

# **The Determinants of Bank Performance in China**

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## **Abstract**

The purpose of this study is to examine the determinants of performance for four different types of Chinese banks from 1999-2006, and to assess which of four measures describes performance best. The independent variables include the standard financial ratios. It also quantifies influences from listing, the type of bank, the extent of foreign ownership, bank reforms and macroeconomic variables. The results suggest economic value added and the net interest margin do better than the more traditional measures of profitability, namely ROAE and ROAA. The type of bank is influential but bank size is not. While listing improves performance, neither the percentage of foreign ownership nor bank reforms has any discernable effect. Some macroeconomic variables and financial ratios are significant with the expected signs.

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## The Determinants of Bank Performance in China

### 1. Introduction

Since 1978, the Chinese economy has been the subject of well-documented economic reforms, designed to improve economic efficiency and resource allocation. Though slower to commence in the banking sector, the pace has picked up after the Chinese authorities came under pressure to meet their WTO (2001) agreement to allow foreign bank participation by 2007.

Since December 2003, the China Regulatory Commission has allowed foreign banks to own up to 25% of a Chinese financial institution but if their equity participation exceeds 25%, they are designated foreign/joint-venture banks.<sup>3</sup> At the end of 2006, there were six wholly owned foreign and five joint venture banks. Recently, foreigners were allowed to buy shares in three of the four big state-owned banks that were “privatized” though the government continues to hold a controlling interest. In addition foreign firms have purchased minority stakes in national and regional/city commercial banks. By allowing foreign bank entry, the Chinese government hopes to improve bank performance in addition to meeting WTO conditions.

China’s banking reform can be divided into three stages. The first stage (1979-1993) began with the creation of a two-tier banking system, when four specialized banks were established. Though state-owned, they were separated from the direct control of the central bank and Ministry of Finance. During stage two (1994-2003), they were converted into state-owned commercial banks. The partial sale of shares in three of these banks marked the beginning of stage three (2004-present) effectively making them joint stock banks.<sup>4</sup>

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<sup>3</sup> The equity participation of a single overseas financial institution in a Chinese cannot exceed 20 per cent. Source: China Banking Regulatory Commission (2003).

<sup>4</sup> There were many other regulatory changes during the period - the big four are singled out because they tend to be at the centre of any new phase of reform. For a detailed review, see Berger et al. (2006) and Heffernan and Fu (2008).

Thus, an important issue is what drives the performance of Chinese banks, and whether foreign bank participation and/or the reforms make a positive contribution. This study seeks to address two key questions. First, what variables influence the performance of China's banks, and in particular, have bank reform and/or foreign ownership had significant influences on their performance? Second, does the model improve if economic value added (EVA) is used as the performance measure rather than the standard measures of profitability such as Return on Average Assets (ROAA) or Return on Average Equity (ROAE), or net interest margins (NIM)? The annual data cover the period 1999-2006, for 76 Chinese banks. The sample includes the big four, 13 national joint stocks, 51 city and 8 rural commercial banks.

In the literature, there are two separate approaches to assessing bank performance. The first focuses on profit and cost X-efficiency frontiers, using data envelope or stochastic frontier analysis. Surveys can be found in Berger and Humphrey (1997) and Williams and Gardener (2003). These techniques have also been applied to emerging markets. See for example, Bonin et al. (2005) on the transition economies and for Pakistan, Bonaccorsi di Patti and Hardy (2005). Both studies find state owned banks to be the least efficient and foreign owned banks the most efficient.<sup>5</sup>

For China, Berger et al. (2006) use cost and profit efficiency frontiers to assess relative efficiency and the influence of minority foreign ownership of Chinese banks during the period 1994-2003. They look at three types of banks: the big four, 9 of 11 "tier 2" national joint-stock banks, and tier 3, consisting of city commercial banks (16 of 113 at the end of 2003), 6 joint-venture banks, and 2 foreign banks. The sample covers 94% of Chinese banking assets. They report that the big four (state owned at the time) are the least efficient, which may be due to a combination of poor revenues and a high percentage of non-performing loans. Minority foreign ownership is associated with higher profit and cost efficiency.

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<sup>5</sup> Bonaccorsi di Patti and Hardy (2005) also report that new private domestic banks out performed foreign owned banks in some cases.

Chen et al. (2005) uses DEA to examine the cost, technical and allocative efficiency of 43 Chinese banks from 1993 to 2000. They find that the large state-owned and smaller banks are more efficient than medium sized banks, and technical efficiency consistently dominates allocative efficiency. Also financial deregulation in 1995 is found to improve cost efficiency levels. Yao et al. (2007) employ SFA on a panel of 22 banks over the period 1995-2001 to estimate the effects of ownership structure and the implementation of a “hard” budget constraint on bank efficiency. Non-state banks were found to be 8-18% more efficient than state banks, and banks facing a hard budget constraint tend to perform better than those relying on substantial capital injections by the state or regional governments.

The second strand of the literature considers the determinants of bank profitability, usually measured by the return on assets, return on equity, and in some cases, the interest margin. These studies assess the impact of bank financial ratios, macroeconomic variables, and regulatory changes on performance. Goddard et al. (2004) study the performance of European banks across six countries. They find a relatively weak relationship between size and profitability - measured by ROE. Only UK banks show a significantly positive relationship between off-balance-sheet business and profitability. However, there is significant persistence of cumulative abnormal returns even though competition among banks is thought to have increased over the period, 1992-1998.

