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Measuring market power in the Mongolian banking sector

Abstract

This paper measures market power in the Mongolian banking sector using bank-level panel data for commercial banks over the period of 1999-2006. The authors show that both the monopoly hypothesis and the perfect competition hypothesis are rejected and that the Mongolian banking sector is instead characterized by monopolistic competition. The results thus show that the Mongolian banking sector is more competitive than market concentration measures may suggest. The authors infer that privatization and the introduction of foreign ownership in the market contributed to the result.

Keywords: Mongolian banking sector, market power, Panzar-Rosse model.

JEL Classification: D40, G24, L13.

Introduction

The transition of Mongolia from a centrally planned economy, which lasted for more than six decades, to a market economy has brought dramatic changes to the Asian nation, particularly in the banking and financial sectors. Until the creation of a two-tiered banking system in 1991, which comprises a central bank – the Bank of Mongolia (BOM) – and a number of private commercial banks, competition in the banking and financial sectors had never existed in Mongolia. Prior to 1991, the single state bank conducted monetary policy and provided a limited range of financial services, focusing solely on the public sector. Because of the negligible rate of growth and development in the banking sector, Mongolian households and enterprises had little access to efficient and qualified financial services and external funding, which was possibly hampering overall economic growth.

It has been more than a decade since the creation of the two-tiered banking system in Mongolia and, as of the end of 2006, 16 banks, 14 of which are under fully private ownership, are providing banking services to customers through their 832 subsidiaries across the country (BOM, 2006). Of the 14 privately owned banks, six have attracted some degree of foreign ownership, which indicates that the Mongolian banking sector has already begun to appeal to foreign investors' interests. As banks have expanded their operations and established new branches, especially in provincial areas, competition in the banking sector in Mongolia has become strong.

Competitive financial and banking sectors ensure that banks are effective forces for financial intermediation, directing savings into investments and thereby promoting stronger economic growth. Preliminary studies, both theoretical and empirical, suggest that having a competitive banking sector is crucial to an economy for a number of reasons, among which are: (a) efficient bank management (Berger & Hannan, 1998); (b) company access to external funding (Beck

et al., 2004); (c) financial system stability (Allen & Gale, 2004); (d) economic growth (Cetorelli & Gamberra, 2001; Claessens & Leaven, 2005); and (e) efficiency in financial services, the quality of financial products, and the extent of innovation in the sector (Claessens & Laeven, 2004).

Many empirical studies investigate the measurement of banking competition (e.g., Shaffer, 1989, 1993; Nathan & Neave, 1989; Molyneux et al., 1994, 1996; Suominen, 1994; Bikker & Groeneveld, 2000; De Bandt & Davis, 2000; Gelos & Roldos, 2002; Bikker & Haff, 2002; Levi Yeyati & Micco, 2003; and Claessens & Leaven, 2004). Most of these studies, however, study the banking sectors of developed economies such as those of North America, Europe, and the OECD, with only a few investigating economies in Asia, Latin America, and Africa. This suggests that banking competition in developing countries with transition economies such as Mongolia has been largely neglected.

This paper is an attempt to fill that gap in the literature, investigating competitive conditions and measuring the intensity of competition in the Mongolian banking sector, by applying the Panzar-Rosse (P-R) approach (Panzar & Rosse, 1987). The approach is applied to the loan market comprising all Mongolian commercial banks by using bank-level panel data for the period of 1999 through 2006.

We find that both the monopoly hypothesis and the perfect competition hypothesis are rejected in the empirical analysis. And we infer from our analysis that the Mongolian banking system is characterized by monopolistic competition. Our results suggest that a recent increase in market concentration under the oligopolistic market structure may not pose an anti-trust concern. We infer also that as privatization and foreign participation in the Mongolian banking sector increase, so will potential market competitiveness. Therefore, openness to well-established foreign banks with a well planned entry policy and vigilant supervision of both domestic and foreign banks are required to enhance the overall efficiency of the Mongolian banking sector.

The remainder of this paper is organized as follows. Section 1 provides an overview of the Mongolian banking sector, focusing on the main structural characteristics and other important features. Section 2 reviews the literature on the intensity of banking competition. Section 3 presents model specifications and the data used in the empirical study. Section 4 discusses the results of the regression analyses. The final section draws conclusions and offers further policy implications.

1. Overview of the Mongolian banking industry

1.1. Structure of the Mongolian banking sector.

1.1.1. The structural characteristics of the Mongolian banking system. The establishment of a two-tiered banking system in Mongolia has played an essential role in its transition from a planned economy to a market economy. Until the new Banking Law of Mongolia was passed in 1991, initiating the establishment of the two-tiered system, Mongolia had had a pure monobank system. As of 1999, a total of 12 commercial banks were operating in the banking system, providing a limited range of financial services to customers through their 421 branches. The Mongolian banking system as a whole was highly concentrated and some banks were near-monopolies in their areas of specialization (BOM report, 1999). The commercial banks at that time were specialized mostly in providing services for retail clients and some small enterprises. Very few focused on financing enterprises or specialized in foreign currency operations.

During the 1990s, the Mongolian banking system as a whole was neither stable nor functioning well. This was most likely due to unfavorable conditions in the economic environment during the transition period, such as hyperinflation and a weak financial sector regulatory framework. Moreover, inefficient loan policies, poor bank management, and a lack of knowledge and practical experience on the part of banks that were learning how to work in the new system forced many banks into bankruptcy. According to BOM data, seven liquidated banks were excluded from the banking system during this period. This was one among several factors that might have contributed to the financial sector crisis in Mongolia over the period of 1994-1999. Since the Mongolian financial sector consists mostly of banking firms, the crisis during this period was also regarded more narrowly as a banking crisis. Many causes of the Mongolian banking sector crisis have been proposed, in addition to the abovementioned unfavorable economic conditions. However, excessive lending to acquaintances or to loss-making enterprises without proper assessment of credit worthiness, inadequate legal enforcement of loan contract rights, and government policies that

require banks to lend to certain privileged sectors and enterprises are among the major factors to which the banking crisis in Mongolia has been attributed. This banking crisis and the poor performances of banks generally have thus contributed to a growing public distrust of Mongolian banks.

