# COMPETITION IN THE KYRGYZ BANKING INDUSTRY: EMPIRICAL STUDY BASED ON PANZAR AND ROSSE MODEL

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ABSTRACT

This study examines the level of competition in the Kyrgyz banking industry over the period of 2010-2013. The calculation of concentration measures suggests that five banks in the Kyrgyz banking industry control on average 55-60% of the lending and deposit market. The concentration of lending and deposit market in the hands of a few players raises concern about the adequacy of competition in the banking industry. However, theory suggests that high concentration ratios do not necessarily imply that markets are not competitive. Therefore, we applied the Panzar and Rosse model, which takes market structure as endogenous factor. Using the financial reports, we have constructed unbalanced panel data with 86 observations and applied several econometric techniques. After testing our models for robustness, we decided that LSDV and within effect estimation are our preferred models. According to our estimations, the H-statistic is positive and significantly different from zero and unity. Therefore, we have concluded that the banking market of Kyrgyzstan is monopolistically competitive if average cost is U-shaped and possibly perfectly competitive if we have flat average cost. Even though, we could not identify the type of average cost which prevails in the banking market, the rejection of the null hypothesis that $H<0$ enables us to strongly reject the possibility of monopoly and oligopoly for both types of cost. Therefore, the concentration of the market share in the hands of a few banks does not imply significant market power in the banking market of the Kyrgyz Republic.

*Dedicated to my Grandmother:*

*Nurush Ismailova*

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# INTRODUCTION

A well-established financial market facilitates the efficient allocation of goods and services and promotes economic growth. The idea that financial development causes economic growth often referred as *supply-leading hypothesis* and was heavily supported by Schumpeter (1911) and developed further by Shaw (1973), MacKinnon (1973) and King and Levine (1993). Mainly, they state that the development of financial markets has positive effect on capital accumulation, rate of savings and investments and this serves as a catalyst for economic growth. Nowadays, the financial market of Kyrgyzstan is dominated by commercial banks. They account for approximately 80% of all financial institutions in Kyrgyzstan.[1] In the context of this idea, it becomes evident that commercial banks play an important role in the financial system and in the economy of the country overall.

Microeconomic theory states that in order to maximize social welfare and reach Pareto efficiency, healthy competition is a necessary component. The same thing applied to the banking market. It is argued that the low level of competition and signs of significant market power in the banking industry can possibly cause negative effects. To illustrate, banks function as financial intermediaries between investors and borrowers. Accordingly, uncompetitive market might have adverse effect on adequate provision of deposits and loans, which can cause undesirable macroeconomic consequences. Furthermore, the National Bank of the Kyrgyz Republic (NBKR) conducts its monetary policy mainly through commercial banks, therefore, dissimilar banking markets, in terms of the level of competition, may respond to monetary tools differently making some monetary policies less effective. However, there are also alternative opinions, which mainly state that non-competitive bank markets can still be efficient owing to the peculiarity of the banking industry. It is believed that non-competitive bank markets with few players are more stable than competitive markets with many participants. However, empirical studies on this issue give different results.[2] Nevertheless, it becomes evident that assessing the level of competition is important. Especially, it is important for commercial bank regulatory agencies to formulate sound regulatory policies.

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[1]National Bank of Kyrgyz Republic, "The Stability of the Financial Sector of the Kyrgyz Republic-Report / 33," NBKR; accessed February 23, 2014, http://www.nbkr.kg/DOC/14012013/000000000019715.pdf.

[2] See Klaus, Schaeck, Martin Cihak and Simon Wolfe. "Are competitive banking systems more stable?"*Journal of Money, Credit and Banking* 41, no. 4 (2009): 711--734.

### *1.1 Purpose*

Between 2010 and 2013, the banking market of Kyrgyzstan was mainly dominated by five banks. Our calculations suggest that these five banks approximately account for 60-65% of deposit and lending services. Such high concentration of market share in the hand of a few banks raise the concerns about adequacy of competition in the Kyrgyz commercial bank market. Moreover, high interest margins and spreads in the Kyrgyz banking market, compared to other developed countries, cast doubt about the effectiveness of the competition forces.[3] However, certain theories suggest that it is still possible for concentrated markets to operate under the healthy competition if the specific conditions are met. Therefore, the aim of this thesis is to examine the level of competitiveness of the Kyrgyz banking market and to answer whether the highly concentrated banking market of Kyrgyzstan is still competitive.

To achieve this goal we will firstly calculate such ratios as the concentration ratio (CR) and the Herfindahl-Hirschman Index (HHI) to obtain clear picture about concentration levels in a banking market. After that, we will apply a more advanced technique which is an empirical model developed by Panzar and Rosse (1977, 1987) to determine the level of competition in the Kyrgyz banking sector.

Currently, only a few studies exist that address the level of competition in the banking sector in Kyrgyzstan. Such research is particularly important for the National Bank that deals with monetary policy and regulation of the commercial banks.

### *1.2 Disposition*

Chapter 1 of this thesis will begin with an overview of the banking system of the Kyrgyz Republic. We will examine major developments and events faced by the banking system after Kyrgyzstan gained independence in the 1990s and observe key statistical facts. Chapter 2 reviews theoretical and empirical literature on assessing competition in the banking sector. Chapter 3 defines econometric methodology and formulates measures of concentration ratio. Chapter 4 presents empirical results. In conclusion, we summarize our study and report the main findings of the thesis.

[3] World Bank, "Interest Rate Spread," World Bank Group; accessed February 25, 2014, http://data.worldbank.org/indicator/FR.INR.LNDP.

# CHAPTER 1

## *1.1 Stages of Development of the Kyrgyz Banking Sector*

The banking sector of Kyrgyzstan achieved significant progress over the last 25 years. It is commonly accepted to divide the process of development of the Kyrgyz banking system into four main stages.

The first stage covers major reforms that were conducted between 1991 and 1995. In this transition period, Kyrgyzstan was experiencing significant changes in the economic structure, caused by transition from planned to market-oriented economy. The period characterized by establishing the fundamentals of the legal and normative framework in the banking system. In 1992, the Law "On the National Bank of the Kyrgyz Republic" and the Law "On banks and banking activity in the Kyrgyz Republic" were introduced. The Law "On the National Bank of the Kyrgyz Republic" determined the functions and objectives of the National Bank. Principally, it stated that the National Bank should ensure stability of the national currency, conduct monetary policy and protect the interest of the creditors and depositors of the bank.[4] The objective of the Law "On banks and banking activity in the Kyrgyz Republic" was to establish a regulatory framework for commercial banks and their relationship with the National Bank of Kyrgyzstan.

Essentially, these two laws helped to make clear distinction between the National Bank and commercial banks. This created a base for introducing national currency, which was necessary to reduce inflation and to stabilize the economy in that period. So, in 1993 the national currency (som) was launched which allowed the National Bank become independent in the formation of monetary policy.[5]

The second stage refers to the 1996-7 period, which was related to the realization of the financial sector reform programme supported by Financial Sector Adjustment and Credit (FINSAC). As the result of this programme, major banking laws were improved and updated. Moreover, it helped to create a normative base for banking regulation, which established requirements for capital adequacy, classification of credits, formation of loan loss provision and introduced several normatives that need to be followed by commercial banks to reduce credit and currency risks. Additionally,

[4] National Bank of the Kyrgyz Republic, "Stages of development of banking regulation," NBKR; February 25, 2014, http://www.nbkr.kg/contout.jsp?item=1576&lang=RUS&material=12732
[5] Ibid.

financial accounting and reporting in the banking system has begun to follow international standards.[6]

The third stage takes its beginning from 1998 to 2001. In this period, the banking system of Kyrgyzstan was heavily affected by macroeconomic destabilization caused by the financial crisis in Russia, devaluation of currencies of trading partners and several internal problems of commercial banks. The National Bank of Kyrgyzstan conducted several steps to avoid systemic crisis in the country. In this period, the NBKR further improved the legislative base and applied the necessary steps to protect commercial banks and interest of the public. Despite the difficulties, the NBKR was able to show competence in performing its main tasks and ability to neutralize the potential risks for the economy of the country.[7]

The fourth stage covers the period between 2001 and 2005. During this period fundamental reforms of the banking system that started in 1990 were completed and the banking system began to grow rapidly. However, in the 2005-2010 period, the growth of the banking system slowed down due to political and economic instability, which severely affected the banking system. The NBKR was able to take the necessary measures and since 2011 the banking system of Kyrgyzstan has shown good trends of growth.

### *1.2 The Kyrgyz Banking Sector: Selected Statistical Facts*

Referring to NBKR, in 2013 23 commercial banks with 282 branches operated on the territory of the Kyrgyz Republic. The amount of foreign capital in the banking sector reached 3.4 billion soms, which is 34% of the total banking capital.[8] As was mentioned above, the financial sector of Kyrgyzstan is largely dominated by commercial banks. The table below shows the structure of assets in the financial sector.