Molyneux and Seth (1998) explicitly look at the performance of foreign banks in the United States (1987-91) and report the risk adjusted capital ratio to be a key determinant of these banks’ performance. Williams (2003) considers the determinants of the performance of foreign banks based in Australia for the period 1989-93. With ROA as the dependent variable, the main finding is that foreign banks with a full Australian license have a significantly lower market share. The coefficients that are significantly positive include the GDP growth of a foreign banks’ home country, and the Australian net interest margin and non-interest income.

With reference to the emerging markets, Bonin et al. (2003) use at least one of the ROA/ROE measures to assess bank performance in several transition economies. Naceur and Goaied (2001) study the performance of Tunisian deposit banks (1980-95). Productivity, capitalization, and portfolio composition are significant and positively related to ROA, but not the size of the bank. Using co-integration techniques, Chirwa (2003) look at eight banks in Malawi (1970-84) and find a significantly positive long run relationship between concentration and performance; similarly for demand deposits. The loan to assets ratio also has a positive and significant coefficient on ROA. No published paper on bank performance in China employs these measures, but Shih et al. (2007) uses principal components analysis to compare bank performance (using financial intermediation) among the big four, joint-stock, and city commercial banks. The mid-size joint-stocks are found to perform significantly better than the state and the city commercial banks. Bank size is not correlated with performance, unlike the findings of studies in other emerging markets.

Our study applies the second approach to a large sample of Chinese banks, but uses economic value added and the net interest margin as dependent variables, in addition to the more standard measures of profitability, Return on Average Assets (ROAA) and Return on Average Equity (ROAE). Put simply, economic value added (EVA) is a value-based performance measure which includes a charge for the opportunity cost of capital. According to Weaver (2001), EVA links economic, accounting and shareholder returns.

The findings can be summarised as follows. The system GMM model is the superior method for estimating this panel. Economic value added and the net interest margin are the best measures of performance. Significant positive determinants of Chinese bank performance include efficiency and the listing of a bank but foreign equity investment had either no effect or significantly reduced performance, depending on which measure of profitability is used. Performance appears to be unaffected by bank reforms implemented over this period. Though bank size does not influence performance, the type of bank does - rural commercials had a positive average EVA over the period, and they significantly outperform the big four, the joint stocks, and city commercial banks,

possibly because they operate as near local monopolies. Certain macroeconomic variables affect bank profits too.

The paper is presented as follows. Section 2 supplies more detail on economic value added as a measure of performance. Section 3 describes the econometric tests and data. Section 4 analyses the results, and section 5 concludes. Since several studies have already reviewed the regulatory changes in China's banking system (see for example, Heffernan and Fu, 2008 and Berger et al., 2006) only the reforms of particular relevance to this paper are mentioned.

## **2. Economic Value Added as a Measure of Performance**

The use of Economic Value Added as a measure of performance began with Stern, Stewart and Company (Stewart, 1991; Stern et al., 1995), an American consulting firm that claims to have developed (and trade marked) the EVA measure to improve the way companies could evaluate everything from business strategies to the relative performance of divisions. Much of the management accounting literature focuses on these areas. For example, O'Hanlon and Peasnell (1998) and Sheikholeslami (2001) look at EVA as a means of rewarding divisions that produce a positive EVA within the firm. EVA is also used to forecast stock market performance and investment decisions. Papers in this area include Farsio et al. (2002), Freedman (1998), Garvey and Milbourn (2000), and Griffiths (2006). Stern, Stewart and Co. has a database that ranks US firms according to EVA and other measures with a view to assisting with investment decisions.

Stouhgtou and Zechner (2007) supply the economic foundations for economic value added, developing a theoretical model of optimal capital allocation with asymmetric information, and extend it to a multi-divisional firm, where managers are assessed based on the value they add to the firm. These authors define value added as:

$$EVA_i = \sum_i \mu_i(\sigma_i) \theta_i - r_D(\sum_i A_i \sigma_i - C_i) - r_E C_i \quad (1)$$

where:

$r_E$  : the cost of capital

$r_D$  : the cost of debt or deposits

$\sum_i A_i \sigma_i$  : total financing requirement

$C_i$ : equity capital; the rest of the of the financing requirement is met by debt

$\sum_i \mu_i(\sigma_i) \theta_i$  : the sum of cash flows over all divisions of the financial institution

The London Business School (LBS) and First Consulting (1992)<sup>6</sup> define value added as [(adjusted operating profits less a charge for shareholder equity) / (factor inputs)]. Data on 25 European banks between 1987 and 1990 show that in an average year, just five produce value added. Kay (1993) employ a similar definition to assess 11 European banks, with 8 showing a positive value added. Boyd and Gertler (1994) look at value added in the banking sector as a percentage of total value added by all financial intermediaries, using definitions and data from the US national income accounts from 1947-87. Banks are found to slightly increase their share of value added over the period.