The Mongolian banking sector is not very diverse. As of the end of 2005, 17 commercial banks were operating through their 732 subsidiaries across the country. Among them, one is state-owned, two have minor state participation, and the remaining 14 banks are under fully private ownership. Of the 14 privately owned banks, six involve some degree of foreign equity ownership. Table 1 (see Appendix) shows that the top seven commercial banks account for 61.9 percent of total assets in the banking sector. As for loans outstanding and deposits, again the top four banks account for 59.6 percent and 65.4 percent, respectively. This suggests that these four banks provide the majority of banking services to customers across the country. As a result of a policy initiative aimed at promoting local banking activities, banks have been encouraged to establish branches in rural areas. According to BOM data, however, only one bank (Bank 3) is now dominant in rural markets, accounting for over 50 percent of bank branches in the outlying regions.

As shown in Table 2 (see Appendix), the main indicators of banking sector development have gradually risen since 1996. The ratio of money supply to GDP, which represents the development status of the banking system, was 19.9 percent in 1996, increasing annually by an average of two to six percentage points and reaching 47.5 percent in 2003 (BOM report, 2003). The enhancement of central bank supervision and improved overall stability in the financial sector has contributed to banking sector development. Due to this positive trend in the banking system, the total assets-to-GDP ratio has tripled since 2002, reaching 60.6 percent in 2003, which resulted from a dramatic increase in deposits, current accounts, and capital in the banking system. The ratio of currency held outside of banks to GDP has fallen every year since 2001, which indicates that public confidence in the banking system has grown significantly. In addition, banks' total loans have risen annually more than ten times, from 64.8 billion in 1996 to 1223.3 billion in 2006. Furthermore, deposits of households, companies, and other institutions have tripled since 1996, again an indication of strong restoration of public confidence in the banking system.

In order to attract more customers, banks have been lowering their loan rates and broadening the scope of the services they provide, such as Internet and telephone banking, and trying to increase their revenues through fees and commissions from providing these services. Table 2 shows that loan rates are

less than one-fourth what they were in 1996, decreasing from 87.9 percent in 1996 to 20 percent within the last ten years. This indicates that customers have been able to access external funds at reasonable rates compared with previous years.

1.2. The regulatory framework. Followed by the banking crisis of 1994-1999, it became clear that regulatory changes were needed to achieve a stable banking system in Mongolia. The actions taken to overcome the banking crisis were focused on enhancing the legal and regulatory framework, ensuring stability in the financial sector, and improving infrastructure. In 2001, significant changes in the regulation of loans and loan collateral were made in Mongolian Civil Law. This change had the positive effect of obliging debtors to repay loans and upgrading the legal environment of the banking system. In addition to this, other measures have been taken by the BOM, including increasing the strength of supervisory authority, enacting new rules and regulations, introducing new prudential ratios, renewing the accounting system, providing various forms of training to new recruits, establishing alternative mechanisms of internal auditing, and creating a Loan Database System. As a result of these operations, the banking system stabilized towards the beginning of 2000 and the money supply held outside the banking system has diminished as public confidence has improved and individuals and businesses have begun to turn to Mongolian banks for their financial needs.

2. Market concentration

Prior to determining the overall market concentration of the Mongolian banking system, we carefully examine trends in the loan and deposit markets.

2.1. Loan market trend. According to BOM data, total loans in the banking system have increased dramatically due to the overall extension of the banks' operations. Both the absolute amount of total loans and the ratio of total loans to GDP have declined since 1993-1995, reaching minimum levels in the 1995-1999 period (Figure 1). These figures have, however, been increasing since the end of the banking system crisis in 1999. The following factors explain why these indicators have increased. First, the banking system generally has been stabilizing since 2000 and banks have gradually been regaining the trust of their customers. Also, banking operations have been intensifying. Finally, decreasing inflation and deposit rates have led to a decline in interest rates, while loan repayment has improved significantly.

2.2. Deposit market trend. It can be seen from Figure 1 that savings by volume has been growing rapidly in recent years. In particular, the deposits-to-

GDP ratio, averaging 7.9 percent in the period of 1992-1999, began to increase in 2000 and reached 26.7 percent by 2003. This increase is explained by many factors, but it can be attributed mainly to the restoration of customer confidence in banks following the banking crisis. Moreover, banks are intensifying their activities and have become generally healthier while the overall economic situation has been stabilizing. The ratio of deposits to GDP reached 28.6 percent by the end of 2004, which indicates that Mongolian banks have tended to meet the average ratio of other emerging markets and developing countries¹.

According to data taken from the BOM, the share of togrog deposits accounted for over 60 percent of total savings from 2000-2004; however, togrog deposits increased in 2004 by only 25.2 percent as compared with 75-percent growth in deposits denominated in foreign currency. A higher inflation rate and exchange rate instability throughout 2004 were the main reasons for such a result.

The BOM data also show that the loan rate has been decreasing in recent years even though the deposit rate has not been falling significantly. Table 2 indicates that differences in deposit rates reported by various banks are shrinking. According to market trends in loans and deposits in the Mongolian banking system, it can be inferred that banks are not willing to decrease refinancing sources. When there is strong competition to raise funds, banks are willing to compete on their rates without lowering the deposit rate. In addition, banks are offering not only higher deposit rates but also are introducing new financial products and offering a mix of incentives to increase their funding sources.

According to Figure 2² the concentration ratio in the loan market has been decreasing since 1999 and it exhibits a tendency to decline further. The four largest banks account for a 55-percent market share, whereas the percentage increases to 65 to 80 percent when six to eight large banks are taken into account. Although the concentration ratio has been falling gradually, there is a significant amount of concentration among a few large banks in the Mongolian banking system.

As for the deposit market, the concentration ratio had been tending to decline, but since 2003 the ratio has shown the opposite trend. When the top six to eight banks have been taken into consider-

¹ The average ratio of savings to GDP of other emerging markets and developing countries increased from 24.6 to 29.9 percent between 1998 and 2003 (Annual Report 2006, BOM).

² *CR-N* is the *N*-bank concentration ratio, *HHI* is the Herfindahl-Hirschman index, *HHCI* is the Hirschman-Herfindahl Concentration index, and *HHA* is the Hirschman-Herfindahl-Agiobenebo index.

ation, the ratio of market share has increased from 60 to 80 percent, which again indicates that the concentration ratio among these few banks has been increasing considerably. Such an increase in market concentration may facilitate the exercise of collusive market power on the part of the banks. If such concentration does not lead to a detectable pricing effect, however, the potential danger of a conflict between market concentration and market competitiveness may be less serious than some observers believe.