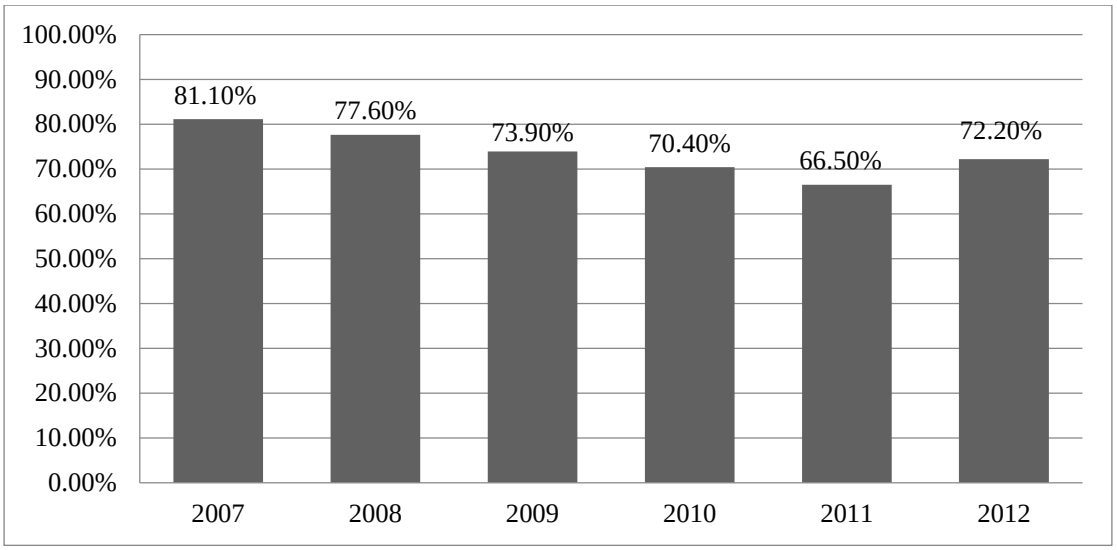
[6] Ibid.
[7] Ibid.
[8] National Bank of Kyrgyz Republic, "Trends of the development of the banking system," NBKR; February 25, 2014, http://www.nbkr.kg/index1.jsp?item=80&lang=RUS.

**Table 1: Structure of Financial Sector Assets in Kyrgyzstan (in %)**[9]

| | 2011 | 2012 |
|---|---|---|
| Banks | 75,80% | 80,00% |
| Non-banking financial institutions | 22,90% | 18,70% |
| Other financial companies | 1,30% | 1,30% |

We can observe that in 2012, the share of commercial banks was 80%, which confirms that commercial banks play a big role in the financial sector of the Kyrgyz Republic. Regarding the share of banks' credit portfolio in total credit portfolio of the financial sector, it has a decreasing trend. In 2012, it was 72.2% which is relatively still high.

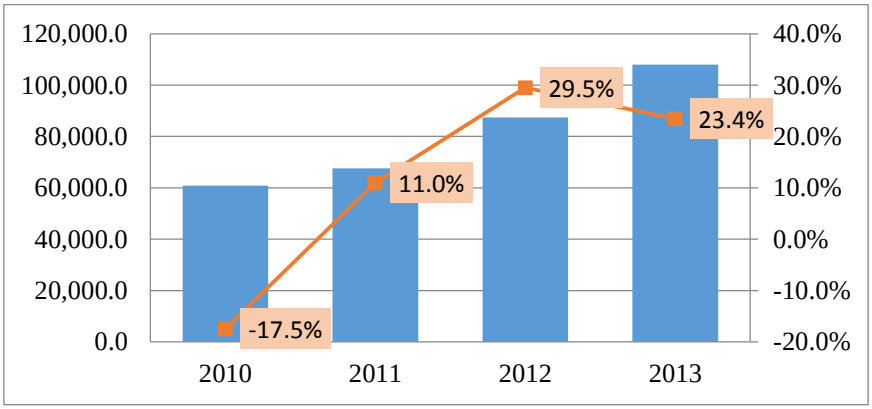
**Figure 1: Share of banks' credit portfolio in the total credit portfolio of the financial sector**[10]




Since 2010, the assets of commercial banks have shown increasing trend. Compared to the previous year, in 2013 assets grew by 23,44% and equaled 107,9 billion soms.

[9] Supra n. 1.
[10] Ibid. 34.

**Figure 2: Total assets of commercial banks (in million soms)**[11]




The credit portfolio of the commercial banks compared to 2012 increased by 35% and was about 53 billion soms. Total deposits and total equity capital during the 2012 - 2013 period increased by 27% and 13%, respectfully.

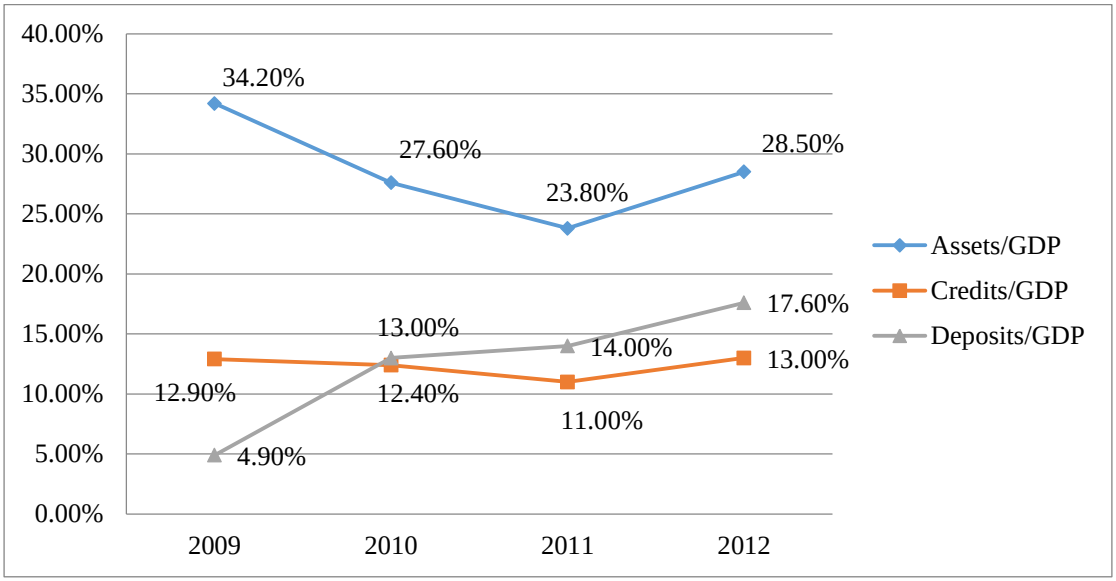
**Table 2: Growth rate of the key indicators of commercial banks (year by year)**[12]

| | **2010** | **2011** | **2012** | **2013** |
|---|---|---|---|---|
| Net Credits | -1.6% | 26.6% | 30.7% | 35% |
| Total deposits | 14% | 13.5% | 31% | 27% |
| Equity capital | 17.6% | 16.2% | 16.7% | 12.9% |

Overall, we can conclude that beginning from 2010 the banking sector of Kyrgyzstan has grown rapidly and there are increasing trends in key indicators. However, indicators of financial intermediation demonstrate relatively low level.

[11] National Bank of the Kyrgyz Republic, "Bulletin of National Bank of Kyrgyz Republic for 2013," NBKR; accessed February 23, 2014, http://www.nbkr.kg/DOC/21022014/000000000025615.xls.
[12] ibid

**Figure 3: Financial intermediation indicators**[13]




From the ratios above we can state that, compared to developed countries, the financial intermediation ratios are at a low level.[14] Therefore, the financial sector of the Kyrgyz Republic has unrealised potential and can grow further.

To sum up, we can state that the Kyrgyz banking sector has been rapidly growing in recent years. Moreover, commercial banks are dominant players in financial market of the Kyrgyz Republic. This fact makes to study competition amongst the commercial banks very important and necessary.

[13] Ibid.

[14] World bank, "Domestic credit provided by banking sector (% of GDP)," World Bank Group; accessed February 25, 2014, http://data.worldbank.org/indicator/FS.AST.DOMS.GD.ZS

# CHAPTER 2

## *2.1 Literature Review: Introduction*

Currently, in the academic literature we can identify two basic approaches for assessing competition in the banking industry, both of which originated from industrial organization theory. The first one is structural approach, which focuses mainly on market structure factors. Predominantly, the structural approach is presented by the Structure-Conduct-Performance Framework (SCP) and the Efficiency Hypothesis. These two concepts used to examine whether concentrated markets cause firms to act collusively and achieve higher profits, or whether superior efficiency of the firms is the reason of high profitability.

On the other hand, non-structural models recognized to be the products of a new trend in Industrial organization theory, which developed in the 1970s and tries to determine the competition in the market without considering market structure factors.

## *2.2 Literature on the Structural Approach*

The origins of the Structure-Conduct-Performance (SCP) approach were developed by Harvard economist Edward S. Mason (1939, 1949) and later followed by his Ph.D. student Joe S. Bain. In the framework of the SCP Model, *the structure* usually refers to the number of firms or some other measure of distributions of firms in the market. *Conduct* means the behavior of buyers and sellers and *performance* refers to the success of the industry in generating benefits for the customers. The model states that the *performance* of the industry depends on *the conduct*, which in turn depends on the *structure* of a market.[15] Usually empirical SCP studies consist of two parts. Firstly, we should obtain a measure of performance and some measures of structure of an industry. Secondly, using cross-sectional data we regress the performance measure to measures of structure to find the relationships between these variables.[16] Generally, to quantify the performance, economists use such measures as Lerner Index, price–cost margin and Tobin's q; to quantify the structure, it is common to use such concentration ratios as the Herfindahl-Hirschman Index (HHI) and k–bank concentration ratio. Joe S. Bain (1951, 1954) did one of the first empirical

[15] Jeffrey M. Perloff, Larry S. Carp and Amos Golan, *Estimating market power and strategies* (New York: Cambridge University Press, 2007), 13
[16] Ibid. 14.

applications of SCP theory in his papers and later in his book *Barriers to New Competition* (Bain 1956). Bain (1951) used descriptive statistics to relate concentration and performance measure. As a measure of concentration he chose eight firm concentration ratio (C8) and as a performance measure he used Return on Equity. On the basis of his analysis he concluded that in concentrated markets the average profitability tend to be higher.[17] Another study by Bain (1956) included barriers for entry in his analysis. Results showed that industries, which have higher barriers to entry, have higher profits. Based on these studies, Joe Bain formulated his hypothesis which mainly states that *industries, which have high concentration and high barriers to entry will have higher profits than other industries***.**[18] Often this is referred as Structure-Conduct-Performance hypothesis.

