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FINANCIAL ARCHITECTURE AND CORPORATE PERFORMANCE: EVIDENCE FROM RUSSIA

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In this paper we study the performance effects of capital structure, ownership structure and corporate governance of Russian companies. To address the lack of research in corporate performance modeling in emerging markets we contribute to the literature by introducing a cluster analysis of the financial architecture and market performance of Russian companies. Our goal is to find out the most efficient and inefficient types of financial architecture in emerging markets. Using a sample of 52 of the largest Russian non-financial companies between 2005-2010 we demonstrate the existence of three sustainable types of financial architecture. Using cluster analysis we form clusters of companies in the pre-crisis period and then demonstrate the relationship between the type of financial architecture and the level of market performance.

JEL Classification: G32, G34.

Keywords: capital structure, ownership structure, emerging markets, performance

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1 Introduction

A large number of non-financial characteristics including ownership structure, capital structure and the performance of the board of directors have an impact on company performance, as research has shown.[3] However knowledge of the interrelations between these characteristics remains limited. Nevertheless, such knowledge may significantly influence policy resulting from corporate performance modeling using regression analysis.

In this paper we apply the concept of corporate financial architecture to take into account different non-financial characteristics of a company, together with non-traditional methodology for corporate performance maximization (Myers, 1999). Using cluster analysis we consider the structure of the company instead of analyzing the impact of separate non-financial characteristics on its performance.

Our paper differs from previous research in two major respects. First, the traditional approach to the study of the relationship between a firm's non-financial characteristics and corporate performance considers performance modeling based on one or several indicators of capital structure, ownership structure or corporate governance. There are two key disadvantages in such research. One is that such studies, while modeling performance, fail to take into account a great deal of important information, since one of the dimensions is studied (e.g. state ownership, size of the board). Two, they do not account for the interrelations between different characteristics. Assuming we study the emerging markets with a low level of institutional investment and a less than optimal debt level. We find that to maximize the performance we need to raise the financial leverage and to attract more institutional investors. Institutional investors usually dislike high leverage. Therefore we could either attract institutional investors, or raise the financial leverage, that proves that while modeling the performance we should take into account the interrelations between different financial architecture components.

This concept, introduced by Myers in 1999, considers several corporate dimensions such as capital structure (or financial leverage), ownership structure, corporate governance mechanisms and the legal form of the company as an integrated system. According to Myers, we should consider the different dimensions all together so as not to develop stylized models which can explain a phenomenon but have low forecasting power.

The second difference is that besides traditional regression analysis we use cluster analysis to model performance. It helps not only to consider the corporate financial architecture as a whole

[3]See, for example, Morck, Shleifer and Vishny (1988), Grossman and Hart (1988), Masulis and Mobbs (2011), Dyck and Zingales (2004), Nenova (2000).

system but also to understand if there are sustainable types of architecture in Russia. Sustainable architecture could be used by the board of directors and top management for building or rebuilding a company to make it as efficient as possible. In this paper we conduct an analysis of market efficiency measured as a Tobin's Q coefficient, so that in finding the 'most efficient architecture' we also describe how to maximize a company's market value.

We conduct our analysis on the sample of 52 of the largest Russian non-financial companies which published their reports between 2005-2010 according to IFRS or US GAAP standards. We start with a descriptive analysis of the ownership and capital structure. Then we determine the clusters of companies based on ownership, board and capital structure criteria. We proceed with empirical testing of the relationship between elements of financial architecture and market performance measured by Tobin's Q to determine the most sustainable clusters. We also analyze the cluster dynamics before and after the credit crunch in 2008-2009.

The rest of the paper is organized as follows. Section 2 contains a brief literature review. Section 3 contains the methodology of the study. Section 4 describes the major empirical results. Section 5 concludes.

2 Literature review

The existing literature concentrates on the influence of a single characteristic (such as ownership concentration or state participation) on corporate performance. As mentioned above the goal of this paper is to take into account different characteristics of the financial architecture. In this section we present a short review of the literature devoted to the interrelations of different components of financial architecture with market performance.