3. Literature review

Financial sector competition, specifically banking sector competition, has drawn the attention of policymakers and researchers for many years due to its potential economic consequences. A number of papers have analyzed the economic significance of banking sector competition. Among these are Berger and Hannan (1998) on the relationship between market concentration and cost efficiency in the U.S.; Beck, Demirguc-Kent, and Maksimovic (2004) on market concentration and financing barriers in 74 developed and developing countries; Allen and Gale (2004) on the relationship between competition and financial stability; Cetorelli and Gamberra (2001) on the impact of bank concentration on industrial growth.

Intensity of competition has drawn much attention in the theoretical and empirical banking literature. Generally, two types of empirical approaches have been applied to evaluate market competition in the banking sector, the P-R approach (1987) and the New Empirical Industrial Organization (NEIO) approach (e.g., Bresnahan, 1982, 1989).

Only a few studies have applied the NEIO model. They include Shaffer (1989, 1993) on U.S. loan markets and the Canadian banking industry, Suominen (1994) on the Finnish banking deposit and loan market, Swank (1995) on the Dutch mortgage and savings deposit market, and Gruben and McComb (2003) on the Mexican banking sector. One problem with the NEIO approach is, however, that the model assumes that banks produce homogeneous products and that market interests are the same across all banks.

In fact the P-R model has been used much more extensively in the literature than the NEIO approach. One of the first applications of the P-R approach to the banking sector was a series of cross-sectional studies conducted by Shaffer (1981a, 1981b, 1982) for a sample of unit banks in New York, using data from 1979. Nathan and Neave (1989) examined the Canadian financial services industry (banks, trusts, and mortgage companies) using data from 1982-1984. Molyneux, Thornton and Lloyd-Williams (1991, 1996) found evidence of the existence of a monopoly in a sample of 72 Japanese commercial banks from 1986-

1988. Vesala (1995) found monopolistic competition in the Finnish banking system, excepting the years 1989 and 1990, from 1985-1992. Coccoresse (1998) found that the Italian banking market was under monopolistic competition from 1987-1989. De Bandt and Davis (2000) investigated banking markets in Germany, Italy, and France from 1992-1996. Focusing on groups of large and small banks, they found monopolistic competition among large banks in all three countries. Bikker and Groeneveld (2000) applied the P-R approach to all 15 European Union countries and found monopolistic competition without differentiating sizes. Bikker and Haaf (2002) also applied the same model to 23 industrialized countries for the period of 1989-1998. They provided strong evidence that the banking markets in these countries were also characterized by monopolistic competition.

We find that a large number of studies have examined the degree of competition in the banking sector in mature markets. Research on developing countries with emerging market economies is, however, very rare. An exception is a study by Gelos and Roldos (2002) on 13 developing countries from Asia, Latin America, and Central Europe. To the best of our knowledge, the present research is the first attempt to assess competitive conditions in the Mongolian banking sector.

4. Model specifications and data

4.1. Model. Following Rosse and Panzar (1987), we consider N -bank industry in which each firm (or bank) i chooses its output q_i to maximize its profits, Π_i defined as total revenue TR_i minus total costs TC_i ,

$$\max_{q_i} \Pi_i = TR_i(q_i, N, DS_i) - TC_i(q_i, X_i, CS_i), \quad (1)$$

where subscript i denotes bank i ; q_i is the output; N is the number of banks and it is assumed that it is endogenously determined; DS_i is a n -dimensional vector of demand-shifting exogenous variables (ds_{ij}); X_i is a k -dimensional vector of prices of factors (x_{ij}); and CS_i is a m -dimensional vector of cost-shifting exogenous variables (cs_{ij}). The first order condition for maximizing the profit of bank i yields:

$$\frac{\partial \Pi_i}{\partial q_i} = MR_i(q_i, N, D, S) - MC_i(q_i, X_i, CS_i) = 0, \quad (2)$$

where MR_i refers to marginal revenues and MC_i to marginal costs. From equation (2), profit-maximizing output and the reduced form of the revenue function are defined as follows:

$$q_i^* = q_i^*(DS_i, X_i, CS_i), \quad (3)$$

$$TR_i^* = TR_i^*(DS_i, X_i, CS_i), \quad (4)$$

where superscript * denotes equilibrium values. Panzar and Rosse (1987) define H -statistic, the sum

of the elasticities of the reduced-form revenues with respect to factor prices:

$$H = \sum_j^k \frac{\partial TR_i^* x_{ij}}{\partial x_{ij} TR_i^*} \quad (5)$$

According to Panzar and Rosse (1987), the *H*-statistic is interpreted as follows. The value of the *H*-statistic is less than or equal to zero under a monopoly market structure. This is because an increase in input prices x_{ij} will increase marginal cost and lead to a reduction in the equilibrium output q_i^* and revenue. In contrast, the *H*-statistic value is equal to unity under perfect competition. In the long-run competitive equilibrium, marginal cost and average cost will be increased by the same proportion due to a rise in input prices, x_{ij} but equilibrium output will not change under certain assumptions¹. Due to inefficiency, some banks are crowded out of the market, which leads to an

$$\ln TR_{it} = \alpha_0 + \alpha_1 \ln CF_{it} + \alpha_2 \ln CL_{it} + \alpha_3 \ln CK_{it} + \alpha_4 \ln OITA_{it} + \alpha_5 \ln EQTA_{it} + \alpha_6 \ln LOTA_{it} + \alpha_7 \ln CDDSTF_{it} + \alpha_8 \ln TA_{it} + \alpha_9 \ln MKTDEP_{it} + \alpha_{10} \ln LRG4_{it} + \alpha_{11} FO_{it} + \alpha_{12} CBBR_{it} + \alpha_{13} INF_{it} + e_{it}, \quad (6)$$

$$\ln IR_{it} = \alpha_0 + \alpha_1 \ln CF_{it} + \alpha_2 \ln CL_{it} + \alpha_3 \ln CK_{it} + \alpha_4 \ln OITA_{it} + \alpha_5 \ln EQTA_{it} + \alpha_6 \ln LOTA_{it} + \alpha_7 \ln CDDSTF_{it} + \alpha_8 \ln MKTDEP_{it} + \alpha_9 \ln LRG4_{it} + \alpha_{10} FO_{it} + \alpha_{11} CBBR_{it} + \alpha_{12} INF_{it} + e_{it}, \quad (7)$$

where \ln is natural logarithm; TR_{it} is total revenue and IR is gross interest revenue of bank i at year t (mlns of MNT). CF is the ratio of interest expense to deposits and short term funds (the unit cost of funds). CL is the ratio of personal expenses to the number of employees (the approximated unit cost of labor). CK is the ratio of non-interest expense to fixed assets (the approximated unit cost of capital). $OITA$ is the ratio of other operating income to total assets. $EQTA$ is the ratio of equity to total assets and $LOTA$ is the ratio of loans to total assets. These last terms are proxies for the risk of insolvency and default risk¹. A positive sign on the coefficients for $LOTA$ is expected since the more loans is more possible interest rate income. The expected sign on $EQTA$ is indeterminate². Molyneux et al. (1994) suggest that $EQTA$ is negatively related to total revenue as lower capital ratios should lead to higher bank revenue. Meanwhile, a high ratio may suggest a highly risky loan portfolio and thus a positive relationship between $EQTA$ and total revenue.

