.735

Notes: The dependent variable is the ratio of interest and personnel costs to the capital, normalized by the price of purchased funds. The standard errors are reported in the parentheses. Statistically significant levels are given at *10%, **5% and ***1%.The translog specification was rejected because of high multicollinearity.

Next we analyzed the pattern for the degree of control, which is defined using power indices as described in Section 3. We made histograms for the normalized Banzhaf, Penrose (absolute Banzhaf), α and ϕ power indices based on the f^+ intensity function (we will refer to these indices as α^+ and ϕ^+, respectively) for the largest shareholder, second largest shareholder (all indices), two and three top shareholders (all except Penrose). These indices were selected as representing the most distinctive power distributions out of the broader set of power indices mentioned in Section 3. Figures 5-7 show the respective histograms for the normalized Banzhaf, Penrose and α^+ power indices. The results for ϕ^+ index are generally similar to those for α^+ and not presented here.



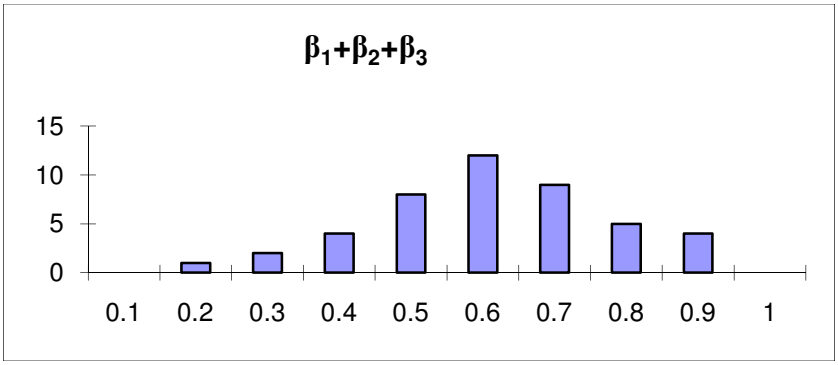


Figure 5. Histograms of the normalized Banzhaf indices for the largest, second-largest, two and three top-largest shareholders.

Notes: The values of the respective power indices are on the horizontal axis, the frequency of occurrence in the sample is shown on the vertical axis.

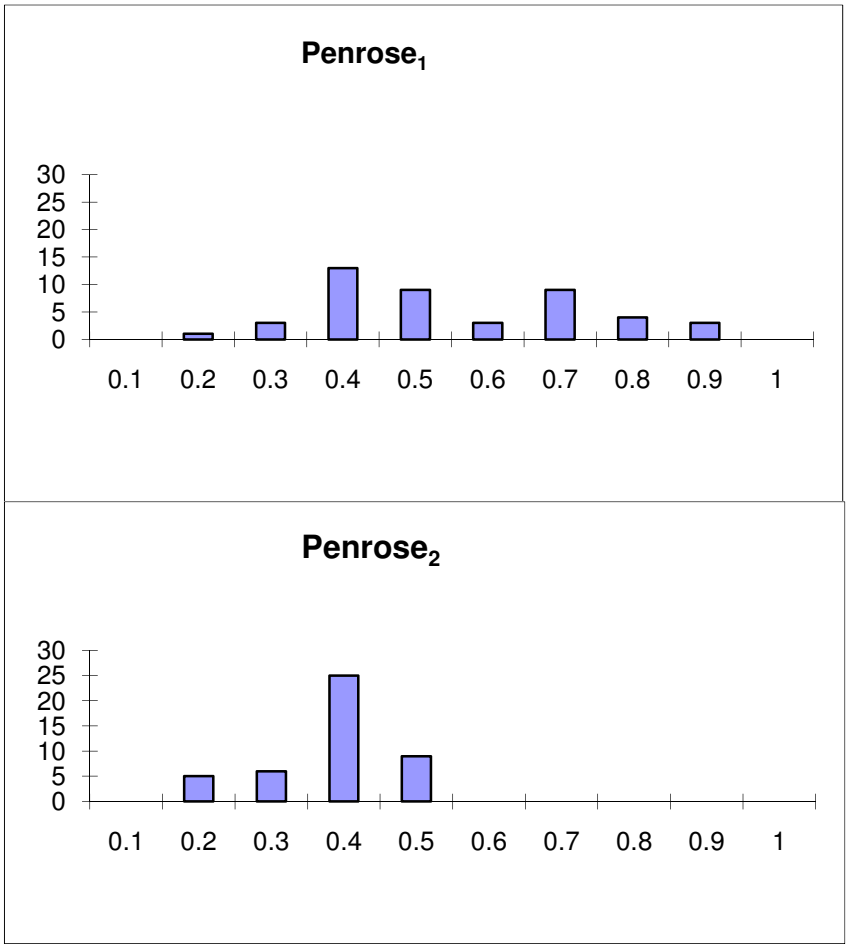
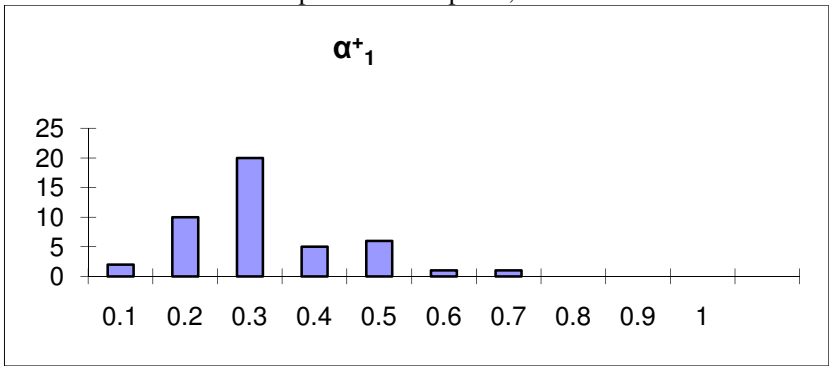