Fiordelsi (2007) develops a shareholder value efficiency frontier, using EVA. Based on data from France, Germany, Italy, and the UK (1997-2007), he concludes it is superior to either relative cost or profit efficiency measures of performance. On average, banks from these countries are 36% value inefficient. While the approach is interesting, it is beyond the scope of this paper to compare similar measures for China.

Millar (2005) is the only study that compares EVA with the better-known performance measures, ROAA and ROAE, for 16 British banks over the period 1998-2003. He uses the LBS definition of EVA. Millar finds that on average, the UK banks add value over this period, which could be due to low yields on 10 year government bonds and a period of relatively strong economic growth in the UK, which boosted banks' profits.

Using panel data and a fixed effects model, Millar's GLS regressions suggest EVA does better overall than either ROAA or ROAE when employed as the dependent variable. Much lower t-ratios are found for the conventional measures, and their overall fit (measured by adjusted  $R^2$ ) is only slightly better – 99% as compared to 94% for the EVA equation. Furthermore, with EVA as the dependent variable, inflation, real GDP growth,

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<sup>6</sup> As reported in *The Economist* (1992).

unemployment, and the output gap are found to be significant with the expected signs, whereas no macro variable has any explanatory power in the ROAA/ROAE regressions. Thus bank performance appears to improve in an environment of low inflation, zero output gap (on average) falling employment and rising GDP growth rates. The cost to income ratio (a significantly negative coefficient), and net interest margins (positive and significant) are the financial ratios that do best in all estimations. The number of branches improved performance but the capital adequacy coefficient is significantly negative. The size coefficient, measured by total assets, is significantly negative in the ROAA/ROAE regressions, suggesting smaller banks perform better.

There do not appear to be any published studies on the use of EVA in emerging markets. One contribution of our study is to compute the EVA for Chinese banks and test for the determinants of bank performance using ROAA, ROAE, NIM, and EVA as dependent variables. The next section explains the methodology and dataset.

### 3. Methodology and Dataset

#### 3.1 Economic Value Added

Though the theoretical concept of economic value added is straightforward, actually measuring it is more controversial, at least in the management accounting literature. Weaver (2001) reports that in a survey of Stern, Stewart and Company clients, not one of the respondents<sup>7</sup> measures EVA in exactly the same way, even though they hold a consistent view of its meaning. In particular, there is pronounced disparity in key measures such as net operating profit after tax and the components of the capital charge.

In light of Weaver's finding, and to ensure comparability with ROAA and ROAE, we employ the LBS-First Consulting (1992) bank value added formula together with adjustments recommended by Uyemura et al. (1996):

$$EVA_{i,t} = (\text{operating profits after tax}_{i,t} - \text{capital charge}_{i,t}) / \text{factor inputs}_{i,t} \quad (2)$$

where:

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<sup>7</sup> Weaver (2006) reports a response rate of 40%, or 29 firms.

$$\begin{aligned} \text{capital charge}_{i,t} &= \text{capital}_{i,t} * \text{cost of capital}_{i,t} \\ \text{factor inputs}_{i,t} &= \text{operating costs}_{i,t} + \text{interest costs}_{i,t} \end{aligned}$$

EVA is normalised by factor inputs<sup>8</sup> to minimise possible heteroskedasticity and scale effects in the model.

Measuring the cost of capital is somewhat arbitrary. The LBS-First Consulting (1992) added a 10% general risk premium to the “risk free” long-term government bond yield. Millar (2005) refined this measure somewhat by assigning AAA rated banks a 10% premium, then adding .25 for every drop in the rating. For China, the calculation presents a greater challenge because Fitch does not publicly rate the banks, and Capital Intelligence (CI) assigns ratings to only 10 banks, ranging from BBB to B.<sup>9</sup> However, Wang (2006) uses principal component analysis on 20 financial indicators to estimate a relative risk index for 118 Chinese banks, with scores between 0 (least risky) and 10 (high risk). The index covers a wide range of risks including liquidity, credit, capital, profit, and price risks. The advantage of this index is that it includes all 76 banks in the sample except for several new small banks. Thus, for this study, two benchmarks are used for the cost of shareholder capital for bank  $i$  at time  $t$ :

$$\text{Cost of Capital}_{i,t} = BY_t + \text{fixed risk premium} + W\text{-risk premium}_i \quad (3)$$

where:

$BY_t$ : average (inflation adjusted) long-term government bond yield in year  $t$

$\text{fixed risk premium}$ : 10.5 % , which is based on the 10% employed in the LBS study for European banks plus 50 basis points based on the CI ratings of 10 Chinese banks. The 50bp is obtained from the Basel II risk weight for banks rated from BBB to BBB-) or 50%

$W\text{-risk premium}$ : This is derived from Wang’s original formula for the risk index:

$$(X_i - X_{\min}) / (X_{\max} - X_{\min}) * 10$$

where  $X_i$  is the risk score for a given bank  $i$ . Wang’s index is divided by 10, and expressed as a percentage.

<sup>8</sup> It is notable that no study in the management accounting literature adjusts for factor inputs. In the banking literature, only Fiordelisi (2007) standardizes EVA by capital invested.

<sup>9</sup> The CI rating in terms of domestic strength is applied here.

It should be stressed that EVA is a relative measure (as is the Wang index), so the somewhat arbitrary nature of computing the cost of capital is less worrying than what might appear.