$CDDSTF$ is the ratio of customer deposits to deposits and short term funds. It is included to take into account the difference in the deposit mix³. TA is total assets, which acts as the scale variable; a positive

increase in the individual demand faced by the rest of the banks in the market. Facing higher demand, the prices and revenue of the remaining banks will increase by the same proportion as costs. The value of the *H*-statistic is between zero and unity under monopolistic competition as an increase in input prices x_{ij} will lead to a less than proportional increase in revenues under the certain assumptions. Hence, the demand faced by individual banks is inelastic. Shaffer (1982) also shows that *H* is unity for a natural monopoly in a perfectly contestable market and also for a sales-maximizing firm that is subject to break-even constraints. Bikker and Haaf (2000) interpret *H* as a continuous measure of the level of competition, in particular between 0 and 1, in the sense that higher values of *H* indicate stronger competition than lower values². The following reduced-form equations for revenues, which are similar to Shaffer (1982), Nathan and Neave (1989), and Molyneux et al. (1994) are used in the empirical analysis:

sign is expected to associated with it, as it captures the possible cost advantages and market power associated with size (economies of scale). $LRG4$ is a dummy variable with a value of one for the four largest banks in the market and a value of zero for the remaining banks. It is included to capture bank credibility from the customer ownership and a value of zero for all other forms. It is expected to be positively correlated with revenues, reflecting management efficiency and new technologies imported by foreign ownership. $MKTDEP$ is market deposits with commercial banks and measures local demand. $CBBR$ is the central bank's nominal treasury bill rate. INF is inflation. These three variables are included to account for changes in the regulation of the BOM and customer expectations. e_{it} is a stochastic error term. CF , CL , and CK are proxies of the unit costs of the perspective, it is expected to have a positive impact on revenues as large banks are more likely to attract more customers. FO is a dummy variable with a value of one for foreign inputs of the banks: funds, labor, and capital. Hence, the *H*-statistic is defined as follows:

$$H = a_1 + a_2 + a_3. \quad (8)$$

We test whether $H = 0$ (the monopoly hypothesis) and whether $H = 1$ (the perfect competition hypothesis) using a *F*-test. Since *F*-tests are valid only when the market is in long-run equilibrium, the following equation needs to be estimated as well and test whether $H = 0$ in the profitability function, i.e., the long-run equilibrium condition (Shaffer, 1982).

¹ For the risk component, net loans/total assets (NLTA), overdue loans/loans (NPLLO) and overdue loans/total assets (NPLTA) are considered, but those are statistically not significant in all cases.

² See Molyneux et al. (1994) and Biker Haaf (2002)

³ Also, interbank deposits/[deposits+short term funds] (IBDDSTF) and cash due from banks/[deposits+short term funds] (CDDFB) are considered. Due to the severe multicollinearity, those are not included in the estimation.

$$\ln ROA_{it} = \alpha_0 + \alpha_1 \ln CF_{it} + \alpha_2 \ln CL_{it} + \alpha_3 \ln CK_{it} + \alpha_4 \ln OITA_{it} + \alpha_5 \ln EQTA_{it} + \alpha_6 \ln LOTA_{it} + \alpha_7 \ln CDDSTF_{it} + \alpha_8 \ln TA_{it} + \alpha_9 \ln MKTDEP_{it} + \alpha_{10} \ln LRG4_{it} + \alpha_{11} FO_{it} + \alpha_{12} CBBR_{it} + \alpha_{13} IN_{it} + e_{it}, \quad (9)$$

where ROA_{it} is the pre-tax return on assets. Molyneux et al. (1994) suggest that “the empirical test for equilibrium is suggested by the fact that competitive capital markets will equalize risk-adjusted rates of return across banks such that, in equilibrium, rates of return should not be correlated statistically with input prices”. We include return on assets as the dependent variable in the equation. In equation (9), $H < 0$ would indicate disequilibrium and $H = 0$ would indicate equilibrium (see Shaffer, 1982; Molyneux et al., 1994). Equations (6), (7), and (9) are estimated using OLS, random effects, and fixed effects.

4.2. Data. A bank-level annual data-set, containing bank financial statements, is used to estimate the Panzar-Rosse model. The data has been obtained from *Bankscope* and the BOM. It is the panel data for all commercial banks in Mongolia for the period of 1999 through 2006. The actual starting date of the sample, however, varies from one commercial bank to another. Some of the observations are missing due to bank mergers and new entries during the sample period. The time period is based on data availability. Table 4 provides a summary of the statistics.

5. Empirical results

We estimated equations (6) and (7) using panel data estimation techniques: OLS, fixed-effect, and random-effect models. The result of the Hausman test indicates that unobserved bank-specific variables are correlated with the independent variables and that the random-effect models are inconsistent¹. In this paper we therefore report only the results of estimating the fixed-effect models and those of OLS. We estimated the two models based on the dependent variables: total revenue and gross interest revenue. We estimated the models for the whole sample and for the two sub-periods, i.e., 1999-2002 and 2003-2006 to examine structural change in the market.