We start with the performance effect of capital structure. The trade-off theory and pecking order hypothesis have been tested many times using different samples [Frank et al. 2005; Shyam-Sunder & Myers, 1999], so that we could reject the hypothesis of irrelevance of capital structure in an imperfect market with significant income taxes, costs of financial distress, etc. Information asymmetry and agency problems influence capital structure through agency costs and signalling power [DeMarzo et al. 2004; Atkeson 2005]. Recent research also considers behavioural aspects as a catalyst of the performance effect of capital structure [Elliott et al. 2008; Frank & Goyal 2009]. Regardless of the preferred theory, capital structure influences corporate performance through the cost of capital and agency costs.

In emerging markets the majority of recent papers on capital structure are devoted to the capital structure determinant identification [Seifert, 2008; Ni, 2008]. A second research direction is capital structure optimization based on three theories: the trade-off theory [Frank et al., 2005;

Shyam-Sunder, Myers, 1999]; empirical testing of pecking order hypothesis [Myers, 1984; Halov et al, 2005]; and signalling and agency models [Baker, 2002; DeMarzo et al., 2004]. There is also research into the interrelations between different financial decisions: capital structure choice and payout policy [Atieh & Hussain, 2008; Noronha et al., 1996], capital budgeting [Hennessy, Whited, 2005] including papers based on the hypothesis of the endogeneity of capital structure [Brailsford et al., 2002; Margaritis & Psillaki, 2010].

The problem of ownership structure optimization has been studied since the 1980s from several perspectives such as insider ownership, state ownership, ownership concentration. The major mechanism of the performance effect of ownership structure is the agency conflicts between managers and shareholders [Holderness et al., 1999; Kole, 1995; Morck et al., 1988], major and minor shareholders [Dyck, Zingales, 2004; Grossman, Hart, 1988; Nenova, 2000], state and private investors. Thus we have 3 different ownership structure indicators to consider.

Research on insider ownership efficiency often shows different results even within national samples. Earlier research demonstrates a linear, non-monotone and insignificant relationship. The later research on the relationship between insider ownership and corporate performance implies the existence of non-monotone relationship with the breakpoint depending on geopolitical factors [Holderness et al., 1999; Kole, 1995; Lloyd et al., 1986]. The non-monotone relationship can be explained by two hypotheses. According to the 'interest alignment' hypothesis, company value should grow with the increase in insider ownership because of the increased management motivation to maximize firm performance. Conversely, according to ‘management entrenchment’ hypothesis, managers prefer to lower the risk level instead of maximizing the value when they have very large holdings in the company since their personal risks are concentrated in one company [Morck et al., 1988]. Minority discrimination and high monitoring costs as well as liquidity issues lead to the hypothesis on the performance effect of ownership concentration [Dyck & Zingales, 2004; Grossman & Hart, 1988; Nenova, 2000].

State ownership and its efficiency has also been widely studied. The State is an economic agent that pursues its own goals that may conflict with value maximization, while on the other hand, the company gets access to government guarantees, additional financing and other benefits [Boycko et al., 1996; Laffont & Tirole, 1993; Megginson, Netter, 2001]. In Russia there is a strong negative correlation between the level of state ownership in the largest companies and ownership concentration which leads to the hypothesis of existence of two typical financial architectures for Russian companies: one is of state-controlled companies and the other is controlled by a group of up to 3 private owners.

In the late 1990s and 2000s the problem of the endogeneity of capital structure and ownership structure was actively discussed [Brown & Earle, 2000; Himmelberg et al., 1999; Claessens & Djankov, 1999] together with the problem of potential reversed relationships. Instrumental variables and systems of simultaneous equations became the key instruments for regression analysis taking into account the endogenous capital and ownership structures. Results are quite different but there is evidence that, for example, capital structure dependends on company size [Brailsford et al., 2002].

The above-mentioned phenomena made us consider alternative instruments for the analysis of the performance effect of a company's financial architecture. One of the potential alternative methods is cluster analysis, which allows us to find sustainable corporate financial architecture and then to analyse the performance effect between these groups. Cluster analysis has only recently appeared in capital structure research [Su, 2010] and there are still no papers devoted to an integrated analysis of financial architecture and company performance.