### **3.2 Econometric Model**

In the banking literature, fixed and/or random effects models are usually employed for panel data. However, a difficulty arises with these models when a lagged dependent variable (or possibly other regressors) is important, particularly in the context of few time periods and many observations (Nickell, 1981). Their coefficients may also be seriously biased if the regressors are correlated with the lagged dependent variable to some degree.

To address this problem, Arellano and Bond (1991) develop the difference GMM model by differencing all regressors and employing Generalized Method of Moments (Hansen, 1982). Arellano and Bover (1995) and Blundell and Bond (1998) augment the difference GMM model by developing the system GMM estimator which includes lagged levels as well as lagged differences. The system GMM estimator assumes that first differences of instrumental variables are uncorrelated with the fixed effects. It allows the introduction of more instruments, and can substantially improve efficiency.

Roodman (2006), among others,<sup>10</sup> also argue that both difference and system GMM estimators are suitable for situations with “small T, large N” panels; independent variables that are not strictly exogenous; fixed individual effects; heteroskedasticity and autocorrelation among, in this study, individual banks. However, the difference GMM estimators can be subject to serious finite sample biases if the instruments used have near unit root properties. Use of the system GMM results in notably smaller finite sample bias and much greater precision when estimating autoregressive parameters using persistent series (Bond, 2002).

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<sup>10</sup> Arellano and Bond (1991), Arellano and Bover(1995), Baltagi (2005), Baum (2006), and Bond (2002).

Since the sample in this paper may share many of the characteristics mentioned above,<sup>11</sup> this study employs the system GMM model to investigate the determinants of performance in China's banking sector. The exogenous variables and the difference of the lagged dependent variable are used as instruments in the level equation; the lagged dependent variable is the instrument in the first-difference equation. Thus, each regressor appears in the instrument matrix. A fixed effects panel data model is also estimated, to allow comparison of the results. Employing the system GMM approach, the reduced form estimating equation<sup>12</sup> for each performance measure is as follows:

$$Y_{i,t} = \alpha Y_{i,t-1} + \beta X_{i,t} + \gamma Z_t + (\mu_i + v_{i,t}) \quad (4)$$

where:

$Y_{i,t}$ : bank  $i$ 's performance in year  $t$ , namely,  $EVA_{i,t}$ ,  $ROAA_{i,t}$ ,  $ROAE_{i,t}$ , and  $NIM_{i,t}$ , which are, respectively, economic value added, return on average assets, return on average equity, and the net interest margin.

$Y_{i,t-1}$ : bank  $i$ 's performance in year  $t-1$ , measured as above.

$X_{i,t}$ : a vector of current and lagged values of bank-specific explanatory variables .

$Z_t$ : a vector of lagged macroeconomic variables<sup>13</sup>

$\mu_i$ : an unobserved bank-specific time-invariant effect which allows for heterogeneity in the means of the  $Y_{it}$  series across banks.

$v_{i,t}$ : a disturbance term which is independent across banks.

### 3.3 Data

The original sample includes 76 banking institutions based in China between 1999 and 2006. Though it includes banks with shareholders, only eight have publicly quoted

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<sup>11</sup> Once lagged variables are introduced, the sample is reduced from 76 to 70 banks over 7 years (2000-2006), hence posing, potentially, a large N small T problem. Fixed individual effects could include the sample of banks sharing some time invariant factors such as certain organizational and ownership structures; Heteroscedasticity may be present because although the study only includes commercial banks, the differences among them is substantial, both in terms of size and business scope. For example, only the city and rural commercial banks are prohibited from setting up branches overseas. Autocorrelation could be a problem if current bank performance is correlated with past profitability to some degree. Or shocks affecting performance could be serially correlated and relative bank-specific factors (cost:income, capital:assets, etc) might respond to these shocks. Thus, though the coefficient on the lagged dependent variable is not of direct interest, allowing for dynamics in the underlying process may be crucial for recovering consistent estimates of other parameters.

<sup>12</sup> Arellano-Bond tests for AR(1) and AR(2) in first differences. The test for no second-order serial correlation of the disturbances of the first-differenced equation is important for the consistency of the GMM estimator. In addition, the Hansen (1982) J test for the joint validity of the moment conditions (the presence of over-identification) is crucial to the validity of GMM estimates.

<sup>13</sup> Normally this equation would include a year-specific intercept to reflect, for example, regulatory reform or a common technology shock. However, we want to test for the influence of macroeconomic variables. The results were found to be very similar if time dummies are included, and can be supplied by the author's upon request.

shares.<sup>14</sup> The sample banks include the big four, 13 national “joint stock” commercials, 51 city<sup>15</sup> and 8 rural commercial banks. Eleven foreign banks (5 joint ventures and 6 wholly foreign owned banks at the end of 2006) are treated as branches for regulatory purposes, even though they are subsidiaries. They were dropped from the sample because over this period, they were restricted to offering foreign exchange facilities to foreign businesses operating in China, making for a highly limited business scope and customer base.<sup>16</sup> Rural coops and credit unions are also excluded.<sup>17</sup>

This leaves 76 banks, covering 95% of assets, which falls to 70 for the system GMM model because certain variables were lagged. The big four state<sup>18</sup> commercial banks offer a full range of commercial banking activities. A similar range of bank services is supplied by the smaller national joint stocks to customers in the major/developed cities, the city commercials to local customers in their respective cities, and the rural commercials to agriculture and small and middle-size enterprises located in a particular area.<sup>19</sup> The city and rural banks are prohibited from having overseas branches, and the rural commercials are largely confined to Renminbi based services. The numbers of customers at year-end 2006 were roughly 1.4 million, 179,000, 114,000 and 20, 000 for the respective types of bank.<sup>20</sup> Though the system appears somewhat segmented, city based customers can bank at the big four, the joint stocks or city commercials. Rural customers are largely dependent on the rural banks (or rural coops, which only offer a basic banking service) since the big four began closing rural outlets since 1999.