Table 5 shows the results for the whole period of 1999 -2006. We find that the H -statistics consistently lie between zero and unity, with values ranging from 0.45 to 0.58. The values of the H -statistic are significantly different from zero and unity. These estimated values of H led to the rejection of both the monopoly hypothesis ($H = 0$) and the perfect competition hypothesis ($H = 1$) at the 1% confidence level². Meanwhile, we are unable to reject the hypothesis of monopolistic competition ($0 < H < 1$). The signs on the coefficients for the unit cost of funds (CF) are found to be positive and statistically significant at the

1% level in all cases. In addition, as we expected, the cost of the funds has a greater influence on gross interest revenue than on total revenue. The results suggest that, in transition economies, the major role of banks is to act as traditional financial intermediates. Unlike the unit cost of funds, the unit cost of labor (CL) does not have a strong impact on either total revenue or gross interest revenue. In the models with fixed effects, the cost of fixed assets is statistically significant in both equations. The coefficient of total assets, TA , is found to be positive and strongly significant in all cases. This suggests that size differences among banks have a great impact on both total and gross interest revenue. Thus, larger banks have an advantage in the Mongolian banking sector. Although the $LRG4$ variable has the expected sign, it is not significant. Therefore, there are no additional size effects in addition to those captured by the scale variable, TA . In contrast, the dummy for foreign ownership is consistently positive and significant at the 5% level in all fixed-effects estimations and at the 10% level for OLS estimations. This suggests that banks that have foreign ownership tend to be more efficient in generating revenue. These results align with those produced in previous studies³. With respect to risk variables, both $EQTA$ and $LOTA$ are positive and statistically significant. This indicates that banks with a higher share of loans or equity to total assets generate higher total and gross interest revenue. The deposit mix variable, $CDDSTF$ is not statistically significant in any case, reflecting that the deposit mix does not vary much across the banks. Finally, other macroeconomic variables, such as INF , and $CBBR$, are not significant. This suggests that bank revenue is mainly determined by bank-specific variables rather than by macroeconomic variables.

We also estimated the equations for the sub-sample periods, 1996-2002 and 2003-2006, to check for structural change. We find instead that the results from each of the sub-sample periods is similar to those from the whole sample (see Table 6 and Table 7 in Appendix). Finally, when we check the stability condition following Shaffer (1982), we find that it is satisfied⁴. Therefore, the estimation H -statistics for the Mongolian banking sector is in general valid.

To check the sensitivity of the results that would be obtained by using an alternative model, we estimate an NEIO model (see, e.g., Bresnahan, 1982, 1989). The NEIO model allows us to test three benchmark cases of market competition – perfect competition, Cournot competition, and full collusion¹. We find that the mar-

¹ The results for the random-effect models will be available from the authors upon request.

² For these analyses we used Wald tests over the sum of elasticities.

³ See Claessens & Laeven (2003), and Gelos & Roldos (2002).

⁴ The result can be obtained from the authors upon request.

ket is more competitive than Cournot competition but less competitive than perfect competition. Because the NEIO models do not test explicitly for monopolistic competition, it is difficult to say that the results from the Panzar-Ross and NEIO models are exactly the same. Together they indicate, however, that collusive market power may not be as strong as the market concentration measures may suggest in a traditional market power analysis.

Conclusions

This paper has investigated competitive conditions and the degree of market power in the Mongolian banking sector. For this purpose, the Panzar-Rosse model has been applied to all commercial banks in Mongolia over the period of 1999-2006. The Panzar-Rosse H -statistics strongly reject both the monopoly hypothesis and the perfect competition hypothesis. Given this empirical evidence, we can infer that the market structure of the Mongolian banking system is characterized by monopolistic competition over the period of 1999-2006.

These findings are consistent with those of previous studies on banking competition for some developing countries (Gelos & Roldos, 2002; Claessens & Laeven, 2004). Given monopolistic competition and the results from the fixed-effects estimation, we can infer that it is very likely that bank features such as credibility, special services capabilities, and the ability to advertise effectively, etc., would greatly 5 banking markets (loans and deposits) could ensure that banks exercise oligopolistic market power. But the empirical results suggest that the market is more competitive

than market concentration measures indicate. The monopolistic market structure this study found seems to be more consistent with contestable markets where market equilibrium is determined by competitive pressure from potential entrants rather than by the number of incumbents.

One policy implication of these results is that the Mongolian banking sector could increase its competitiveness with higher levels of privatization and foreign participation. The entry of foreign banks has a crucial impact on further development of domestic banking systems through the introduction of modern banking know-how and new technologies. It is therefore better to keep banking markets open to highly developed foreign banks. Meanwhile, a well planned entry policy and better banking supervision for both domestic and foreign banks would alleviate financial distress among banks that could be caused by increasingly competitive market conditions. Furthermore, Mongolian commercial banks are expected to react to increasing competition by enhancing and expanding the variety of their services to range beyond traditional intermediate services, and by implementing advances in technologies. In the recent literature that measures market power in banking or financial sectors, much attention has been devoted to developed countries (mature markets). However, developing countries (infant markets) or emerging markets will continue to attract considerable attention well into the future. In this context, analyzing how banks in developing countries react to changing market competition conditions would be a fruitful next avenue for future research.

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¹ In the NEIO model, we specify the loan demand as a function of lending rate, real gross domestic product, exchange rate, time trend, inflation, and treasury bill rate. The marginal cost is defined as a function of loans, the unit cost of funds, labor cost, capital cost, total assets, the ratio of other income to other assets, treasury bill rate, inflation, and exchange rate. In the pricing relationship, the conduct parameter that measures the degree of competition was estimated at 0.32 using 2SLS and 0.29 using GMM, respectively.