Beginning in the 1970s, several economists criticized the conclusions drawn on the basis of SCP hypothesis about the relationship between profitability, concentration and high barriers to entry. Ideas proposed by these economists often referred as efficiency school of thought. They stated that efficiency was the primary driver of a firm's performance.[19] According to the efficiency school, efficient firms have some distinct characteristics, which allow them to increase their market share. When efficient firms begin to grow and capture the market, inefficient firms tend to exit from it. This tendency of driving out ineffective firms makes markets more concentrated.[20] In addition, they conclude that entry barriers do not necessarily result in superior profits by the firm. Referring to efficiency school, above average profits in a particular industry is a temporary phenomenon. When other firms observe that there is a possibility to earn above average profits, reallocation of resources will occur by the entry of new competitors or by the existing firms' increasing capacity.[21] The possibility of equilibrium in an industry largely depends on the ability of new entrants to duplicate the cost structure of the already existing firms.[22] In contrast to the SCP paradigm, which states that firms in concentrated markets tend to act collusively and use their market power to raise prices, the efficiency hypothesis states that, **"***through*

[17] Ibid. 25.
[18] Ibid.
[19] Naresh K. Malhotra, *Estimating market power and strategies* Volume *1* (New York: M.E Sharpe, 2004), 214.
[20] Ibid.
[21] Ibid. See also, Robert Jacobson "Distinguishing Among Competing Theories of the Market Share Effect," *The Journal of Marketing* 52, no. 4 (1988): 68-80, accessed February 26 , 2014 http://www.jstor.org/discover/10.2307/1251634?uid=2&uid=4&sid=21103592837837
[22]Ibid.

*superior innovativeness or managerial skills, efficient firms can lower their costs, increase their size, and achieve above-normal profits.*"[23]

### *2.3 Empirical Studies on the Banking Industry: Structural Approach*

The SCP relationship in a banking industry is thoroughly examined in the literature.

Gilbert (1984) examined wide-ranging research papers, which applied the SCP methodology to determine relations between banking structure and the profitability of banks. He analysed forty-four studies, 32 of which showed certain evidence of relationship between market structure and bank performance. Only seven studies of these 32, however, have measures of market structure, which are statistically not significant. Owing to this fact, he proposed to evaluate the structure-performance relationship using the studies with small conceptual and measurement errors. In these better studies identified by Gilbert, results show significant relationship between market structure and performance. However, the author points out that most of these studies fail to take into account that causal relationship could exist owing to the fact that a company is simply efficient in minimizing its costs through efficient management. Therefore, high profits could be achieved by efficiency, rather than through market power.

A study by Smirlock (1985) takes into account the efficiency hypothesis and examines correlation between the market structure and profits of 2,500 banks in the USA. The result shows that the above mentioned efficiency hypothesis certainly explains the examined sample. That is, market concentration is not the proper measure to explain banks' profitability. Outcomes suggest that higher profit is not the result of using market power.

The table below summarizes empirical studies that used structural approach techniques. The main goal of these studies was to find whether the performance their sample of banks explained by the SCP Hypothesis or Efficiency Hypothesis. Empirical studies suggest that results of the structural approach are mixed and it is not possible to give certain priority to one or the other hypothesis mentioned above. Therefore, researchers begin to search for alternative tools to measure the level of competition.

[23] Ibid. See also Harold Demsetz "Industry Structure, Market Rivalry, and Public Policy" *The Journal of Law and Economics* 16, no. 1 (1973): 1-9, accessed February 26 , 2014 http://www.jstor.org/discover/10.2307/724822?uid=2&uid=4&sid=21103592837837

## Table 3: Structural approach studies and results

| Year | Data and Type | Author(s) | Results |
|---|---|---|---|
| 1984 | Analysed 44 studies about SCP framework | Gilbert | Mixed results. However, most of studies supported SCP hypothesis. The main drawbacks founded by Gilbert in related studies are methodological errors and failure to identify whether market power or market efficiency are drivers of profitability. |
| 1985 | 2500 state banks (USA) | Smirlock | Taken into account the possibility of Efficiency Hypothesis and found no relationship between concentration and profitability. |
| 1995 | 18 European countries data from 1984 -1989 | Molyneux and Forbes | They found that the European banking industry is explained by the SCP paradigm. |
| 2001 | Eastern Carribean Union 44 commercial banks annual data 1991 – 1999 | Polius and Samuel | The results strongly support the Efficiency Hypothesis. |
| 2010 | Pakistan 20 commercial banks 1996-2004 | Bhatti and Hussain | The study provides strong support for the SCP Hypothesis. |
| 2010 | Sample of over 2,500 bank observations from nine Latin American countries over 1997-2005. | Georgios E. et al | The results of the study support the Efficiency Hypothesis. |
| 2012 | Indian banking Sector Panel Data set of 59 banks 1999 – 2000, 2008-2009 | Sahoo and Mishra | They found inter-linkage between structure, conduct and performance of the bank and multidirectional SCP relationships. |

### *2.4 Literature on Non-structural Approach*

In reaction to the above-mentioned traditional methods used in industrial organization theory, new concepts started to evolve. This new empirical industrial organization (NEIO) paradigm tries to define the level of competition without considering the structure of a market, which is assumed to be determined endogenously. The most dominant model of this school was developed by Panzar and Rosse (1987) and was extensively applied by researchers in their studies. Principally, the model relies on the fact that if we change the factor "costs" of the banks, banks will respond differently depending on whether it has monopoly or operates in a competitive market. One of the advantages of the Panzar and Rosse model is that we do not need to define a geographic market.[24] Moreover, the model uses bank data which is easily obtainable and verifiable. Also there are several other recent non-structural models such as the persistence of profit indicator (Goddard and Wilson 1999) and the Boone indicator (Boone 2008). The main tool of this thesis is the Panzar and Rosse model so we will cover it more widely compare to other non-structural models.

### *2.5 Panzar and Rosse Model: Theory*

The model is based on establishing revenue equation using micro level bank data and assessing the impact of change of the input prices factor to the revenue of the bank. The Panzar and Rosse model assumes that market is in the long run equilibrium and that the performance of the banks is influenced by the actions of other banks in the market. Moreover, the model assumes that price elasticity is greater than unity and that the cost structure is homogeneous across the banks.[25] Referring to general market model, to get equilibrium output and equilibrium number of banks, we maximize profits both at bank and industry level.[26] Therefore, bank *i* maximizes profits when marginal revenue equals to marginal cost:

$$R_i'(x_i, n, z_i) - C_i'(x_i, w_i, t_i) = 0 \quad (1.1)$$

Where, $x_i$ is the output of the bank *i*, $n$ is the number of banks, $z_i$ is the vector of exogenous variables that shift revenue function of the bank, $w_i$ is the vector of factor

[24] J. A. Bikker and K. Haaf "Measures of competition and concentration in the banking industry: a review of the literature." *Economic and Financial Modelling* 9, no. 2 (2002): 53-58.
[25] Ibid.
[26] Ibid.

input prices of the bank and $t_i$ is the vector of exogeneous variables that shifts the cost function of the bank. Moreover, in the long-run equilibrium zero profit condition holds at the market level:

(1.2) $$R_i^*(x^*, n^*, z) - C_i^*(x^*, w, t) = 0$$

The sign * indicates equilibrium values. The market power is measured by how changes in factor prices will change equilibrium revenues earned by the bank. Panzar and Rosse introduce H-statistic as measure of competition which is the sum of elasticities of reduced form revenues to factor prices:

(1.3) $$H = \sum_{k=1}^{m} (\partial R_i^* / \partial w_{k_i})( w_{k_i} / R_i^*)$$

Where $\partial w_{k_i}$the change in factor is input prices and $\partial R_i^*$ is a change in equilibrium revenue. The H-statistic ranges between $-\infty < H \leq 1$. If $H$ is smaller than zero then the market is monopoly and if H ranges between 0 and unity, market is under the monopolistic competition H–statistics of unity indicates that there is perfect competition.[27]

**Table 4: H –statistic of interpretation**

| **H – statistic** | **Results** |
|---|---|
| H<0 | Monopoly |
| 0<H<1 | Monopolistic competition |
| H=1 | Perfect competition |

To be more precise, the Panzar and Rosse model assumes that the market in the long-run is in equilibrium. So if our bank market operates under perfect competition the price should be equal to average costs. Increase in input factor costs will result in the same increase in price. Therefore our H-statistics is equal to one. In case of monopolistic competition increase in costs causes increase in revenue but less than proportionally, consequently H-statistic is between 0 and 1. When our market is monopoly, increase in input prices increases the marginal costs of a bank and the bank

[27] Ibid.

reduces equilibrium quantity which decreases revenue. Therefore H-statistics is less than zero.

### *2.6 Empirical studies: Non-structural approach*

There are numerous empirical studies which applied the Panzar and Rosse model to the bank market. Below we will summarize the selected literature.