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<sup>14</sup> The listed banks include the Industrial and Commercial Bank of China, Bank of China Limited, China Construction Bank Corporation, China Merchants Bank Co. Ltd., China Minsheng Banking Corporation, Shanghai Pudong Development Bank, Hua Xia Bank, and Shenzhen Development Bank Co. Ltd.

<sup>15</sup> Out of a possible 113 city banks at the end of 2006.

<sup>16</sup> Even by the end of 2006, only a select number (3) were allowed to offer Renminbi services and/or establish a limited number of branches. They continue to complain of discrimination.

<sup>17</sup> Financial information is available for just 2 rural cooperative banks and 3 credit unions. They were dropped because there are over 25,000 of these institutions, providing very basic banking services to local members.

<sup>18</sup> Roughly 20% of shares are listed on the Hong Kong stock exchange for three of these banks, but they remain largely state-owned. The Agricultural Bank of China was confined to providing services to the rural sector but following reforms in 1999, it has been allowed to expand its customer base, on a par with the other state banks. According to the *Annual Report* of the Chinese Banking Regulatory Commission (CBRC) the Bank of Communications was re-classified as a state commercial bank sometime in 2007.

<sup>19</sup> Since the end of 2006, a few (e.g. Bank of Beijing, Bank of Shanghai.) have been allowed to establish branches in other cities/regions.

<sup>20</sup> Sources: www.cbrc.gov.cn and Bankscope.

The dependent variables for bank  $i$  at time  $t$  are:

$EVA_{it}$ : Economic value added for bank  $i$ , as explained in section 3.1.

$ROAA_{it}$ : Return on Average assets for bank  $i$

$ROAE_{it}$ : Return on Average Equity for bank  $i$

$NIM_{it}$ : net interest margin or net interest income divided by average earning assets, and measures a bank's interest spread. In the West, NIM is usually dismissed as too narrow a measure because of the expansion into off-balance-sheet (OBS) activities. Although Chinese banks have OBS income, it is largely derived from the more traditional forms, such as income from service charges. In 2004, the ratio of net fee income to net operating income ranged from 5.45% to 8.85% for the big four and 2.49% to 7.35% for the national commercial banks.<sup>21</sup> Thus, their main focus is on asset-liability management.

The bank-specific independent variables include:

- *CI*: cost to income ratio. This is a measure of operational efficiency reflecting the cost of running the banks as a percentage of income. The higher this ratio the less efficient the bank will be, which should adversely affect bank profits, depending on the degree of competition in the market. But generally, a negative relationship with performance is expected.
- *EA*: equity/total assets. This measures the banks' ability to withstand losses. Banks with substantial EA ratios may be over-cautious, passing up profitable investment opportunities. Alternatively, a declining ratio may signal capital adequacy problems. Hence, the sign of the coefficient could be either positive or negative.
- *LIQ*: liquid assets/deposits plus short-term funding. A measure of liquidity, bank managers have to strike an optimal balance given the risk/return trade-off of holding a relatively high proportion of liquid assets. Too little liquidity might force the bank to borrow at penal rates from the interbank market and/or central bank, depending on its reputation. On the other hand, a high ratio could result in lost profitable investment activities, making the sign of the coefficient unclear.

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<sup>21</sup> Other banks have even lower net fee income ratio due to much fewer networks (Wang, 2006).

- *LLR*: loan loss reserves/gross loans: the percentage of the total loan portfolio that has been set aside for bad loans. Higher provisioning signals the likelihood of possible future loan losses, though it could also indicate a timely recognition of weak loans by prudent banks. So the expected sign on this coefficient is ambiguous.
- *LOGTA*: natural logarithm of total assets. As a proxy for bank size, it assesses whether the size of the bank is related to performance. It is well known that small profitable banks exist, making the sign of the coefficient unclear.
- *NLA*: net loans/total assets, or the percentage of assets that comprise the loan portfolio.<sup>22</sup> Higher ratios may be indicative of better bank performance because of increases in interest income. However, very high ratios could also reduce liquidity and increase the number of marginal borrowers that default. Again, its affect on bank performance is ambiguous.
- *OIA*: the ratio of other operating income to average assets. A proxy for off balance sheet (OBS) activities, it also provides an indicator how much the bank has diversified away from the traditional intermediary function. A positive coefficient is expected.
- *DF*: a dummy for foreign equity investment, 1 for banks with foreign equity investment, 0 otherwise. Similarly, a positive sign is expected.
- *DL*: a dummy for the listing of a bank's shares, 1 for listed bank, 0 otherwise. Research on corporate governance suggests listed firms which are monitored by (especially institutional) investors increases managerial accountability.<sup>23</sup> Thus, it is expected that the listed banks will outperform the non-listed banks.
- *DR*: dummy for bank reform, 1 for 2004-6; 0 for 1999-2003. Reforms have been aimed at improving bank efficiency and performance, so a positive sign is expected.
- *DB<sub>i</sub>*: Dummy for type of bank:  $i = 1$  (big 4), 2 (national joint stocks); 3 (city commercials), 4 (rural commercials); 0 otherwise. This bank dummy variable will provide a measure of the relative performance of the four bank types. The time invariant nature of the bank type dummies means they are only tested in the system GMM model.