Choosing the integrated concept of financial architecture for performance modeling we take into account all the important elements of a company's financial architecture. We also need to consider its corporate governance mechanisms which are usually reflected in the structure of the board of directors. First, independent directors in the board raise its performance by adding expertise and offering independent opinions on the company's strategic decisions. Second, the size of the board has a significant negative influence over corporate performance due to a longer and more expensive decision-making process [Jensen, 1993].

We formulate the following hypotheses:

1. There are several sustainable types of corporate financial architecture in Russia which differ significantly;
2. The type of financial architecture influences company's market performance significantly;
3. The financial architecture is indifferent to the sector (industry specific factors).

3 Methodology and data

Sample description

Our analysis is based on a sample of the largest actively traded non-financial Russian companies which prepare their financial reports according to IFRS or US GAAP standards. The sample period is 2005-2010 (2004 data were used to calculate sales growth rates). The financial data

were initially gathered from the Bloomberg database and the gaps were filled with the data from the audited financial reports on the official sites of the companies. All the data are in US dollars.

Ownership structure and corporate governance information was gathered from the annual reports of the companies. The final sample consists of 52 public non-financial Russian corporations with a high level of information disclosure. The descriptive statistics of the sample are presented in Appendix 1.

Methodology

Our research was conducted in two stages. A hierarchical cluster analysis (average linkage method) was used at the first stage. We divided the sample into several subsamples: the pre-crisis period data for 2005-2007 years, the crisis period (2008, 2009)[4] and post-crisis 2010. The division was made to examine the dynamics of cluster characteristics and company movements from year to year.

The following criteria of corporate financial architecture were used for data clustering:

- *Capital structure variables*: Total debt ratio calculated as total interest bearing debt to the sum of total interest bearing debt and book value of equity;
- *Ownership variables*: ownership concentration calculated as the share of three largest shareholders; foreign ownership measured as the share of equity held by foreign investors from developed capital markets;
- *Board of directors variables*: size proxied by the total number of the board members; independency rate measured as the ratio of the number of independent directors to the total number of the board members.

The clusters obtained were examined from different perspectives. First, we analyzed the measures of firm performance in each cluster: market performance measured as the Tobin's Q coefficient (market value of equity to book value of equity ratio), return on equity (ROE), return on total assets (ROA), growth rates of sales and capital expenditures. Secondly, we monitored whether the same firms were clustered similarly from year to year. Thirdly, we checked whether the firms from one industry were gathered in one cluster or not.

The second stage of our research was an implied regression analysis of the influence of the financial architecture component on the market performance of Russian companies.

[4]Although in most developed countries credit crunch began in 2007, in the majority of emerging markets (including Russia) the consequences of crisis appeared in 2008.

We run the following linear regressions using panel data with fixed effects method (for 2009 and 2010 a cross section analysis was applied):

$$Q_{it} = \alpha_0 + \alpha_1 TDR_{it} + \alpha_2 OC3_{it} + \alpha_3 Ind_{it} + \alpha_4 Size_{it} + \alpha_5 foreign_{it} + \alpha_6 gsales + \alpha_7 prof_{it} + \varepsilon_{it}$$

(1)

where *Q* is Tobin's Q coefficient, *TDR* is the total debt ratio; *OC3* is the ownership concentration of three major shareholders; *Ind* is the rate of board independency; *Size* is the size of a company measured as a natural logarithm of total assets; *prof* is the profitability measured as EBIT to total assets; *gsales* is the growth rates of sales (three variables of sales growth rates were used: pre-crisis growth rates (2004-2007), overall growth rates (2005-2010), moving average growth rates with a two year interval).

Within the other variables that were included in regressions specifications are the following: *Tang* is the tangibility of assets calculated as fixed assets to total assets ratio; *Size1* is the size of a company measured as natural logarithm of sales; *beta* is a measure of market risk of the firm (beta coefficient); *ROE* is return on equity; *Doil* is a dummy variable which equals to 1 if the firm operates in oil and gas industry, 0 otherwise; *Dcr* is a dummy variable which equals to 1 if the firm operates in customer and retail industry, 0 otherwise; *gcapex* is the capital expenditure to total assets ratio as a measure of capital expenditure growth rates and the expected future growth.

A description of the independent variables is presented in Table 1.

Table 1. Definition and calculation method of variables.