Nathan and Neave (1989) in their empirical study assess the competiveness and the existence of contestability in Canadian banking, trust and mortgage industries. Based on the works of Shaffer, they employ Panzar and Rosse H-statistic and establish empirical model for the Canadian banks. In the regression equation, as the dependent variable, they use total revenue less provision for loan losses to capture the effect of loan losses. Prices of input factors such as funds, labor and capital were estimates by the following ratios: interest expenditures to total deposits (unit price of funds), wages and salary expenses to number of employees (unit price of labor) and premises expenditure to number of branches (unit price of capital). Moreover, to identify the possibility of scale economies, the authors included such explanatory variables as total assets, number of branches of the bank and introduced the so-called dummy variable to distinguish the six largest banks of Canada. The Panzar Rosse test was applied cross-sectionally based on financial statement data of Canadian banks from 1982-1984. The results of the study suggest that in 1982 the value of H-statistic was 1.058 which states that the banking market was in perfect competition. In 1983 and 1984 the value of H-statistic was 0.68 and 0.729 respectively, which allows accepting the hypothesis of monopolistic competition in these years. The authors conclude that asset and number of branches variable capture the size effects while dummy variable has no explanatory power. Owing to this fact, the six largest banks of Canada do not have extra revenue effects in addition to the size.

Molyneux, Lloyd-Williams, and Thornton (1994) examined the competitive conditions in major EC bank markets (Germany, United Kingdom, France, Spain and Italy). They applied regression model similar to Nathan and Neave (1989) and Shaffer (1982). As the dependent variable they use interest revenue to total assets which explained by such variables as personal expenses to total assets (proxy for unit price of labor), capital expenses to fixed assets (proxy of unit price of capital) and interest expenses to total funds (unit price of funds). To capture the risk, cost and size characteristics they have introduced several control variables such as total assets of

the bank, loans to assets ratio, total risk capital to assets ratio, interbank deposits to total deposits. The Panzar Rosse Test was applied cross-sectionally based on individual data of each country from 1986-1989. The authors state that in the estimated reduced revenue equation, coefficient of total asset variable is mainly negative, which indicate that differences in size may lead to lesser revenues per dollar of assets. Also, coefficient of loans to assets ratio is positive suggesting that banks with significant amount of loans tend to earn more revenue per dollar of assets. The negative coefficient of interbank deposits to total deposits indicates that banks engaged in wholesale funding earn lesser revenue per dollar of assets. The coefficient of capital to assets ratio does not have explanatory power. Results of the long-run equilibrium test suggest that markets are in the long-run equilibrium and therefore H-statistic is meaningful. The results of the Panzar and Rosse test suggest that H-values are positive and significantly different from zero and unity when in the long-run equilibrium for the United Kingdom, France, Germany (except for 1987) and Spain. Therefore the bank markets of these countries seem to be operating under monopolistic competition. H–statistic for Italy was -0.2578 and -0.8945 in 1987 and 1989 respectively, which allows accepting monopoly or conjectural variations short-run oligopoly hypothesis for Italian banks in those years.

Molyneux, Lloyd-Williams, and Thornton (1996) applied regression equations similar to Nathan and Neave (1989) and Shaffer (1982) to 72 Japanese commercial banks for the years of 1986 and 1988. The empirical results of Shaffer's model state that H-values for 1986 were -0.004 and -0.006 which do not reject the monopoly or conjectural variations short-run oligopoly hypothesis. However, in 1988, H-statistic was 0.245 and 0.423, which allows to accept the monopolistic competition hypothesis.

Coccorese (1998) applied similar methods to evaluate the degree of competition in the Italian banking industry for the 1988-96 period. The results of H-statistic were significantly non-negative and different from the unity (except for 1992 and 1994). Therefore, the author concludes that Italian banks operated under the condition of monopolistic competition between 1988 and 1996 (except for 1992 and 1994). The long-run equilibrium test indicated that in 1988, 1989, 1990 and 1992 the data were in the long-run equilibrium and this allows meaningfully to interpret H-values for these years. Additionally, the author conducted diagnostic tests for heteroskedasticity and normality. The results suggest that regression equations of 1992, 1993 and 1994 have

the problem of heteroskedasticity and that five of nine equations are not normally distributed.

Hondroyiannis, Lolos, and Papapetrou (1999) assess the competitive conditions of the Greek banking system over the period of 1993-1995 using the Panzar-Rosse H-statistic and econometric model similar to previous studies. To estimate reduced revenue equation they apply two different methods. The first method uses times-series cross–section estimation and consists of two steps. Firstly, ordinary least squares applied to pooled data to estimate the variance weights. Secondly, the variance weights used to estimate the generalized least square parameters. The second method estimate regression equation to each year separately by ordinary least square method. Both methods suggest that the Greek banking market operated under the conditions of monopolistic competition over the 1993-1995 period.

De Bandt and Davis (2000) examined the level of bank competition using the H-indicator in France, Italy, and Germany. Particularly, they measure competition separately for large and for small banks. They use data from 1992-1996 to estimate their results. Compared to previous studies, they use panel data set to construct their reduced-revenue equations. Firstly, they run OLS on the pooled data assuming that all observations are independent. Then to account for bank-specific and time factors, they introduce fixed effect estimator. Results of the econometric estimates suggest that in France and Germany, large banks operate under the monopolistic competition and small banks tend to show monopoly behavior. In Italy, both large and small banks exhibit features of monopolistic competition.

Bikker and Haaf (2002) examined the degree of competition in the European bank markets and the relationship between concentration and competition. They apply PR model to banks from 23 European and non-European countries and use individual bank data from 1988-98. Moreover they classified banks according to size and applied the PR model to each sample. They have concluded that large banks mostly operate in very competitive environment and small banks operate in weaker competition. They have also concluded that European bank markets appear to be more competitive than in non-European countries included into the sample.

Gelos and Roldos (2004) examined the structure of bank market for selected emerging economies. They carried out panel data estimation with fixed effects to calculate H-statistic. Using the time dummy variables they divided 1994-1999 for two-sub periods to examine the effect of structural breaks. The econometric results of their estimation

suggest that almost all selected countries operate in monopolistic competition. The structural breaks which represented the start of the consolidation process in selected countries mostly did not affect the market structure. They concluded that the process of consolidation in the banking industry was not accompanied by decreasing competition.

Murjan and Ruza (2002) examined banking competition in the Arab Middle Eastern countries. They applied the Panzar-Rosse test using the data of the 1993-1997 period. Mainly, they follow the methodology of Nathan and Neave (1989) and Shaffer (1982) to establish their reduced revenue equation. However, due to the constraints, they combined price of labor and price of capital into a single variable. In their study, they run two sets of regressions. First, OLS equation estimated on pooled sample of banks over each year. Second, they have introduced interactive time dummies to account for time-varying factors. The results of their study suggest that Arab Middle Eastern countries banking markets operated under monopolistic competition.

Claessens and Laeven (2004) applied the PR Model by collecting micro-level bank data from 50 countries. They constructed a panel data from 1994-2001 and estimated reduced revenue equation using OLS with time dummies and GLS with fixed bank-specific effects. On the basis of H-statistic they have concluded that more presence of foreign banks and limitation of restrictions on bank activity results in more competitive bank markets. Moreover, they found that concentrated banking markets tend to be more competitive. Also they have found negative relations between the competitiveness of the banking system and the number of banks in a country.

Mamatzakis et al. (2005) measured the degree of competition in the South-east European banking sector. They have constructed panel data for the 1998-2002 period and employed the Panzar and Rosse model. To control for heterogeneity, regression equations are estimated using fixed effects estimator. The equations include different intercepts for each country to capture variance amongst countries and time trends to capture time effects. The results of the study suggest that South-east European countries and their banking market operate under monopolistic competition.

Drakos and Konstantinou (2005) measure the degree of competition in selected transition countries (Estonia, Latvia, Lithuania, Ukraine, Bulgaria, the Czech Republic, Hungary, Poland, Romania, and the Slovak Republic). They use panel data set for the 1992-2000 period. They employ three specifications of regression equations. First, they run pooled OLS on a whole sample assuming that observations

are independent. Second, to control for bank-specific variables they have introduced fixed effect estimator. Third, they have introduced both fixed effects and time effects. The results of estimation suggest that almost all banking markets in these countries explained by monopolistic competition. However, Latvia and Ukraine banking markets seem to be far from long-run equilibrium, so H-statistic has little explanatory power.

Mkrtchyan (2005) examines the market structure of the Armenian banking industry using data from 1998-2002 and applied panel estimation with fixed effects to calculate H-statistic. Then he examines relationship between selected concentration level indicators and H-statistic. The results show that the Armenian banking system operates in monopolistic competition. Moreover decrease in H-statistic is supplemented by increase in concentration ratios which supports market-power hypothesis.

Al-Muharrami et al. (2006) investigated the market structure of the Gulf Cooperation Council (GCC) countries, namely Bahrain, Kuwait, Oman, Qatar, Saudi Arabia and the United Arab Emirates. They apply PR model for the 1993-2003 period and evaluate the degree of competition using H-statistic and panel data techniques. They suggest that GCC banking system operates under monopolistic competition but results vary if to consider each country's economy. They find that Kuwait, Saudi Arabia and the UAE operate in nearly perfect competition. Bahrain and Qatar in monopolistic competition and Oman's banking system operates in monopoly conditions. (Al-Muharrami and Matthews et al. 2006, 3487--3501)

Yuan (2006) assesses the level of competitiveness in China's banking industry. The author uses panel data from 1996-2000 to apply PR model. They found that China's banking industry overall is nearly perfectly competitive. Moreover, they have found that competition between small banks in China is perfect (Yuan 2006, 519--534).

Yildirim and Philoppatos (2007) examine the level of banking competition in 11 Latin American countries for the period 1993-2000. They employ the Panzar and Rosse model in their study and find that their sample of countries operates under monopolistic competition. The findings of their study suggest that high concentration in the banking markets does not necessarily result in monopoly rents. Moreover, they have concluded that openness of the financial market to foreign participants, increases the competitiveness of the banking market.