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Appendix

Table 1. Structure of the banking sector as of 2005

	Total assets			Loans outstanding			Deposits			Branches		Employees		
	Amount (blns of togrog)	Share of total (%)	As percent of GDP	Amount (blns of togrog)	Share of total (%)	As percent of GDP	Amount (blns of togrog)	Share of total (%)	As percent of GDP	Number	Share of total (%)	Number	Share of total (%)	
Banking system	1585.0	100.0	68.4	859.4	100.0		37.1	692.8	100.0	29.9	732	100.0	6533	100.0
Bank 01	308.8	19.5	13.3	148.6	17.3		6.4	69.5	10.0	3.0	17	2.3	530	8.1
Bank 02	295.7	18.7	12.8	135.9	15.8		5.9	162.6	23.5	7.0	23	3.1	404	6.2
Bank 03	205.0	12.9	8.9	134.3	15.6		5.8	113.7	16.4	4.9	397	54.2	2226	34.1
Bank 04	171.5	10.8	7.4	93.8	10.9		4.1	107.2	15.5	4.6	23	3.1	423	6.5
Bank 05	109.3	6.9	4.7	62.0	7.2		2.7	50.2	7.2	2.2	33	4.5	441	6.8
Bank 06	100.2	6.3	4.3	62.0	7.2		2.7	51.8	7.5	2.2	86	11.7	611	9.4
Bank 07	86.3	5.4	3.7	49.7	5.8		2.1	31.2	4.5	1.3	9	1.2	149	2.3
Bank 08	77.0	4.9	3.3	39.8	4.6		1.7	2.0	0.3	0.1	1	0.1	60	0.9
Bank 09	59.1	3.7	2.6	37.8	4.4		1.6	27.1	3.9	1.2	40	5.5	617	9.4
Bank 10	57.2	3.6	2.5	24.7	2.9		1.1	33.5	4.8	1.4	45	6.1	497	7.6
Bank 11	43.3	2.7	1.9	27.9	3.2		1.2	26.0	3.8	1.1	20	2.7	219	3.4
Bank 12	21.8	1.4	0.9	15.5	1.8		0.7	9.3	1.3	0.4	18	2.5	121	1.9
Bank 13	13.3	0.8	0.6	1.0	0.1		0.0	0.0	0.0	0.0	1	0.1	13	0.2
Bank 14	12.5	0.8	0.5	10.6	1.2		0.5	3.6	0.5	0.2	9	1.2	86	1.3
Bank 15	10.1	0.6	0.4	6.1	0.7		0.3	0.2	0.0	0.0	1	0.1	40	0.6
Bank 16	7.4	0.5	0.3	4.8	0.6		0.2	2.4	0.3	0.1	5	0.7	43	0.7
Bank 17	6.3	0.4	0.3	4.8	0.6		0.2	2.5	0.4	0.1	4	0.5	53	0.8

Source: Bank of Mongolia.

Table 2. Main ratios of the banking sector

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Real GDP growth	2.4	4.0	3.5	3.2	1.1	1.0	4.0	6.1	10.8	7.1	8.4
GDP, current prices, billions of togrog	646.6	832.6	817.4	925.3	1018.9	1115.6	1240.8	1479.7	1945.6	2524.3	3172.4
Inflation	44.6	20.5	6.0	10.0	8.1	8.0	1.6	4.7	11.0	9.5	6.0
Unemployment	6.5	7.5	5.8	4.7	4.6	4.6	3.4	3.5	3.6	3.5	3.2
Monetary survey (billions of togrog)											
M2	128.4	170.1	167.2	220.2	258.8	331.1	470.1	703.3	847.0	1140.1	1536.5
Net foreign assets	73.7	135.4	96.6	167.5	201.7	220.2	308.5	256.3	311.0	570.2	1131.8
Net domestic credit	90.2	67.6	136.1	116.6	84.8	129.3	200.0	514.6	647.3	769.0	745.4
M2/GDP (%)	19.9	20.4	20.5	23.8	25.4	29.7	37.9	47.5	43.5	45.2	48.4
Loans/GDP (%)	10.0	6.1	10.5	8.4	6.6	12.1	18.7	29.9	31.2	34.1	38.6
Deposits/GDP (%)	13.4	14.4	13.6	13.7	9.1	12.1	17.6	24.6	26.6	29.9	31.4
Capital/GDP (%)	-2.1	2.0	0.9	2.2	3.1	4.2	5.0	8.1	9.3	8.2	8.0
Total assets/GDP (%)	21.3	23.6	22.0	22.9	23.1	29.4	39.7	60.6	59.5	68.4	73.0
Currency outside banks/GDP (%)	6.5	6.0	6.9	10.0	10.3	9.7	9.8	9.7	7.9	6.0	5.8
Banks' total loans	64.8	50.4	85.6	77.5	66.8	135.1	231.4	442.1	606.8	859.9	1223.3
Non-performing loans	33.0	14.5	32.6	42.1	14.6	9.1	11.7	21.1	39.1	49.5	60.0
Non-performing loans/Banks' total loans (%)	51.0	28.9	38.1	54.3	21.9	6.7	5.1	4.8	6.4	5.8	4.9
Banks' loan rate	87.9	82.1	46.8	37.7	30.3	31.8	26.6	25.6	24.0	21.6	20.0
Banks' deposit rate	44.8	36.4	27.5	19.8	13.8	13.2	14.0	14.0	13.2	12.6	13.5
CB Bill's weighted average rate	109.0	45.5	23.3	11.4	8.6	8.6	9.9	11.5	15.8	4.8	6.4

Source: Bank of Mongolia, Annual Reports.

Table 3. Financial soundness indicators for banking sector, 2001-2006*

	2001	2002	2003	2004	2005	June/2006
Capital adequacy						
Tier I capital ratio	21.6	17.7	18.5	17.4	15.8	15.3
Total regulatory capital/risk-weighted assets	24.6	20	20.4	20	18.2	17.2

Table 3 (cont.). Financial soundness indicators for banking sector, 2001-2006*

	2001	2002	2003	2004	2005	June/2006
Total regulatory capital/total assets	14.2	12.4	13.4	15.6	13.6	12.9
Asset quality						
Distribution of risk weight category in (billion togrog)						
0 percent	0	0	0	0	0	0
20 percent	9.7	13.5	26.8	31.1	52	70.9
50 percent	0.2	2.1	2.6	13	22.2	35
100 percent	174.4	283.5	499.2	739.8	994.7	1218.3
Large exposures/total assets	n/a	19.2	22.4	23.3	22.5	20.5
Large exposure/total capital	n/a	154.6	167.7	149.8	165.8	159.2
Foreign exchange loans/total loans	35.2	32.5	42.8	45.6	47	47.9
NPLs/total gross loans (or exposures)	6.7	5	4.7	6	5.6	5.5
NPLs net of provisions/total capital	-0.5	-1	0	0.7	0.2	2.1
Provisions to NPLs	102.8	105.2	99.9	97.2	99.2	91.8
Asset sectoral concentration						
Agriculture, hunting, forestry and fishing	4.8	4.1	5.7	4.7	6.7	...
Electricity, steam and water supply	2.8	1.5	1.9	2.5	2.2	...
Construction	4.3	6.2	7.5	8.6	8.9	...
Mining and quarrying	17.5	15.4	8.4	8.6	9	...
Manufacturing	26.5	24.2	20.1	18.7	16.2	...
Wholesale & retail trade, repair of goods	27.4	30.8	34	34.6	33.2	...
Tourism and hotels, restaurants	3.5	1.7	1.8	2	2.1	...
Transport, storage and communication	2.3	2.9	3	2.8	4.3	...
Immovable asset renting business	0.6	1.1	2.2	2.6	2.4	...
Health and education	0.8	0.6	0.5	1	0.7	...
Financial intermediaries	0.6	0.5	1	0.9	1	...
Others	8.8	11	13.8	13.1	13.2	...
Profitability						
Return on (average) assets	5.9	4.3	3.1	2.5	2.2	2.7
Return on (average) equity	23.2	20.8	14.7	12.3	12.1	13.6
Interest margin/gross income	41.3	39.8	35.9	31.5	30.9	27.7
Expenses/income	69.2	78.9	84.7	85.5	86	86.6
Non-interest expenses/gross income	55.4	50.3	49.1	58.8	54.3	59.7
Personnel expenses to noninterest expenses	26	22.4	22.3	26.7	28.5	27.2
Trading and fee income to total income	19.8	23.1	10.8	13.7	16.2	16
Liquidity						
Loans to deposits	92.8	100	113.1	116.6	121.8	111.9
Liquid assets/total assets	41.3	39.9	35.3	31.6	36	36.2
Liquid assets/short-term liabilities	80.6	90.9	83.5	28.8	37.7	35.7
Demand deposits/total liabilities	11.4	12	10.9	11.9	14	13.9
Deposits to total non-interbank loans	89.9	83.8	85.4	82.5	72.6	69.6
Memorandum item:						
Net forex open position to total capital	12.4	8.9	36.5	33.6	27.4	30.6