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<sup>22</sup> Net loans equal gross loans minus loan loss reserves.

<sup>23</sup> See, among others McConnell and Servaes (1990) and Shleifer and Vishny (1986).

- $F EI_i$ : the percentage of foreign equity investment in bank  $i$ . Again, on the assumption that foreign investors will monitor their investment, banks are expected to be more efficient, and perform better than those with little or no foreign equity participation.

The macroeconomic explanatory variables are lagged by one year on the assumption that it will take time for their effects to filter through to customers and banks. They include:

- $INF_{t-1}$ : annual inflation rate. This measures the overall percentage increase in the consumer price index for all goods and services. The People's Bank of China uses interest rates to target inflation. They are increased if inflation is expected to rise, to reduce expenditure and borrowing by firms and households, which could raise default rates. Both will affect a bank's performance adversely.
- $RGDP_{t-1}$ : annual real GDP growth rate - the growth of China's total goods and services adjusted for inflation. The greater demand for bank services coupled with a lower risk of default on loans in periods of real GDP growth should mean the coefficient is positive.
- $U_{t-1}$ : annual unemployment rate. Rising unemployment could reduce aggregate demand and increase the loan default rate, so a negative sign is expected.

Table 1 supplies the descriptive statistics for the variables employed in the regression analysis, and Table 2 reports on significance tests for correlation among the variables. On average, banks in China did not add value to their shareholders during the sample period. Two of the big 4, six joint stocks and eight city commercial banks, showed a slight value positive value added (ranging from 0.010 to 0.17) in certain years but they are very much the exception, and there is no pattern showing an improving EVA. The finding is consistent with most studies on European banks. Fiordelisi, (2007), among others, reports negative average EVAs for banks in France, Germany, Italy and UK. Even though the average EVA was positive for the rural banks,<sup>24</sup> two had negative average EVAs (-0.06 and -0.22), and one had a negative EVA at the beginning and end of the period.

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<sup>24</sup> Their positive EVAs were due to higher net income.

*(Table 1 inserted here)*

The average ROAA and ROAE of the sample banks is 0.49% and 11.97%., respectively and the average net interest margin is 2.4%, with a high of 6.7% and a low of 0.82%. The average ROAA is the lowest among the joint stocks (0.34%), followed by the big four (0.36%), rising to 0.49% and 0.94% for the city and rural commercial banks, respectively. The big four are well behind the others when measured by ROAE, averaging 4.8% compared to respectively, 11.5% and 11.7% for the joint stocks and city banks, while the rural commercials do even better at 22.7%. There is a narrow range in the net interest margin, with the big four at 2.2%. The joint stocks and city commercials are only slightly higher at around 2.5%, rising to 2.7% for the rural banks. Within each bank type, there is not much variation in ROAA and NIM (though there is the odd negative number), but there are considerable differences among the ROAE. Like EVA, there is no discernable upward trend in any of these figures: most banks do well in some years but worse in others. About 9% of the sample banks are listed and one quarter has some degree of foreign ownership. The average percentage of foreign ownership is 10.83%.

*(Table 2 inserted here)*

#### **4. Analysis of Empirical Results**

##### **4.1. Mean Difference t-Tests on Performance Measures**

Table 3 reports the mean difference t-tests on the four measures of bank performance. The rural commercial banks are significantly different from the other bank types. ROAA and ROAE, and NIM are significantly lower for the four state banks compared to the national joint stocks and city commercial banks.

With the exception of the net interest margin, the foreign ownership dummy indicates no significant difference between banks with some foreign equity investment and those without. We return to this issue when reporting the estimation results using a more sensitive variable, the percentage of foreign equity investment (FEI). The dummy for whether or not a bank is listed is significant at 1% for 3 of the 4 measures, and at 10% for

ROAA. The t-statistic on bank reform shows the most recent phase (2004-2006) is significantly different from the first phase.

*(Table 3 inserted here)*

#### **4.2 Determinants of Bank Performance**

Table 4 reports the key empirical results<sup>25</sup> based on the estimation of a system GMM and Fixed Effects (FE) model for panel data. The system GMM yields the best overall results because the lagged dependent variable is significant for all four dependent variables. The Hansen test is insignificant as shown by the p-values, suggesting the model does not suffer from overidentification, while the significant F-test(1) confirms the joint significance of the independent variables. The null of no first order correlation is rejected based on an insignificant AR (1) while the significant AR (2) means the null of no second order serial correlation cannot be rejected, a finding which is expected in a first-differenced equation, where it is assumed that the original disturbance terms are not serially correlated. Given these findings, most of the discussion will focus on the results of the GMM estimation.