Cocoresse (2009) applies the Panzar and Rosse model to sample of Italian single-branch banks which operated as monopolists in specific local areas in the 1998-2005 period. The results of his study suggest that market power can still be small even in a market with one bank. Therefore, it is possible to have high concentration and competition in a banking sector.

Gorener and Choi (2013) employ the Panzar and Rosse model to investigate competitive forces in the Turkish banking system in 1992-2009. They break this time horizon into three periods: pre-crisis period (1992-1998), crisis period (1999-2003) and post-crisis period (2004-2009). The results suggest that during the pre-crisis and post-crisis period the banking market of Turkey could be explained by monopolistic competition. However, during the crisis period, the Turkish banking system was in perfect competition.

# CHAPTER 3

## *3.1 Data Description*

This study uses data from 23 commercial banks of the Kyrgyz Republic for the 2010–3 period. Using the annual financial statements of commercial banks, we have constructed a panel data for the given number of banks and years. Owing to the fact that some banks do not provide financial reports for specific years, we created an unbalanced panel data with 86 bank-year observations. Our collection of data enabled us to cover all banks that currently operate on the territory of the Kyrgyz Republic, so that the banking market could be presented fully.

## *3.2 Concentration Measures: CR and HHI*

To get information about the concentration level in the banking market of Kyrgyzstan we use the most widely applied measures such as the concentration ratio (CR) and Herfindahl-Hirschman Index (HHI). Following Bikker and Haaf (2002), the k bank concentration ratio sums the share of k leading banks and takes the following form:

(1.4) $$CR_k = \sum_{i=1}^{k} S_i$$

Where $S_i$ stands for share of the bank, k is the number of chosen banks and $CR_k$ is the concentration measure.[28] There is no specific rule for choosing the number of banks. In our study we will use C(3) , C(5) and C(10) which represent the sum of the shares of leading three, five and ten banks respectively. Another most widely used measure is the Herfindahl-Hirschman Index (HHI) and the formula for this indicator is following:

(1.5) $$HHI = \sum_{i=1}^{k} S_i^2$$

The HHI ranges between 1/n to 1, which means that at the lowest value of 1/n, the shares of market distributed equally among competitors and 1 means that there is a monopoly.[29] Referring to NBKR's provision regarding the determination of dominant position in a banking market, if HHI is greater than 0.18 this means that there is a

[28] J.A. Bikker and K. Haaf, "Measures of competition and concentration in the banking industry: a review of the literature." *Economic and Financial Modelling* 9, no. 2 (2002): 53-58.
[29] Ibid.

high concentration and low level of competitiveness in a banking market.[30] In our study we will calculate the above mentioned measures taking as a basis the total assets separately for credit and deposit markets.

### *3.3 Econometric Methodology: Panzar and Rosse Model*

In order to apply the Panzar and Rosse model to banking we assume that banks are single product firms, which is consistent with intermediation approach. The intermediation approach states that banks are intermediaries of financial services rather than producers. Therefore, loans and investments treated as output, while labor and capital as inputs.[31]

Based on previous studies, to calculate H-statistic we establish the following reduced revenue equation:

$$(1.6)\ In(R_{it}) = \alpha + \beta_1 \ln(w_{1,it}) + \beta_2 \ln(w_{2,it}) + \beta_3 \ln(w_{3,it}) + \gamma_k \sum z_k + \delta D + \varepsilon_{it}$$

Where, subscript *it* denotes bank *i* at time *t*.

$R_{it}$ is the revenue of the bank, $w_1$ is an input price of labor, $w_2$ is an input price of capital, $w_3$ an input price of funds, $z_k$ is a vector of control variables and *D* is a vector of time dummies.

Due to limitation of bank financial reports and the impossibility to differentiate between price of labor and price of capital we follow Murjan and Ruza (2002) and combine this two factor input prices into a single variable. Therefore, our equation takes the following form:

$$(1.7)\ In(R_{it}) = \alpha + \theta \ln(w_{1,it} + w_{2,it}) + \beta \ln(w_{3,it}) + \gamma_k \sum z_k + \delta D + \varepsilon_{it}$$

Where, $\theta$ is the input price of labor and capital and $\beta$ is the input price of funds. H-statistic is the sum of elasticities of factor input prices. $H = \theta + \beta$

[30] Nbkr.kg. "Provision regarding the determination of dominant position in the banking market." 2014. http://www.nbkr.kg/contout.jsp?item=103&lang=RUS&material=47381 (accessed 31 Mar 2014).

[31] O. De Bandt and E. Philip Davis. "Competition, contestability and market structure in European banking sectors on the eve of EMU." *Journal of Banking & Finance* 24, no. 6 (2000): 1045—1066.

Owing to the fact the Panzar and Rosse model assumes that the market is in the long-run equilibrium we perform long-run equilibrium test and establish the following equation:

$$(1.8) \qquad In(1 + ROA_{it}) = \alpha + \theta \ln(w_{1,it} + w_{2,it}) + \beta \ln(w_{3,it}) + \gamma_k \sum z_k + \delta D + \varepsilon_{it}$$

In the long-run equilibrium, factor input prices should not be correlated with return on assets, therefore H should equal to zero. If factor input prices, negatively correlated with return on assets then the market is in disequilibrium.

We follow Bikker et al (2012) and establish unscaled-revenue equation owing to the fact that controlling for the firm scale overestimates H-statistic and gives invalid results. To proxy the revenue of the bank ($R_{it}$) we use the total revenue of the bank (TR). The price of labor and capital $(w_{1,it} + w_{2,it})$ estimated by the ratio of operating expenses to total assets (OETA). The price of funds ($w_{3,it}$) is measured by the ratio of interest expenses to deposits and other liabilities (IEDL).

Furthermore, we include bank–specific variables which can potentially affect our dependent variable. We include the ratio of non-earning assets to total deposits (NETA) to reflect the asset structure of the bank. The ratio of customer loans to total assets (LOTA) captures the credit risk of the bank. This ratio is expected to be positively correlated to dependent variable because higher risk usually results in more return. To account for liquidity we use the ratio of cash and deposits in NBKR to total deposits (LIQD). The ratio of equity capital to total asset (EQTA) is used as a proxy of capital. The sign of this measure is expected to be negative owing to the fact that less capital should result in more revenue. We, also include the ratio of number of branches to the total of branches in the banking system (BRANCH) to capture the network effect obtained by relatively large number of branches.

All the variables are expressed in natural logarithm form. For more detailed explanation of variables refer to Appendix 1.

Consequently our model takes the following form:

(1.9) $$In(TR) = \alpha + \theta\beta \ln(OETA) + \beta \ln(IEDL) + \gamma_1 \ln(NETA) + \gamma_2 \ln(LOTA) + \gamma_3 \ln(LIQD) + \gamma_4 \ln(EQTA) + \gamma_5 \ln(BRANCH) + \delta D + \varepsilon_{it}$$

To avoid manual calculation of H-statistic and its standard error we follow Gorener and Choi (2013) and reestablish the above mentioned equation in the following way:

(1.10) $$In(TR) = \alpha + \beta_1(\ln(OETA) - \ln(IEDL)) + (\beta_1 + \beta_2)\ln(IEDL) + \gamma_1 \ln(NETA) + \gamma_2 \ln(LOTA) + \gamma_3 \ln(LIQD) + \gamma_4 \ln(EQTA) + \gamma_5 \ln(BRANCH) + \delta D + \varepsilon_{it}$$

In this case the coefficient of IEDL is our H-statistic.

We use several econometric techniques to estimate our Panzar and Rosse model and observe the differences among them. Firstly, we apply pooled OLS which assumes constant intercept and slope regardless of the bank. Secondly, we use LSDV model and introduce bank dummy variables to account for bank specific aspects. Thirdly, we use within effect model which does not require dummy variables to control bank specific factors. Finally, we perform random effect GLS regression. All our models include time dummies and we use robust standard errors to account for heteroskedasticity. Additionally, we conduct specific tests to determine which model is more appropriate for our data.

Bikker et al (2012) raise the concern about possible implicit correction of scale. To avoid this problem they state that there is a need to verify low correlation between explanatory variables and total assets. If correlation of some explanatory variables is high, they suggest taking into unscaled equation only part of the explanatory variable, which is orthogonal to the variable.[32] Therefore, we also run alternative model specifications and replace some explanatory variables with the part of explanatory variable.

[32] J. A.Bikker, Sherrill Shaffer and Laura Spierdijk. "Assessing competition with the Panzar-Rosse model: The role of scale, costs, and equilibrium." *Review of Economics and Statistics* 94, no. 4 (2012): 1025--1044.

# CHAPTER 4

## *4.1 Concentration Measures: Empirical Results*

To get more comprehensive information regarding the concentration level in the commercial bank market of the Kyrgyz Republic we calculated concentration ratio (CR) and Herfindahl-Hirschman Index (HHI) using equation (1.4) and (1.5) respectfully. The CR measure presented by $CR_3$, $CR_5$ and $CR_{10}$ which indicate the market share of 3, 5 and 10 largest banks in the market. (For more detailed information see Appendix 2.) The results presented in the table below.