Variable	Calculation and definition
Q	Tobin's Q coefficient based on equity only
ROE	Return on equity (Net income divided by total equity)
Ind	Number of independent directors divided by the total number of board of directors' members
bsize	Board of director's size, the number of directors on the board
OC3	Shareholding of the three major shareholders
state	Shareholding of the federal and municipal institutions and by the government-related companies
for	Total shareholding of the foreign investors

Variable	Calculation and definition
devfor	Total shareholding of the foreign investors except those based in post-soviet countries
TDR	Total debt of the company divided by its total equity (Total Debt / Total Equity)
Size	Natural logarithm of the total assets of the company

4 Empirical results

4.1 Cluster analysis results

The cluster analysis on subsamples for different time periods revealed three clusters. The statistics of the clusters are presented in Appendix 3. The clusters are persistent in stable, crisis and post crisis periods. Moreover the companies show almost no movements from cluster to cluster across the time of analysis. The analysis of industries structure of clusters revealed no industry effects in cluster formation.

The clusters are characterized by the following features.

Cluster 1: Companies in this cluster experience the most sustainable growth. The cluster is described by declining management ownership share and growing ownership of foreign investors from the developed markets. The level of independent directors on the board is about 30%. This cluster shows a Tobin's Q coefficient of approximately 2 before and after the crisis, and 1.5 during the crisis accompanied by stable growth in capital expenditure and the positive sales growth rates before the crisis and across the whole sample period. The level of debt is the lowest across the clusters (approximately 28% in stable periods).

Cluster 2: The cluster is characterized by the lowest foreign ownership and the largest management ownership. The level of debt in the cluster is approximately 30% before the crisis and 40% after the crisis. The low rates of return on total capital together with the growth rate decreasing during the crisis are accompanied by a weak negative growth rate for the entire study period.

Cluster 3: Companies in this cluster, characterized by approximately equal management and foreign investor ownership, have the highest level of ownership concentration, the highest level of debt, leading to the highest ROE indicators with average profitability ratios. The growth rates of capital expenditure in these companies are the highest before the crisis, but move to the lowest levels after the crisis. The sales growth rates undergo a similar scenario that leads to a negative

cumulative growth rate during the research period. Tobin's Q coefficient before the crisis is high (2.9), fluctuates in the crisis period and after it, due to both fluctuations in the market value of equity, and the reduction of the book value of equity during the crisis.

Thus we believe that the combined analysis of market performance, growth rates and profitability measures leads us to the conclusion that the clusters are sorted from most to least efficient. The third cluster, although demonstrating high Tobin's Q ratios, reveals the short-term character of positive growth and therefore is represented by the least sustainable companies.

4.2 Regression analysis results

The results of the regression analysis partly confirmed the results demonstrated above.

First, the results for pre-crisis period (2004-2007) showed that independent directors on the board improve the market performance measured with Tobin's Q coefficient. The results emphasized also the positive role of financial leverage (*TDR*) before the global financial turmoil. At the same time, the performance effect of foreign investment participation is ambiguous. Regression analysis results demonstrate a negative effect of foreign investment from developed countries (*devfor*) while the level of foreign ownership is higher for the most efficient cluster of companies.

Second, we found no significant influence of insider ownership which is also in line with the cluster analysis results because of the low level of volatility of insider ownership across the clusters.

Finally, we failed to demonstrate any significant performance effect of ownership concentration and state ownership before the crisis.

The analysis revealed the negative impact of board size which is usually explained by a longer and more expensive decision-making process of a large board.

Table 2.

Results of panel regression analysis of the model with Tobin's Q (Q) as a dependent variable; oc3, state, tdr, manag, devfor, independ, bsizeas independent variables. Table 2 demonstrates the results of analysis using fixed effects estimation.