Figure 6. Histograms of the Penrose (absolute Banzhaf) indices for the largest and second-largest shareholders.

Notes: The Penrose index is the probability that player *i* is decisive in the vote, provided that all players vote independently 'aye' or 'nay' with the same probability of ½ (for details, see Straffin (1977)). As for different players the Penrose indices are defined on different probabilistic spaces, the sum of the indices does not make sense.



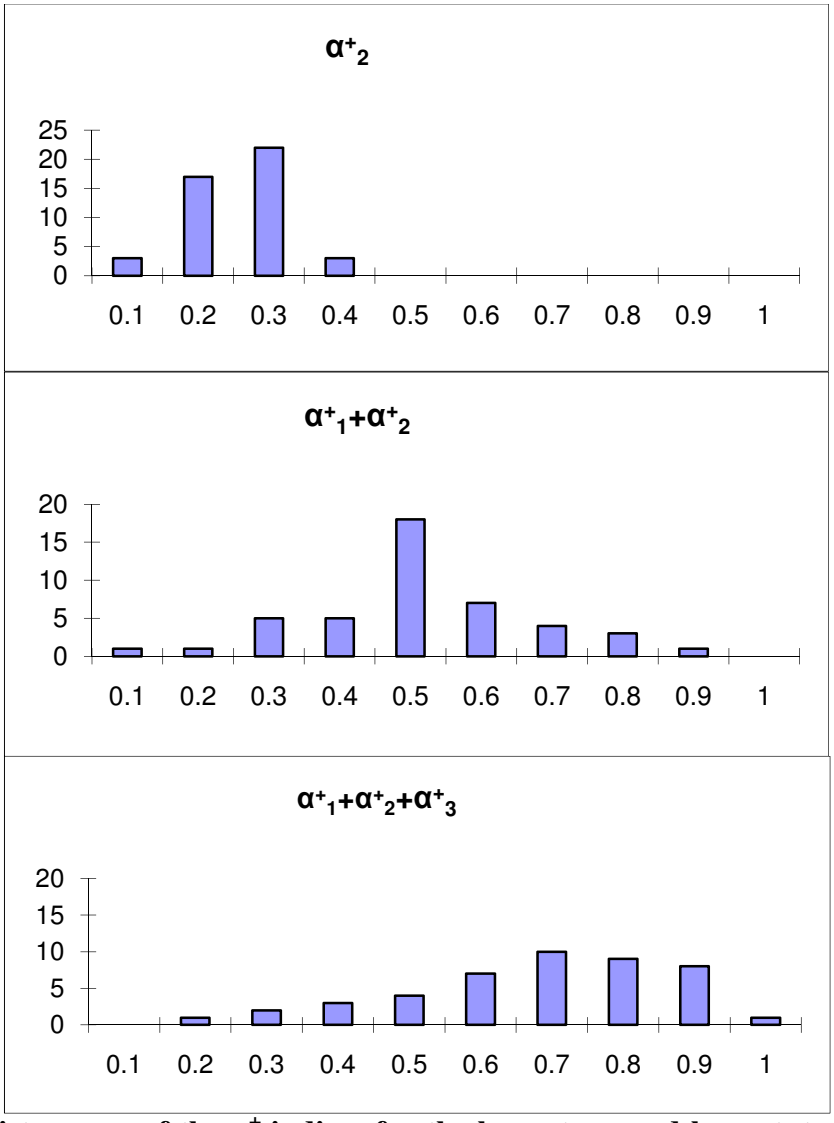


Figure 7. Histograms of the α^+ indices for the largest, second-largest, two and three top-largest shareholders.

Notes: The values of the respective power indices are on the horizontal axis, the frequency of occurrence in the sample is shown on the vertical axis.

As Figures 5 and 7 reveal, most frequently the power of the largest shareholders as a group increases with its size, ranging from as low as 20% for the largest shareholder alone to more than 60% for top-3 shareholders for all indices considered. As for the Penrose indices (Figure 6), most frequent cases assign power of level of 0.4 (29% of the sample) 0.5 and 0.7 (20% of the sample) for the largest shareholder and about 0.4 (56% of the sample) and 0.5 (20% of the sample) for the second largest.