**Table 5: Concentration measures in the Kyrgyz banking market**

| | **2010** | **2011** | **2012** | **2013** |
|---|---|---|---|---|
| **Total assets** | | | | |
| $CR_3$ | 41,26% | 42,85% | 42,08% | 38,65% |
| $CR_5$ | 59,13% | 59,28% | 59,14% | 55,72% |
| $CR_{10}$ | 81,90% | 82,63% | 81,72% | 81,30% |
| HHI | 0,09 | 0,09 | 0,09 | 0,08 |
| **Customer Loans** | | | | |
| $CR_3$ | 43,82% | 44,87% | 40,49% | 39,30% |
| $CR_5$ | 61,16% | 62,10% | 56,95% | 56,24% |
| $CR_{10}$ | 86,14% | 85,63% | 84,00% | 84,52% |
| HHI | 0,10 | 0,10 | 0,09 | 0,09 |
| **Total Deposits** | | | | |
| $CR_3$ | 48,95% | 45,77% | 46,86% | 43,06% |
| $CR_5$ | 66,31% | 63,35% | 66,47% | 62,79% |
| $CR_{10}$ | 85,91% | 84,36% | 85,18% | 83,67% |
| HHI | 0,11 | 0,10 | 0,11 | 0,10 |

By looking at the table we can see that all three $CR_k$ measures had a stable or increasing trend during the 2010-2011 period. However, in the 2012-2013 period concentration measures declined. One of the key reasons of this decline appears to be the emergence of a new player in a banking market. In 2012 year, one of the largest microfinance company Baitushum, obtained banking license and has become the first microfinance organization in Kyrgyzstan which transferred its status to the

commercial bank. In terms of total assets and customer loans, Baitushum was able to capture significant portion of the market and became the 6th largest commercial bank of Kyrgyzstan. Moreover, several small commercial banks were acquired by foreigners and strengthened their positions both in the credit and deposit markets.

The HHI index is relatively stable in all three markets ranging between 0.09 and 0.11 which indicates that markets are not concentrated and relatively competitive.

As was discussed before, high concentration ratios and entry barriers do not necessarily mean that the markets are uncompetitive. However, the fact that five commercial banks control almost 60% of the market, raise some doubts about sufficient level of competition in the banking market of the Kyrgyz Republic. Therefore, we apply the Panzar and Rosse model which treats the structure of the market as an exogenous factor and allows us to draw a conclusion about the degree of competition regardless of its structure.

### *4.2 Panzar and Rosse Model: Empirical results*

Firstly, we estimated unscaled revenue equation (1.9) using pooled OLS with time dummies. The total revenue (TR) was regressed on input price factors (IETA and OETA) and bank-specific control variables (NETA, LOTA, EQTA, LIQD, and BRANCH). When we estimated the correlation of total assets with explanatory variables, we found that EQTA and BRANCH strongly correlated with total assets variable (-0.73 and 0.62 correspondingly). Therefore, as proposed by (Bikker et al 2012) we adjusted this variable to avoid implicit scale correction. The results of unadjusted and adjusted equations are shown in table 6. In our unadjusted equation three variables appear to be significant. (NETA, EQTA, BRANCH). The negative sign of NETA suggests that the higher the share of non-earning assets the lower the total revenue of the bank and the negative sign of EQTA suggests that higher the equity capital the lower the total revenue of the bank. The positive sign of BRANCH suggests that increasing the number of branches increases the revenue of the bank. However, in adjusted equation results are somewhat different. The variables EQTA, LIQD, BRANCH appear to be significant. The EQTA variable is positive suggesting that increase in equity increases total revenue. LIQD variable has a negative sign and states that the higher the liquidity of the bank the lower the revenue. The sign BRANCH variable is the same as it was in unadjusted equation.

**Table 6: The Panzar and Rosse model: Pooled OLS**

| Variables | Equation1(unadjusted) | Equation 2 (adjusted) |
|---|---|---|
| LnIEDL | 0.209***<br>(4.94) | 0.395***<br>(9.22) |
| LnOETA | -0.654***<br>(-3.76) | -1.319***<br>(-5.59) |
| LnNETA | -0.542***<br>(-2.65) | -0.31616<br>(-0.94) |
| LnLOTA | -0.00838<br>(-0.08) | 0.06312<br>(0.44) |
| LnEQTA | -0.345**<br>(-2.37) | 0.60144**<br>(2.31) |
| LnLIQD | -0.05230<br>(-0.69) | -0.24284**<br>(-2.56) |
| LnBRANCH | 0.802***<br>(10.7) | 0.734***<br>(4.60) |
| Adjusted $R^2$ | 0.857 | 0.6617 |
| F | 67.68 | 38.35 |
| H-statistic | -0.444***<br>(-2.70) | -0.924***<br>(-4.03) |

t-statistics for parameter estimates in parentheses
*** coefficient estimates significant at 1% level
** coefficient estimates significant at 5% level
* coefficient estimates significant at 10% level

Estimates of our specified equations suggest that during the 2010-2013 period the H-statistic was -0.444 and -0.924 correspondingly. As proposed by Bikker et al (2012) we test the following null hypotheses: 1) $H_0$: *H-statistic < 0* 2) $H_0$: *0<H-statistic <1* 3) $H_0$: *H-statistic =1*. We also estimated equation (1.8) to obtain $H^{ROA}$ and tested null hypothesis that $H^{ROA}$=0. Results of the null hypothesis are presented in Table 7.

**Table 7: Hypothesis Testing: Pooled OLS**

| Null Hypothesis | Alternative Hypothesis | Results for unadjusted equation | Results for adjusted equation |
|---|---|---|---|

| | | | |
|---|---|---|---|
| H0: H <0 | H1: H >0 | We cannot reject null hypothesis at the 5 per cent level | We cannot reject null hypothesis at the 5 per cent level |
| H0:0 <H <1 | H1: H<0 or H=1 | We reject the null hypothesis at the 5 per cent level | We reject the null hypothesis at the 5 per cent level |
| H0: H =1 | H1: H <1 | We reject the null hypothesis at the 5 per cent level | We reject the null hypothesis at the 5 per cent level |
| H0: $H^{ROA}$ =0 | H1:$H^{ROA}$<0 | We cannot reject the null hypothesis at the 1 per cent level | We cannot reject the null hypothesis at the 1 per cent level |

Both of our equation specifications give similar results in the hypothesis testing procedure. Interpretation of H-statistic is somewhat difficult owing to the fact that several situations can occur. We largely follow Bikker et al (2012) to interpret our results. The table below summarizes the properties of H-statistics of unscaled revenue equation:

**Table 8: Summary of Properties of the H statistic under alternative cost conditions[33]**

| ***Market Power*** | ***AC Function*** | ***H statistic (unscaled revenue equation)*** |
|---|---|---|
| Long-run competition | U shaped | Rosse and Panzar(1977):H=1 |
| Long-run competition | Flat | Bikker et al (2012):H <0 or 0<H <1 possible |
| Short-run competition | U shaped | Shaffer (1982a, 1983a):H <0 possible<br>Rosse and Panzar (1977): 0<H <1 possible |
| Monopoly | U shaped | Rosse and Panzar (1977):H <0 |
| Monopoly | Flat | Bikker et al (2012):H <0 |
| Oligopoly | U shaped | Rosse and Panzar (1977):H <0 |
| Oligopoly | Flat | Bikker et al (2012):H <0 |
| Monopolistic competition | U shaped | Rosse and Panzar (1977): 0<H<1<br>under conditions, but H <0 possible |

Our analysis suggests that at 5 per cent significance level we cannot reject that H<0.

Moreover, we could not reject that $H^{ROA}$=0 suggesting that the banking market is in equilibrium in the long-run. Therefore, we reject the possibility of short-run equilibrium. Referring to our table above, we cannot reject the possibility of monopoly and oligopoly under both types of average cost. However, when we have

[33] J. A.Bikker, Sherrill Shaffer and Laura Spierdijk. "Assessing competition with the Panzar-Rosse model: The role of scale, costs, and equilibrium." *Review of Economics and Statistics* 94, no. 4 (2012): 1025—1044.

U-shaped average cost we also cannot reject the monopolistic competition. If banks face flat average cost, observing H<0 can also be possible in the long-run competition. So, as proposed by Bikker et al (2012) the negative value of H-statistic cannot adequately discriminate between perfect and imperfect competition.

Our next econometric technique is the LSDV model, which introduce bank dummy variables to account for bank fixed effects. We regress our dependent variable to our factor input prices, control variables times dummies and newly introduced bank dummies. We run LSDV for both of our equation specifications. Results are presented in Table 9.

**Table 9: The Panzar and Rosse Model: LSDV Model**

| **Variables** | **Equation1(unadjusted)** | **Equation 2 (adjusted)** |
|---|---|---|
| LnIEDL | 0.202***<br>(5.10) | 0.189***<br>(4.8) |
| LnOETA | 0.157<br>(0.96) | 0.297**<br>(2.3) |
| LnNETA | -0.382*<br>(-1.82) | 0.039<br>(0.23) |
| LnLOTA | -0.091<br>(-1.24) | 0.0068<br>(0.1) |
| LnEQTA | -0.7017**<br>(-2.52) | 0.284<br>(1.08) |
| LnLIQD | -0.034<br>(-0.43) | -0.073<br>(-1.16) |
| LnBRANCH | 0.501<br>(1.40) | -1.445***<br>(-4.40) |
| Adjusted $R^2$ | 0.978 | 0.981 |
| F | 555.87 | 449.93 |
| H-statistic | 0.360**<br>(2.31) | 0.486***<br>(3.90) |

t-statistics for parameter estimates in parentheses
*** coefficient estimates significant at 1% level
** coefficient estimates significant at 5% level
* coefficient estimates significant at 10% level

Even though our estimated equations give somewhat different coefficients and t-statistics regarding the control variables, both of them give similar value of H-statistic (significantly positive). As was shown previously, we test several null hypotheses and results are shown in Table 10

**Table 10: Hypothesis Testing: LSDV Model**

| **Null Hypothesis** | **Alternative Hypothesis** | **Results for unadjusted equation** | **Results for adjusted equation** |
|---|---|---|---|
| H0: $H \leq 0$ | H1: $H > 0$ | We reject null hypothesis at the 5 per cent level | We reject null hypothesis at the 5 per cent level |
| H0: $0 < H < 1$ | H1: $H \leq 0$ or $H = 1$ | We cannot reject the null hypothesis at the 5 per cent level | We cannot reject the null hypothesis at the 5 per cent level |
| H0: $H = 1$ | H1: $H < 1$ | We reject the null hypothesis at the 5 per cent level | We reject the null hypothesis at the 5 per cent level |
| H0: $H^{ROA} = 0$ | H1: $H^{ROA} < 0$ | We cannot reject the null hypothesis at the 1 per cent level | We cannot reject the null hypothesis at the 1 per cent level |

Results of the hypothesis testing suggest that we can reject the null hypothesis that $H<0$. Therefore, we can reject the possibility of monopoly and oligopoly. We cannot reject the hypothesis that H0: $0<H<1$ and this suggests that our banking market is in the monopolistic competition if average cost is U-shaped and possibly in the long-run competitive equilibrium if we have constant average cost.