	(1)	(2)	(3)	(4)
VARIABLES	Q	Q	Q	Q
devfor	-5.267***	-5.419***	-6.178***	-6.178***
	(1.386)	(1.420)	(1.573)	(1.584)

	(1)	(2)	(3)	(4)
Ind	2.772***	2.877***	2.709**	2.709**
	(0.963)	(0.979)	(1.076)	(1.085)
OC3	0.440	0.383	0.0457	0.0451
	(1.030)	(1.045)	(1.160)	(1.169)
TDR	2.435**	2.366*	2.632*	2.634*
	(1.204)	(1.218)	(1.410)	(1.423)
bsize	-0.242**	-0.236**	-0.244**	-0.245**
	(0.103)	(0.108)	(0.113)	(0.117)
state		2.010		0.0518
		(2.921)		(3.713)
manag			0.223	0.222
			(2.025)	(2.040)
Constant	3.294**	3.150**	3.646**	3.646**
	(1.354)	(1.388)	(1.500)	(1.511)
Observations	134	133	121	121
R-squared	0.325	0.326	0.341	0.341

*Note: Standard errors are in parentheses. ***, ** and * indicate significance at 1%, 5% and 10% level respectively.*

The results of the cross-section analysis for 2009 and 2010 indicate the dramatic changes in performance drivers. The results demonstrate the growing role of different types of ownership in performance level including the positive influence of foreign and insider ownership. At the same time there is no positive effect of financial leverage or independent directors in the board.

Nevertheless these results should be considered as a pilot and require an enlarged sample and thorough endogeneity analysis in further research.

Table 3.

Results of cross-section regression analysis of the model with Tobin's Q (Q) as a dependent variable; oc3, state, tdr, manag, devfor, independ, bsizeas independent variables. Table 3 demonstrates the results of analysis using ordinary least squares estimation.

	(1)	(2)	(3)	(4)

	2009	2009	2010	2010
VARIABLES	Q	Q	Q	Q
devfor	2.205*	2.189*	2.907	2.986
	(1.188)	(1.181)	(1.927)	(1.887)
Ind	-0.468	-0.723	0.507	0.295
	(1.198)	(1.146)	(1.891)	(1.769)
OC1	0.118	-0.274	-4.103*	-4.528**
	(1.433)	(1.334)	(2.385)	(2.031)
TDR	0.771	0.552	1.432	1.304
	(1.034)	(0.990)	(1.633)	(1.570)
bsize	-0.0470	-0.0677	-0.275	-0.303
	(0.117)	(0.113)	(0.211)	(0.194)
state	-0.889		-0.636	
	(1.139)		(1.800)	
manag	2.555**	2.735***	3.236**	3.399**
	(1.015)	(0.983)	(1.549)	(1.457)
Constant	1.480	2.024	6.517*	7.092**
	(1.879)	(1.735)	(3.311)	(2.844)
Observations	42	42	38	38
R-squared	0.250	0.236	0.327	0.324

*Note: Standard errors are in parentheses. ***, ** and * indicate significance at 1%, 5% and 10% level respectively.*

5 Conclusion and discussion

The analysis allowed the development of an original classification of financial architecture types in the Russian capital market. We determined the most effective type of financial architecture which results in the most sustainable market performance after the global financial turmoil. Analysis of the dynamic cluster results suggests recommendations concerning the optimization of corporate financial architecture to achieve sustainable growth in non-financial companies in emerging markets.

The cluster analysis showed three sustainable types of financial architecture of large Russian non-financial companies. The first is the most efficient since it allows a high level of market performance in periods of high volatility. An independent board of directors (over 30%), a

modest level of insider ownership, a conservative capital structure and significant foreign participation drive sustainable growth and market performance.

Locally owned companies with a high level of insider ownership and a medium debt level demonstrated high performance before the crisis but low sustainability when Tobin's Q goes below 1 with negative (or zero) sales growth in 2010.

Finally, companies with the highest ownership concentration and owners involved in governance process demonstrate high market performance even after crisis while the growth rates are strongly negative.

These results are supported partly with the regression analysis results while the influence of foreign investors on the performance is quite ambiguous.

Further research will focus on international analysis including Eastern European countries where the investment climate and business environment is comparable to Russia. Then the methodology will be used to compare the process of financial architecture construction and its performance effect in developed and emerging markets.

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Appendices

Appendix I.

Descriptive statistics of key variables.

Table reports the descriptive statistics (mean, standard deviation, minimum and maximum) of key variables for the total sample, for the pre-crisis period, for 2008, for 2009 and for 2010 separately.