Source: Bank of Mongolia. * In percent, unless otherwise indicated.

Table 4. Sample statistics

Variable	Obs.	Mean	Std. dev.	Min	Max
$\ln R$	69	8.79	1.26	4.16	11.01
$\ln R A$	69	-2	0.47	-4.08	-0.96
\ln/R	69	8.62	1.28	4.14	10.92
$\ln/R A$	69	-2.17	0.51	-4.1	-1.02
\ln	69	8.71	1.27	3.67	11
$\ln A$	69	-2.08	0.51	-4.57	-1.02
\ln	69	-2.84	0.81	-5.66	-0.88
\ln	69	0.98	0.75	-1.08	3.48
\ln	69	-0.39	0.63	-1.66	1.5

Table 4 (cont.). Sample statistics

Variable	Obs.	Mean	Std. dev.	Min	Max
$\ln I/A$	69	-4.11	0.82	-7.97	-2.71
$\ln E/A$	67	-2.17	0.74	-3.8	0.32
$\ln A$	69	-0.97	1	-5.61	-0.22
\ln	69	-0.21	0.42	-1.99	0.02
$\ln A$	69	10.79	1.19	7.16	12.96
\ln	123	13.03	0.78	11.8	14.1
RG	123	0.26	0.44	0	1
	123	0.35	0.48	0	1
A	69	42815.9	52376.26	155.9	242581.6
EP/I	69	72329.1	79617.38	181	360710.7
E/R	103	31.8	10.2	10.4	60
EPR	105	7.09	1.89	1.2	13.2
RG/P	123	1180776	160047.7	1008236	1459030
R	123	9.55	3.39	4.4	15.75
I	123	7.26	2.98	1.6	11

Table 5. The estimation results of the P-R model for the period of 1999-2006

	OLS	FE	OLS	FE
\ln	0.46***	0.35***	0.55***	0.42***
	(0.04)	(0.03)	(0.04)	(0.04)
\ln	-0.02	0.04	-0.03	0.04
	(0.04)	(0.04)	(0.05)	(0.04)
\ln	0.01	0.07*	0.03	0.12***
	(0.05)	(0.04)	(0.06)	(0.04)
$\ln I/A$	0.24***	0.20***	0.12***	0.06
	(0.04)	(0.04)	(0.05)	(0.04)
$\ln E/A$	0.11*	0.10*	0.12*	0.09*
	(0.06)	(0.05)	(0.07)	(0.05)
$\ln A$	0.05	0.08**	0.07	0.11***
	(0.04)	(0.04)	(0.04)	(0.04)
\ln	0.03	-0.03	0.05	-0.07
	(0.06)	(0.06)	(0.07)	(0.06)
$\ln A$	1.10***	1.15***	1.11***	1.17***
	(0.06)	(0.06)	(0.07)	(0.07)
$\ln EP$	-0.24***	-0.28	-0.25**	-0.32***
	(0.09)	(0.08)	(0.10)	(0.09)
RG	0.13	-	0.15	-
	(0.08)		(0.10)	
	-0.11*	0.20***	-0.14*	0.22***
	(0.06)	(0.07)	(0.07)	(0.08)
R	0.01	0.01	0.00	0.01
	(0.01)	(0.01)	(0.01)	(0.01)
INF	0.00	-0.01	0.00	-0.01
	(0.01)	(0.01)	(0.01)	(0.01)
Constant	2.67***	2.24***	2.41***	2.00***
	(0.68)	(0.56)	(0.77)	(0.61)
R^2	0.98	0.99	0.98	0.99
Num. obs.	67	67	67	67
PR H-stat.	0.45	0.46	0.55	0.58
$F(H=0)$	54.68	78.5	63.87	104.04
$F(H=1)$	83.38	109.4	42.33	55.15

Note: The numbers in parent hesis are standard errors. * Significant at 10%; ** significant at 5%; *** significant at 1%.

Table 6. The Result of the P-R model for the period of 1999-2002

	OLS	FE	OLS	FE
ln	0.29***	0.33***	0.34***	0.39***
	(0.08)	(0.04)	(0.10)	(0.04)
ln	-0.07	0.14	-0.09	0.13
	(0.10)	(0.08)	(0.11)	(0.09)
ln	0.17*	0.02*	0.25**	0.13
	(0.09)	(0.06)	(0.11)	(0.07)
ln / A	0.29***	0.21***	0.17**	0.04
	(0.07)	(0.05)	(0.08)	(0.05)
lnE A	0.11	-0.09	0.10	-0.13
	(0.10)	(0.09)	(0.12)	(0.10)
ln A	0.00	0.01	0.02	0.03
	(0.08)	(0.05)	(0.09)	(0.05)
ln	-0.11	0.00	-0.22	-0.06
	(0.19)	(0.14)	(0.22)	(0.15)
ln A	1.08***	1.02***	1.10***	1.04***
	(0.12)	(0.09)	(0.14)	(0.10)
ln EP	-0.57	-0.29	-0.71	-0.41
	(0.51)	(0.25)	(0.59)	(0.27)
RG	0.13		0.16	
	(0.13)		(0.15)	
	0.08	0.20**	0.09	0.22**
	(0.14)	(0.07)	(0.16)	(0.08)
R	-0.01	0.00	-0.02	0.00
	(0.04)	(0.02)	(0.05)	(0.02)
INF	-0.06	-0.02	-0.07	-0.03
	(0.04)	(0.02)	(0.05)	(0.02)
Constant	7.17	3.16	8.23	3.72
	(5.99)	(2.85)	(6.90)	(3.12)
R ²	0.99	0.99	0.98	0.99
Num. obs.	29	29	29	29
PR H-stat.	0.39	0.46	0.5	0.64
F (H= 0)	24.45	44.39	30.47	64.6
F (H= 1)	60.06	49.66	30.29	20.19

Note: The numbers in parenthesis are standard errors. * Significant at 10%; ** significant at 5%; *** significant at 1%.