The within effect model, which uses group differences to control for fixed effects, gives the same coefficient estimates and SSE as our LSDV model. However, the within effect model reports incorrect coefficient standard errors and measures of goodness of fit which need to be adjusted. Generally, the LSDV model is preferable owing to the fact that it gives correct statistics straightway. Regarding the hypothesis testing results, they are similar to LSDV model, stating that our H statistic is between zero and one. The estimation of the within effect model is given in the Appendix.

The next econometric model, which is random effect GLS regression, examines how bank specific features effect on the error variance. We run the model on both our equation specifications. The results are presented in Table 11.

**Table 11: The Panzar and Rosse Model: Random Effect GLS Regression**

| Variables | Equation 1(unadjusted) | Equation 2 (adjusted) |
|---|---|---|
| LnIEDL | 0.205***<br>(3.36) | 0.253***<br>(4.08) |
| LnOETA | -0.05<br>(-0.26) | 0.002<br>(0.02) |
| LnNETA | -0.466**<br>(-2.32) | -0.114<br>(-0.47) |
| LnLOTA | -0.061<br>(-0.64) | -0.07<br>(-0.83) |
| LnEQTA | -0.693***<br>(-4.38) | 0.37<br>(1.31) |
| LnLIQD | -0.024<br>(-0.29) | -0.14<br>(-1.44) |
| LnBRANCH | 0.65***<br>(7.13) | -0.321<br>(-1.14) |
| $R^2$ overall | 0.8109 | 0.33 |
| Chi2 | 661.98 | 520.99 |
| H-statistic | 0.1543<br>(0.87) | 0.256<br>(1.60) |

t-statistics for parameter estimates in parentheses

*** coefficient estimates significant at 1% level

** coefficient estimates significant at 5% level

* coefficient estimates significant at 10% level

We observe positive H-statistic in both of our equation specifications. However, there is a wide difference between coefficients of control variables. The next step is to test our null hypothesis to infer the level of competition in the banking market. We present the results in table 12.

**Table 12: Hypothesis Testing: Random Effect GLS Regression**

| Null Hypothesis | Alternative Hypothesis | Results for unadjusted equation | Results for adjusted equation |
|---|---|---|---|
| H0: $H \leq 0$ | H1: $H > 0$ | We cannot reject null hypothesis at the 5 per cent level | We cannot reject null hypothesis at the 5 per cent level |
| H0:$0 < H < 1$ | H1: $H \leq 0$ or $H=1$ | We reject the null hypothesis at the 5 per cent level | We reject the null hypothesis at the 5 per cent level |
| H0: $H =1$ | H1: $H <1$ | We reject the null hypothesis at the 5 per cent level | We reject the null hypothesis at the 5 per cent level |
| H0: $H^{ROA} =0$ | H1:$H^{ROA}<0$ | We cannot reject the null hypothesis at the 1 per cent level | We cannot reject the null hypothesis at the 1 per cent level |

Similar to Pooled OLS, in random effect GLS Model we failed to reject that H0: H<0 suggesting that the banking market of the Kyrgyz Republic is either monopoly, oligopoly, monopolistic competition or in the long-run competitive equilibrium, depending on the type of average cost.

### *4.3 Panzar and Rosse Model: Choosing the Right Model*

Our previous estimations suggest that, depending on which model we choose the results of H-statistic change significantly. Pooled OLS and Random effect GLS model reject that H0: 0<H<1 and could not reject that H0: H<0, while fixed effect models (LSDV and within estimation) reject that H0: H<0, and could not reject that H0: 0<H<1. Depending on the results of H-statistic we draw conclusions regarding the level of competition. Table 11 summarizes the interpretation of competition in the banking market depending on the chosen model.

**Table 13: Results of Econometric Models: Summary**

| | **Pooled OLS** | **Random effect GLS estimation** | **LSDV Model and Within Estimation** |
|---|---|---|---|
| H-statistic | H<0 | H<0 | 0<H<1 |
| Market Power | • Monopoly<br>• Oligopoly<br>• Monopolistic competition<br>• Long-run competitive equilibrium | • Monopoly<br>• Oligopoly<br>• Monopolistic competition<br>• Long-run competitive equilibrium | • Monopolistic competition<br>• Long-run competitive equilibrium |

Owing to the fact, that results are dissimilar we perform several tests to determine the appropriate model.

To assess whether our data have significant fixed time and group effects we use F-test. The null hypothesis of F-test is that our bank and time dummy variables are equal to zero. Failure to reject the null hypothesis suggests that there is no significant fixed group and time effects and Pooled OLS is preferable. In our case, F-test is equal to 12.66, which allows to reject the null hypothesis at 1 per cent significant level and accept alternative hypothesis of significant time and group effects. Therefore, we conclude that the fixed effect model is more appropriate compared to pooled OLS.

To determine if there are significant random effects we perform Breusch-Pagan Lagrange multiplier (LM) test. The null hypothesis of LM test is that variances across the banks are zero. In our case, chi squared of 47.89 allows us to reject the null hypothesis in favor that there is a significant random effect in our data. Consequently, random effect model is more suitable than pooled OLS.

Owing to the fact that both fixed and random effect models were accepted, we perform a test of overidentifying restrictions. Compared to the traditional Hausman test, this test allows comparing models which are heteroskedastic and contain robust errors.

The null hypothesis of the test is that the random effect model is efficient. Therefore, rejection of the null hypothesis states that we should use a fixed effect model. In our case, the Sargan-Hansen statistic is 26.657 that allows to reject the null hypothesis in favor that a fixed model is more suitable than the random effect model. The above

mentioned results are for unadjusted type of equations. However, the test results of the adjusted equations give similar conclusions. (See Appendix 4.)

To sum up, as a result of several tests, LSDV and within effect models are our preferred models. Therefore, the results of these models, constitute our final results.

As was mentioned above, when we employ these models we obtain significantly positive H-statistic for both of our equation specifications (0.36 and 0.486 correspondingly). We strongly reject the possibility of $H<0$, therefore it is safe to conclude that the banking market of Kyrgyzstan is neither monopoly nor oligopoly. However, the value of H-statistic between zero and one is consistent with both monopolistic competition and long-run competitive equilibrium. To differentiate between these two types of competition we need to identify the type of average cost which prevails in the banking market. Due to the limited information available, we could not infer any conclusion regarding the structure of average costs in the banking market. However, we can state that if banks face U-shaped average cost then the banking market is in the monopolistic competition and possibly in the long-run competitive equilibrium if they have constant average cost.

# CONCLUSION

This study investigated competitive conditions of the Kyrgyz banking sector using yearly financial reports of commercial banks from 2010 to 2013. To get information about the concentration level in a banking market of Kyrgyzstan we used the concentration ratio (CR) and Herfindahl-Hirschman Index (HHI). Our calculations suggest that five banks control on average 55-60% of the lending and deposit market. The concentration of these markets in the hands of a few players, raises concern about the adequacy of competition in the banking industry. However, theory suggests that high concentration ratios do not necessarily imply that markets are not competitive. Therefore, we applied the Panzar and Rosse model which takes the market structure as endogenous factor.

Using the financial reports we constructed unbalanced panel data with 86 observations and applied several panel data estimation models. After testing our models, we decided that the results of the LSDV and within effect model to be our final results. According to our estimations, the H-statistic for our both equation specifications is 0.36 and 0486, which are significantly different from zero and unity. Therefore, we conclude that the banking market of Kyrgyzstan is monopolistically competitive if average cost is U-shaped and possibly perfectly competitive if we have flat average cost. Even though, we could not identify the type of average cost, which prevails in the banking market, the rejection of the null hypothesis that $H<0$ enables us to strongly reject the possibility of monopoly and oligopoly for both types of costs. Therefore, the concentration of the market share in the hands of a few banks, does not imply significant market power in the banking market of the Kyrgyz Republic. The only possible type of imperfect competition is monopolistic competition which is close to perfect competition rather than to monopoly. Even though, monopolistic competition carries nearly all features of perfect competition, it is subject to some additional caveats. First of all, firms under the monopolistic competition have excess capacity. Moreover, from the welfare perspective they are less efficient than perfect competition. However, it is worth mentioning that monopolistic competition also creates some positive externality which is the provision of great number of heterogeneous products.

As an extension of this paper, it may be possible to assess the relationship between overall stability of the Kyrgyz banking system and the competitive banking market.