Variable	Obs	Mean	Std. Dev.	Min	Max
Total sample					
gsales_overall	310	.1591079	.1441983	-.1116582	.7249448
gsales_precrisis	288	.3588154	.22542	.0018324	1.246115
gsales_moving	260	.2336335	.4931267	-.4219331	6.498903
TDR	302	.4426682	.6428516	0	9.598102
Tang	302	.5153687	.2177321	.0315869	.9312729
OC3	312	.6861437	.2258968	0	1
for	312	.0740497	.1770652	0	.9349
Ind	292	.3175731	.1933824	0	.9090909
Q	276	2.03276	1.903588	0	9.798117
prof	300	.1144074	.104921	-.3114493	.5113177
ROE	302	.073007	.566886	-6.348531	2.970773
Size	302	7.773236	1.486666	4.568672	12.61975
Size1	302	7.493159	1.381071	4.569355	11.85959
gcapex	291	.0960175	.0744407	0	.5849887
beta	275	.7749393	.4109028	-.519	4.1967
Variable	Obs	Mean	Std. Dev.	Min	Max
Pre-crisis					
gsales_overall	154	.1595552	.1447957	-.1116582	.7249448
gsales_precrisis	144	.3588154	.2258138	.0018324	1.246115
gsales_moving	108	.4469622	.6589383	-.0647061	6.498903
TDR	147	.3694705	.245317	.0035947	1.514869
Tang	147	.5284539	.2103197	.0315869	.9312729
OC3	156	.6795143	.2622523	0	1
for	156	.0417512	.1361587	0	.9154
Ind	138	.2887862	.1662362	0	.6666667
Q	131	2.330953	2.008598	0	9.798117
prof	144	.133568	.1009373	-.2208928	.5113177
ROE	147	.1378538	.2897606	-2.364034	.8115895
Size	147	7.567685	1.490126	4.568672	12.52697
Size1	147	7.314332	1.403638	4.687278	11.44528
gcapex	141	.1017264	.0711311	0	.4252474
beta	127	.7805402	.4937807	-.519	4.1967

Variable	Obs	Mean	Std. Dev.	Min	Max
2008					
gsales_overall	52	.1586663	.1450098	-.1116582	.7249448
gsales_precrisis	48	.3588154	.2274097	.0018324	1.246115
gsales_moving	49	.294469	.1801769	-.2038138	.6767547
TDR	52	.4591912	.4088233	0	2.950448
Tang	52	.5046182	.2193629	.0656756	.8903631
OC3	52	.7014703	.1598442	.199	1
for	52	.075281	.1724589	0	.9063
Ind	52	.362437	.2031499	0	.7777778
Q	51	1.104765	1.399739	.0751215	8.720411
prof	52	.1088336	.1250124	-.3114493	.3666905
ROE	52	-.0288157	1.034419	-6.348531	2.970773
Size	52	7.93905	1.43709	5.059864	12.40413
Size1	52	7.771628	1.328892	5.33918	11.85959
gcapex	51	.1238626	.0955339	0	.5849887
beta	50	.803322	.4968253	-.1605	2.4606
Variable	Obs	Mean	Std. Dev.	Min	Max
2009					
gsales_overall	52	.1586663	.1450098	-.1116582	.7249448
gsales_precrisis	48	.3588154	.2274097	.0018324	1.246115
gsales_moving	52	-.012728	.1856525	-.4219331	.5510858
TDR	52	.60166	1.310357	0	9.598102
Tang	52	.5120858	.2191127	.0816396	.8968258
OC3	52	.702741	.175961	.199	1
for	52	.1181465	.2174435	0	.9054
Ind	52	.3157061	.2213089	0	.9090909
Q	47	1.737945	1.446024	.0575709	7.89641
prof	52	.07451	.1023031	-.2273551	.3624652
ROE	52	-.0790891	.7102157	-3.915797	.4861394
Size	52	7.938083	1.485286	4.587875	12.53699
Size1	52	7.514088	1.310763	4.569355	11.45724
gcapex	49	.0724743	.0614674	0	.3086598
beta	50	.747502	.2067084	.3578	1.153
Variable	Obs	Mean	Std. Dev.	Min	Max
2010					
gsales_overall	52	.1586663	.1450098	-.1116582	.7249448
gsales_precrisis	48	.3588154	.2274097	.0018324	1.246115
gsales_moving	51	-.025379	.1750847	-.3759351	.406795
TDR	51	.4746939	.5889478	0	4.059803