*(Table 4 inserted here)*

The cost to income ratio is negatively signed and significant for all four types of performance measure, suggesting that more efficient banks perform better. The coefficient on EA, the ratio of equity to assets, is significant for the EVA and NIM performance measures but negatively and positively signed, respectively. The EVA measure may be more sensitive to the effects of too much capital being set aside because it includes the cost of shareholder capital, whereas the measure for net interest margins

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<sup>25</sup> In all, 5 versions of the GMM and two of the Fixed Effects (FE) were tested using different specifications. For example, the log of total assets (LOGTA) was tested in other GMM estimations and found to be insignificant. Likewise for the reform dummy and the lagged inflation rate. In the fixed effects model it is not possible to test for time invariant dummies such as type of bank. The reported estimations are based on the best results in terms of AR(1), AR(2), and the Hansen test for GMM, and for FE, the F-tests and adjusted R<sup>2</sup>.

does not. If so, its negative coefficient is consistent with the view that holding too much capital can result in lost profit opportunities.

For EVA and ROAA, the dummy for whether a bank is listed or not is significant and the positive coefficient suggests that performance improves, possibly because listed banks are more accountable to investors. It is also in line with findings from the mean difference t-tests. The FEI coefficient is only significant when NIM is used as the proxy for performance but appears to be wrong signed (though the coefficient is just 0.01), which is at odds with the results in table 2, where the tests using the dummy for foreign banks show a positive effect on NIM. Anecdotal evidence suggests foreign investors have had, to date, little influence on how these banks are managed.<sup>26</sup> Alternatively, it may be too early to assess their influence because most FEI took place relatively recently. In 1999, foreign equity was invested in just two banks, doubling to 4 by 2003. This figure doubled again in both 2004 and 2005 but remained unchanged at 16 in 2006.

Though insignificant, the coefficient on OIA has the expected sign for three measures, suggesting that diversification into off-balance sheet activities boosts performance. Its insignificance may be because the move into OBS activities has been relatively slow to date, so it is not yet an important factor in explaining performance.<sup>27</sup> The significantly negative coefficient on NIM may suggest that margins fall as banks diversify into other activities, making this proxy for performance less reliable if and when Chinese banks engage in a wider range of OBS activity.

To avoid collinearity, one of the bank type dummies (DB3) was dropped from the estimating equation. The results from table 4 show that for EVA and NIM, the rural commercial banks performed significantly better than either the joint stocks or big four. Though not reported in table 4, DB3 was used instead of DB4 in one estimation and

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<sup>26</sup> For example, most foreign banks have 5-10% shareholding in the respective banks so there is no real control. HSBC owns nearly 20% of the Bank of Communications but just 2 seats on the board and 12 HSBC employees in China.

<sup>27</sup> This is borne out by the relatively small percentage of non-interest income to total income for most banks. In 2005, the ratio of non-interest income to total income was between 3.3% and 12.4% among the big four. For the 12 joint-stocks, the figure ranged from 1% to 19%. Sources: Bankscope; *Almanac of China's Finance and Banking*, 2006.

found to be insignificant. The insignificance of LOGTA (see below) suggests these differences among the bank types are not due to size effects. Based on the findings from table 3, the city commercials (DB3) perform somewhere between the state and joint stocks, but are significantly outperformed by their rural counterparts. The superior performance of the rural commercials may be because the government cleaned up their balance sheets by writing off their bad debt<sup>28</sup> and, more important, they face relatively little competition. The state banks have withdrawn from these areas, while the rural coops supply a very basic banking service, and remain under pressure to provide “policy loans”.<sup>29</sup> Thus the rural commercials operate in what are effectively local monopolies. But the big four, joint stocks, and city commercial customers compete for deposits and loans. In the cities, there is nothing to stop potential customers from doing business with one of these three types of bank. On the cost side labour and space rents will be considerably dearer in the cities.

The macro variable that performs best is the real GDP growth rate, followed by the unemployment rate, both lagged by a year.<sup>30</sup> As expected a rise in the real growth rate boosts bank performance for EVA, ROAA, and NIM. The coefficient on lagged unemployment is significantly negative for EVA and NIM. The results show the importance of including macroeconomic variables when testing bank performance - to date they have been largely neglected in this literature. Furthermore if ROAE (and to some extent ROAA) are used to proxy profitability, the macro indicators may appear to be insignificant when they are not.

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<sup>28</sup> The reform of the rural credit cooperatives (RCCs) began in 2001 when three rural commercial banks were created. They were classified into three types, namely rural commercial banks, rural cooperative banks and credit unions. As with other banks, to help relieve their accumulation of non-performing loans (NPLs), the government (via its central bank, the PBC) adopted a series of policies including government subsidies, preferential taxation and financial aids. By April 2005, the PBC had swapped RMB36.9 billion worth of central bank bills for RMB31.9 billion of NPLs. It also wrote off RMB4.99 billion of losses incurred by 648 RCCs in the 8 provinces selected for the pilot reform. In addition, the PBC extended financial aid to the RCCs in another 21 provinces selected for the second batch of the pilot reform. Source: [www.cbrc.gov.cn](http://www.cbrc.gov.cn)

<sup>29</sup> Policy loans finance key projects designated by the government to be of national importance. In 1994 three policy banks were created for this purpose, so other banks could operate on a national footing. However banks that are largely state owned (from the big four to rural coops) continue to be pressured into making these loans.