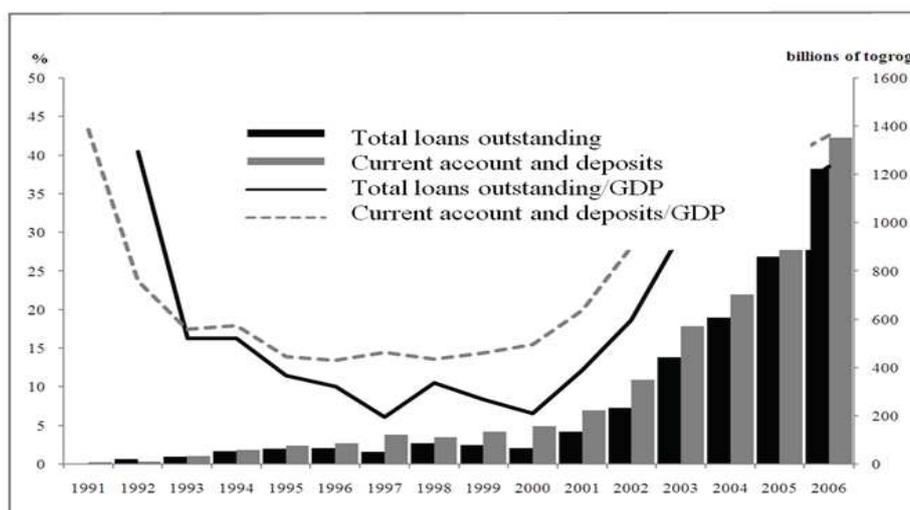
Table 7. The estimation results of the P-R model for the period of 2003-2006

	OLS	FE	OLS	FE
ln	0.52***	0.10	0.62***	0.16***
	(0.08)	(0.07)	(0.09)	(0.09)
ln	0.10	0.06	0.11	0.08
	(0.08)	(0.06)	(0.09)	(0.07)
ln	-0.08	0.09	-0.08	0.10
	(0.08)	(0.07)	(0.09)	(0.08)
ln / A	0.26***	0.09*	0.17	-0.03
	(0.08)	(0.05)	(0.09)	(0.06)
lnE A	0.07	0.04	0.09	0.06
	(0.09)	(0.06)	(0.10)	(0.07)
ln A	0.14	0.28***	0.17	0.33***
	(0.15)	(0.08)	(0.17)	(0.09)
ln	0.03	-0.01	0.05	-0.02
	(0.08)	(0.08)	(0.08)	(0.10)
ln A	1.00***	0.78***	0.99***	0.76***
	(0.10)	(0.13)	(0.11)	(0.15)
ln EP	-0.36**	0.09	-0.37	0.11
	(0.17)	(0.17)	(0.19)	(0.20)

Table 7 (cont.). The estimation results of the P-R model for the period of 2003-2006

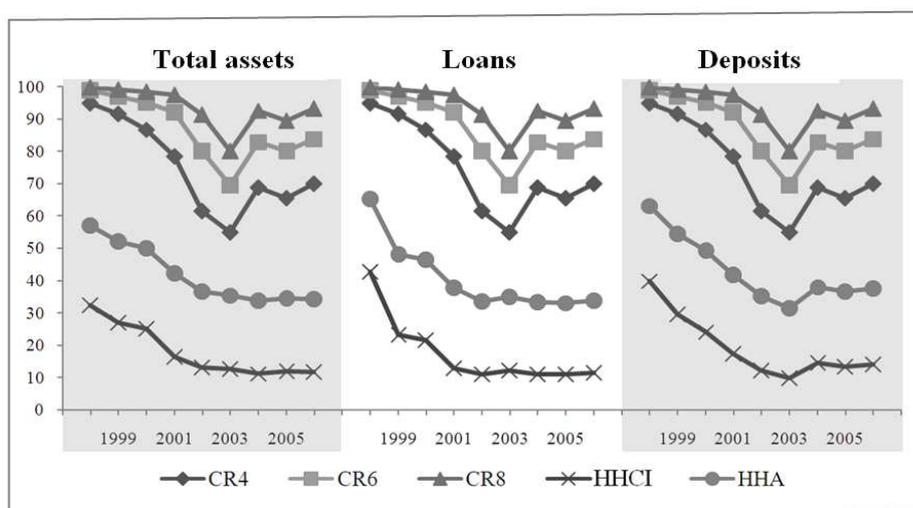
	OLS	FE	OLS	FE
<i>RG</i>	0.03		0.01	
	(0.12)		(0.14)	
	0.04	0.00	0.04	0.00
	(0.09)	0.00	(0.10)	0.00
<i>R</i>	-0.01	0.00	-0.01	0.00
	(0.01)	(0.01)	(0.01)	(0.01)
INF	0.02	0.01	0.02	0.00
	(0.01)	(0.01)	(0.01)	(0.01)
Constant	5.47***	-0.01	5.42***	-0.45
	(1.81)	(1.23)	(1.99)	(1.46)
<i>R</i> ²	0.98	0.98	0.98	0.98
Num. obs.	38	38	38	38
PR H-stat.	0.55	0.25	0.64	0.34
F (<i>H</i> = 0)	18.27	7.17	20.98	9.52
F (<i>H</i> = 1)	12.76	67.34	6.53	37.11

Note: The numbers in parenthesis are standard errors. * Significant at 10%; ** significant at 5%; *** significant at 1%.



Source: Bank of Mongolia, Annual Report.

Fig. 1. Loans outstanding, deposits and ratios of those to the GDP



Source: Authors calculation based on the data provided by bank of Mongolia.

Fig. 2. Concentration ratios (CR) and Hirschman-Herfindahl index (HHN)