Tang	51	.4919612	.2387062	.0411096	.8762923
OC3	52	.6741078	.2117503	0	1
for	52	.1256173	.2234532	0	.9349
Ind	50	.3523082	.2125826	0	.8181818
Q	47	2.503412	2.125462	.0818347	9.708097
prof	52	.1068187	.0844289	-.0588106	.4709601
ROE	51	.1449929	.1760992	-.2038175	.9350551
Size	51	8.028562	1.489016	4.868293	12.61975
Size1	51	7.703332	1.398352	4.736198	11.68268
gcapex	50	.0745883	.058329	0	.3196178
beta	48	.7591354	.1636483	.3923	1.1459

Appendix II.

Correlation matrix of variables.

The table reports the correlation coefficients for 11 main variables for the total sample. The table also shows the pair correlation of dependent variable measured with Tobin's Q with key independent variables.

beta	*Q*	*gsales_overall*	*gcapex*	*TDR*	*OC3*	*for*	*Ind*	*prof*	*Size*	*Tang*	*beta*
Q	1.0000										
gsales_overall	0.1515	1.0000									
gcapex	0.0952	0.2202	1.0000								
TDR	0.0212	-0.2073	0.0326	1.0000							
OC3	-0.1030	-0.0087	-0.1142	-0.1253	1.0000						
for	0.1841	0.0574	-0.0991	-0.2640	0.0888	1.0000					
Ind	0.0825	-0.0347	-0.0211	0.0983	-0.0306	0.0043	1.0000				
prof	0.0350	0.0805	-0.0074	-0.3523	0.0875	0.2608	0.0356	1.0000			
Size	-0.1671	0.0538	0.0369	-0.2996	0.1932	0.0562	0.1607	0.1595	1.0000		
Tang	-0.0889	0.0517	0.3715	-0.2850	0.0683	0.0583	-0.0398	0.0603	0.2897	1.0000	
beta	-0.1869	-0.0959	-0.0561	-0.1023	0.0856	-0.0087	-0.0670	0.1218	0.3285	0.0583	1.0000

Appendix III.

Descriptive statistics of key variables inside the clusters across time periods.

The table reports the summary of statistics of the main variables inside each cluster in pre-crisis period, 2008, 2009 & 2010.

Pre-crisis cluster characteristics

cluster	Variable	Q	prof	ROE	beta	TDR	OC3	Ind	for	manag	gcapex	gsales_moving	gsales_precrisis	gsales_overall
	Number	37	42	40	33	43	43	43	43	36	43	31	42	43
1	Mean	2,1844	0,1257	0,1598	0,7810	0,2808	0,6890	0,3017	0,0146	0,1548	0,0911	0,4245	0,3519	0,1577
	St.dev.	1,6364	0,1054	0,1050	0,3473	0,1829	0,2210	0,1173	0,0402	0,3408	0,0473	0,4370	0,3059	0,1854
	Number	32	32	30	27	32	32	32	32	30	29	29	31	32
2	Mean	2,6302	0,1544	0,1870	0,6856	0,2953	0,6835	0,3715	0,0361	0,1620	0,0783	0,4026	0,3791	0,1567
	St.dev.	2,1318	0,0842	0,1137	0,3314	0,1798	0,2016	0,1456	0,0839	0,2761	0,0482	0,2340	0,1981	0,0952
	Number	31	36	32	32	36	36	36	36	33	33	30	32	36
3	Mean	2,9051	0,1388	0,2074	0,7684	0,4330	0,7636	0,2847	0,1314	0,1974	0,1183	0,5552	0,3453	0,1459
	St.dev.	2,1572	0,1276	0,1082	0,3942	0,1744	0,1520	0,1364	0,2499	0,2945	0,0836	1,1403	0,1792	0,1232