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**APPENDIX 1**

**Table 1.1: Definitions of Variables used in the estimation of reduced revenue equation**

| Variable Name | Calculation | Explanation |
|---|---|---|
| TR | $Interest\ revenues + Comission\ revenues$ | We estimated total revenues as the sum of the two dominant sources of revenue of then Kyrgyz banks |
| OETA | $\frac{Operating\ expenses}{Total\ Assets}$ | This ratio proxies the price of labor and capital |
| IEDL | $\frac{Interest\ expenses}{Deposits + other\ liabilites}$ | The ratio indicates the price of funds. |
| NETA | $\frac{Cash\ and\ Fixed\ assets}{Total\ assets}$ | The ratio controls for the asset structure |
| LOTA | $\frac{Cusomer\ Loans}{Total\ Assets}$ | The ratio takes into account the risk of the bank |
| LIQD | $\frac{Cash\ and\ deposits\ in\ NBKR}{Total\ deposits}$ | The ratio takes into account liquidity of the bank |
| EQTA | $\frac{Total\ equity}{Total\ assets}$ | Leverage ratio |
| BRANCH | $\frac{Number\ of\ branch\ in\ bank}{Total\ number\ of\ branch\ of\ the\ banks}$ | The ratio takes into account network effect achieved by bank |
| ROA | *(1+ROA)* | Return on assets. We add 1 because some measures are negative. |

**APPENDIX 2**

**TABLE 2.1: Concentration measures of the Kyrgyz banking system (Total assets)**

| Ck | 2010 | 2011 | 2012 | 2013 |
|---|---|---|---|---|
| **C1** | 15,29% | 15,33% | 15,37% | 14,69% |
| **C2** | 29,41% | 30,63% | 29,16% | 27,85% |
| **C3** | 41,26% | 42,83% | 42,08% | 38,69% |
| **C4** | 52,25% | 52,96% | 53,35% | 48,85% |
| **C5** | 59,13% | 59,24% | 59,14% | 55,78% |
| **C6** | 65,26% | 65,18% | 64,89% | 62,48% |
| **C7** | 71,07% | 70,73% | 70,07% | 68,92% |
| **C8** | 75,80% | 75,75% | 74,13% | 75,07% |
| **C9** | 79,02% | 79,39% | 78,15% | 78,43% |
| **C10** | 81,90% | 82,58% | 81,72% | 81,28% |
| **C11** | 84,69% | 85,32% | 84,39% | 84,09% |
| **C12** | 87,45% | 87,38% | 86,99% | 86,66% |
| **C13** | 89,72% | 89,43% | 89,01% | 89,04% |
| **C14** | 91,75% | 91,46% | 90,92% | 91,40% |
| **C15** | 93,53% | 93,34% | 92,56% | 93,03% |
| **C16** | 95,10% | 95,14% | 94,15% | 94,60% |
| **C17** | 96,63% | 96,73% | 95,62% | 96,01% |
| **C18** | 97,86% | 98,06% | 97,00% | 97,40% |
| **C19** | 99,09% | 98,91% | 98,36% | 98,55% |
| **C20** | 99,82% | 99,61% | 98,98% | 99,03% |
| **C21** | 100,00% | 99,82% | 99,53% | 99,48% |
| **C22** | 100,00% | 100,00% | 99,78% | 99,86% |
| **C23** | 100,00% | 100,00% | 100,00% | 100,00% |

**TABLE 2.2: Concentration measures of the Kyrgyz banking system (Total loans)**

| Ck | 2010 | 2011 | 2012 | 2013 |
|---|---|---|---|---|
| **C1** | 20,26% | 21,02% | 16,62% | 17,15% |
| **C2** | 32,77% | 33,92% | 30,38% | 30,61% |
| **C3** | 43,81% | 44,60% | 40,49% | 39,32% |
| **C4** | 53,80% | 54,57% | 49,12% | 47,98% |
| **C5** | 61,15% | 61,72% | 56,95% | 56,28% |
| **C6** | 68,35% | 68,80% | 64,26% | 63,93% |
| **C7** | 74,22% | 74,86% | 71,56% | 71,34% |
| **C8** | 79,56% | 78,62% | 76,44% | 77,24% |
| **C9** | 83,35% | 82,08% | 80,31% | 81,27% |
| **C10** | 86,13% | 85,51% | 84,00% | 84,57% |
| **C11** | 88,34% | 88,36% | 87,13% | 87,60% |
| **C12** | 90,26% | 90,66% | 89,80% | 89,70% |
| **C13** | 92,16% | 92,54% | 91,55% | 91,72% |
| **C14** | 93,79% | 94,01% | 93,28% | 93,54% |
| **C15** | 95,27% | 95,43% | 94,91% | 95,34% |
| **C16** | 96,43% | 96,84% | 96,20% | 96,92% |
| **C17** | 97,56% | 97,66% | 97,48% | 98,22% |
| **C18** | 98,51% | 98,36% | 98,12% | 98,67% |
| **C19** | 99,40% | 98,98% | 98,71% | 98,96% |
| **C20** | 99,78% | 99,49% | 99,28% | 99,24% |
| **C21** | 100,00% | 99,80% | 99,65% | 99,51% |
| **C22** | 100,00% | 100,00% | 100,00% | 99,77% |
| **C23** | 100,00% | 100,00% | 100,00% | 100,00% |

**TABLE 2.2: Concentration measures of the Kyrgyz banking system (Total deposits)**

| Ck | 2010 | 2011 | 2012 | 2013 |
|---|---|---|---|---|
| **C1** | 17,37% | 19,14% | 16,08% | 16,53% |
| **C2** | 33,29% | 32,43% | 31,30% | 30,26% |
| **C3** | 48,91% | 45,70% | 46,50% | 42,66% |
| **C4** | 58,74% | 56,66% | 60,44% | 54,97% |
| **C5** | 66,26% | 63,24% | 66,53% | 62,95% |
| **C6** | 71,76% | 69,78% | 71,36% | 69,46% |
| **C7** | 76,08% | 74,24% | 75,87% | 74,20% |
| **C8** | 79,70% | 78,63% | 79,36% | 77,64% |
| **C9** | 82,84% | 81,54% | 82,57% | 80,85% |
| **C10** | 85,85% | 84,21% | 85,10% | 83,64% |
| **C11** | 88,84% | 86,76% | 87,41% | 86,40% |
| **C12** | 90,92% | 88,98% | 89,69% | 89,12% |
| **C13** | 92,58% | 91,11% | 91,61% | 91,51% |
| **C14** | 94,17% | 93,11% | 93,38% | 93,43% |
| **C15** | 95,61% | 94,85% | 95,01% | 95,22% |
| **C16** | 97,03% | 96,54% | 96,48% | 96,73% |
| **C17** | 98,10% | 97,79% | 97,91% | 98,01% |
| **C18** | 98,75% | 99,03% | 99,08% | 98,79% |
| **C19** | 99,39% | 99,89% | 99,74% | 99,30% |
| **C20** | 99,97% | 99,96% | 99,90% | 99,78% |
| **C21** | 100,00% | 99,99% | 99,97% | 99,97% |
| **C22** | 100,00% | 100,00% | 100,00% | 100,00% |
| **C23** | 100,00% | 100,00% | 100,00% | 100,00% |

## APPENDIX 3

### Table 3.1: The Panzar and Rosse Model: Within effect estimation

| Variables | Equation1(unadjusted) | Equation 2 (adjusted) |
|---|---|---|
| LnIEDL | 0.202***<br>(3.29) | 0.189***<br>(3.16) |
| LnOETA | 0.157<br>(0.93) | 0.297**<br>(2.24) |
| LnNETA | -0.382*<br>(-1.59) | 0.039<br>(0.23) |
| LnLOTA | -0.091<br>(-1.19) | 0.0068<br>(0.1) |
| LnEQTA | -0.7017***<br>(-4.15) | 0.284<br>(1.11) |
| LnLIQD | -0.034<br>(-0.40) | -0.073<br>(-0.98) |
| LnBRANCH | 0.501<br>(1.19) | -1.445***<br>(-4.33) |
| $R^2$ within | 0.77 | 0.81 |
| F | 67.60 | 36.31 |
| H-statistic | 0.360**<br>(2.36) | 0.486***<br>(4.32) |

t-statistics for parameter estimates in parentheses

*** coefficient estimates significant at 1% level

** coefficient estimates significant at 5% level

* coefficient estimates significant at 10% level

## APPENDIX 4

**Table 4.1: Test for group and time effects (F-test)**

| Null Hypothesis | t-statistic | P-value |
|---|---|---|
| Bank and time dummies equal to zero | 12.66 | 0.0000 |
| Bank and time dummies equal to zero (adjusted eq) | 122.64 | 0.0000 |

The null hypothesis that bank and time dummies are equal to zero can be strongly rejected at 1% significance level.

**Table 4.2: Test for random effects (Breusch-Pagan Lagrange multiplier (LM) test)**

| Null Hypothesis | Chi square-statistics | P-value |
|---|---|---|
| Var(u)=0 | 47.89 | 0.0000 |
| Var(u)=0 (adjusted eq) | 58.67 | 0.0000 |

The null hypothesis that var(u) is equal to zero can be strongly rejected at 1% significance level.

**Table 4.3: Tests of overidentifying restrictions**

| Null Hypothesis | Chi square-statistics | P-value |
|---|---|---|
| Random effect is consistent | 26.657 | 0.0016 |
| Random effect is consistent (adjusted eq) | 72.464 | 0.0000 |

The null hypothesis that random effect is consistent can be strongly rejected at 1% significance level.