There is a difference between the distributions obtained using the classical and preference-based indices. In particular, the latter ones tend to assign greater power to the blocks of two and three shareholders compared to the normalized Banzhaf index. Taking into account the findings of Figures 5-7 and the fact that the banks' ownership structure usually comprises two blockholders (see Table 1), we conjecture that these blockholders have a similar degree of control, about 50% of total power.

Concerning the relation between the cost efficiency, concentration and degree of control, several regressions were tested. Table 4 reports only those with the greatest explanation power.

The results from table 4 show that there exists a relation between the cost efficiency and the degree of control, although rather weak (R^2 does not exceed 13.2%), and one should note the very moderate size of the sample (just 45 banks), which of course affected the results. However it is interesting, that the ratio of the normalized Banzhaf index of the largest shareholder gives better results than all other cases considered (case 6).

Table 4. Cost Efficiency vs. Power Indices and Concentration Ratio

		Dependent Variable			
		Cost Frontier Efficiency		**Interest Cost to Interest Income Ratio**	
Case	**Variables**	**Coefficient (Standard-error)**	**R^2_{adj}**	**Coefficient (Standard-error)**	**R^2_{adj}**
Case 1	Constant	-0.206*** (0.003)	0.065****	-0.667*** (0.101)	0.064
	CR_3	-0.007** (0.003)		0.291* (0.149)	
Case 2	Constant	-0.205*** (0.002)	0.072****	-0.700** (0.080)	0.083
	CR_4	-0.008** (0.003)		0.342*** (0.157)	
Case 3	Constant			-0.834*** (0.045)	0.045****
	$(HHI-p_1^2)/(1- p1)^2$			-0.025*** (0.009)	
Case 4	Constant	-0.209*** (0.004)	0.078****	-0.654*** (0.076)	0.042****
	(Normalized) Banzhaf index for the largest shareholder (β_1)	-0.005* (0.002)		0.126** (0.054)	
Case 5	Constant	-0.207*** (0.003)	0.081****	-0.664*** (0.114)	0.045
	(Absolute) Banzhaf index for the largest shareholder (β_1^a)	-0.007** (0.003)		0.228* (0.133)	
Case 6	Constant	-0.200*** (0.001)	0.132****		
	Normalized Banzhaf/largest shareholding size $\frac{\beta_1}{s_1}$	-0.025** (0.011)			
Case 7	Constant	-0.334*** (0.050)	0.103****		
	$\frac{\beta_1^a + \beta_2^a}{s_1 + s_2}$	-0.030*** (0.011)			
Case 8	Constant	-0.201*** (0.001)	0.103****		
	$\frac{\beta_1 + \beta_2}{s_1 + s_2}$	-0.023*** (0.011)			
Case 9	Constant	-0.207*** (0.004)	0.058****	-0.698*** (0.100)	0.0277
	γ_1^+	-0.004* (0.002)		0.101* (0.057)	
Case 10	Constant	-0.208*** (0.004)	0.061****		
	α_1^+	-0.004* (0.002)			
Case 11	Constant	-0.208*** (0.004)	0.063****	-0.670*** (0.078)	0.034****
	$\bar{\alpha}_1$	-0.004* (0.002)		0.117** (0.050)	
Case 12	Constant	-0.200*** (0.002)	0.056****		

		Dependent Variable			
		Cost Frontier Efficiency		Interest Cost to Interest Income Ratio	
Case	**Variables**	**Coefficient (Standard-error)**	**R^2_{adj}**	**Coefficient (Standard-error)**	**R^2_{adj}**
	$\frac{\bar{\alpha}_1 + \bar{\alpha}_2}{s_1 + s_2}$	-0.026* (0.014)			

Notes: All the variables are in logarithms.
*,**,*** Statistically significant levels at *10%, **5% and ***1%
**** Breusch-Pagan test for heteroscedasticity is applied to the data. The robust estimates are used if heteroscedasticity is detected. For such cases, R2 is reported.

5 Conclusions

This paper presents just preliminary results of the ongoing research and naturally the data need more exploration. Nevertheless, several observations can already be made.

First, the ownership structure of the top-100 Russian commercial banks comprises mostly either a largest shareholder with absolute control, or two blockholders, having absolute control together. Therefore the shares' concentration is very high, unlike, e.g., in the US and the UK. This feature of the Russian banks may have a negative impact on both their cost efficiency and performance as it is known that the ownership concentration may deepen the agency conflict between different types of banks' shareholders.

Second, concentration and degree of control negatively influence the cost efficiency of the banks when measured by the frontier technique as well as method of traditional indicators. We show that cost efficiency of the less concentrated banks is higher. The relation is robust to various concentration and power indices tested. This conclusion is in line with the results received by Kapelyushnikov & Demina (2005) who revealed the reverse relation between ownership concentration and corporate performance, though measured by profitability indicators.

Further analysis of the data is required and is under way.

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