2008 cluster characteristics

cluster	Variable	Q	prof	ROE	beta	TDR	OC3	Ind	for	manag	gcapex	gsales_moving	gsales_precrisis	gsales_overall
	Number	14	14	12	13	14	14	14	14	14	14	13	13	14
1	Mean	1,2291	0,0966	0,1693	0,5842	0,3188	0,6887	0,3442	0,0959	0,0398	0,1282	0,2479	0,3698	0,1921
	St.dev.	2,1959	0,1465	0,1097	0,2610	0,2050	0,1774	0,1859	0,2031	0,1302	0,0693	0,0825	0,3066	0,1846
	Number	15	15	10	15	15	15	15	15	13	14	14	14	15
2	Mean	0,7640	0,1360	0,1650	1,0868	0,3984	0,7219	0,4185	0,0224	0,2523	0,1073	0,2964	0,2949	0,1399
	St.dev.	0,7645	0,0903	0,1044	0,4664	0,1770	0,1014	0,1980	0,0537	0,3589	0,0430	0,2027	0,1620	0,0985
3	Number	17	17	11	17	17	17	17	17	15	17	16	15	17
	Mean	1,3586	0,1236	0,2120	0,6324	0,5073	0,7323	0,3981	0,1056	0,1591	0,1369	0,3325	0,3821	0,1470

	St.dev.	1,1826	0,0943	0,1328	0,3597	0,2275	0,1453	0,1956	0,2233	0,2628	0,1432	0,1933	0,1879	0,1268
2009 cluster characteristics														
cluster	Variable	Q	prof	ROE	beta	TDR	OC3	Ind	for	manag	gcapex	gsales_moving	gsales_precrisis	gsales_overall
	Number	16	17	13	16	17	17	17	17	16	17	17	16	17
1	Mean	1,4754	0,0862	0,1138	0,7834	0,3185	0,6616	0,3390	0,2013	0,0560	0,1038	0,0256	0,3470	0,1931
	St.dev.	1,0047	0,0952	0,0799	0,1841	0,2126	0,1486	0,2399	0,2832	0,2052	0,0796	0,1719	0,2830	0,1711
	Number	12	12	8	12	12	12	12	12	10	10	12	11	12
2	Mean	1,8624	0,0616	0,1540	0,7707	0,3988	0,7439	0,3669	0,0350	0,1929	0,0709	0,0039	0,2514	0,1501
	St.dev.	1,2064	0,0733	0,1398	0,1979	0,2517	0,1642	0,2239	0,0730	0,3042	0,0410	0,2120	0,1633	0,0828
	Number	14	16	11	16	16	16	16	16	14	15	16	14	16
3	Mean	2,0438	0,1035	0,1403	0,6869	0,4741	0,7244	0,3036	0,1125	0,1322	0,0530	-0,0158	0,4053	0,1407
	St.dev.	2,1407	0,0802	0,0831	0,2241	0,2552	0,1605	0,2266	0,2256	0,2312	0,0477	0,1422	0,1708	0,1301
2010 cluster characteristics														
cluster	Variable	Q	prof	ROE	beta	TDR	OC3	Ind	for	manag	gcapex	gsales_moving	gsales_precrisis	gsales_overall
	Number	14	15	13	14	15	15	15	15	13	15	15	14	15
1	Mean	2,0109	0,1144	0,1441	0,7629	0,2830	0,6959	0,3539	0,2388	0,0675	0,0862	0,0159	0,3704	0,2066
	St.dev.	1,4936	0,0700	0,0773	0,1927	0,2026	0,1488	0,1966	0,2820	0,2278	0,0618	0,1546	0,2952	0,1783
	Number	13	13	11	13	13	13	13	13	11	12	13	12	13
2	Mean	2,1536	0,0892	0,1650	0,7680	0,4031	0,6186	0,3932	0,0241	0,1975	0,0760	-0,0214	0,2949	0,1515
	St.dev.	1,3781	0,0597	0,0910	0,1659	0,2360	0,2497	0,2157	0,0438	0,2762	0,0366	0,1770	0,1744	0,0833
	Number	14	15	14	14	15	15	15	15	12	15	15	13	15
3	Mean	3,6114	0,1082	0,2070	0,7187	0,4327	0,7361	0,3512	0,1395	0,1536	0,0663	-0,0531	0,3770	0,1388
	St.dev.	3,0823	0,0711	0,2387	0,0913	0,2299	0,1720	0,2536	0,2572	0,2463	0,0784	0,1868	0,1860	0,1324

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