<sup>30</sup> The lagged inflation rate and dummy reform variables were dropped because they insignificant in all seven models tested, and were highly correlated with the other macro variables.

The results from the GMM estimation suggest the fixed effects model is misspecified; hence its estimates are biased. Nonetheless, it is useful for a number of reasons. First, the FE model tests for the influence of bank size (LOGTA) but its coefficient is insignificant, meaning performance is unaffected by the size of Chinese banks, a finding which supports the results of Shih et al. (2007).<sup>31</sup> Second, only the fixed effects model provides a goodness of fit measure, which shows that estimations using EVA or NIM outperform the more standard return on equity/assets. The GMM model tends to confirm this: more coefficients are significant and confidence levels are higher for EVA and NIM compared to ROAA and ROAE. The AR(1) test is most significant for ROAA, followed by EVA, and NIM, but based on the number of significant explanatory variables, ROAA is inferior. ROAE is the worst performing measure given its low adjusted  $R^2$ , the lack of significant coefficients, and the GMM diagnostics. Using the same criteria, EVA and NIM do best overall. However, if and when Chinese banks expand their off-balance-sheet activities, the net interest margin is likely to become a less reliable measure of performance.

## 5. Conclusions

The main objective of this paper was to identify the determinants of Chinese bank performance, and to assess whether recent reforms and/or foreign bank participation affected it. The sample covers 76 banks (95% of assets) between 1999 and 2006. The results show that the system GMM model is a better estimation method than fixed effects. The study also sought to identify which of four performance measures worked best. Based on diagnostics and the significance of coefficients, the results suggest the best dependent variables are economic value added and the net interest margin, as against the more traditional ROAA or ROAE. Though bank listing exerted a significant, positive influence on performance, foreign equity investment did not except in the case of margins where it fell. Nor did bank reforms. Efficiency significantly improved performance but off balance sheet activities were insignificant, perhaps because Chinese banks remain

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<sup>31</sup> LOGTA was also insignificant in the GMM estimations when included, which are not reported here because they did less well (by all measures) than the one discussed in the main text.

focused on traditional bank services. Real GDP growth rates and unemployment also registered significant effects. Though there is no evidence that bank size influences performance, the type of bank did. Rural commercials are the only banks with a positive average EVA over the period, and they significantly outperformed the big four, the joint stocks, and city commercial banks, perhaps because they effectively operate as local monopolies. By contrast, the other three types of banks compete for customer business to some degree.

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**Table 1 Descriptive Statistics**

Variable	Description	Mean	S.D.	Min	Max	Obs.
<b>A. Dependent variable</b>						
EVA	Economic value added	-0.149	0.233	-2.634	1.034	342
ROAA	Return on average assets (%)	0.489	0.358	-1.250	1.910	342
ROAE	Return on average equity (%)	11.972	9.511	-23.730	82.350	342
NIM	Net interest margin (%)	2.393	0.818	0.420	6.680	342
<b>B. Independent variables and Instruments</b> (see note in table 4)						
CI	Cost to income ratio (%)	52.175	16.081	22.320	165.050	342
EA	Equity/total assets (%)	4.450	2.350	-10.770	31.340	342
LIQ	Liquid assets/deposits & short-term funding (%)	20.190	9.740	5.280	74.300	342
LLR	Loan loss reserves/gross loans (%)	2.041	1.898	0.000	16.430	342
NLA	Net loans/total assets (%)	53.289	8.907	29.100	76.270	342
OIA	Other operating income/average assets (%)	0.378	0.365	-0.080	2.003	342
LOGTA	Log of total assets	4.728	0.819	3.141	6.833	342
DL	A dummy for whether some of a bank's shares are listed, 1 = listed bank, 0 otherwise	0.102	0.304	0.000	1.000	342
FEI	The percentage of foreign ownership of a bank (%)	2.283	6.160	0.000	24.980	342
DR	Reform dummy, 1 for the 2004-2006 period, 0 otherwise	0.503	0.501	0.000	1.000	342
DB1	Bank type dummy 1, 1 for big four, 0 otherwise	0.091	0.288	0	1	342
DB2	Bank type dummy 1, 1 for national joint stocks, 0 otherwise	0.234	0.424	0	1	342
DB3	Bank type dummy 1, 1 for city commercial banks, 0 otherwise	0.614	0.488	0	1	342
DB4	Bank type dummy 1, 1 for rural commercial banks, 0 otherwise	0.061	0.240	0	1	342
U <sub>t-1</sub>	1-year Lag of annual unemployment rate (%)	3.855	0.470	3.100	4.300	342
RGDP <sub>t-1</sub>	1-year Lag of annual real GDP growth rate (%)	9.264	0.979	7.600	10.400	342
LINF <sub>t-1</sub>	annual inflation rate (%), lagged by one year	1.053	1.703	-1.400	3.900	342
<b>C. Variables used to compute EVA</b>						
OP	Operating profits after-tax (mil CNY)	1599.778	5863.53	-356.419	46678.66	342
K	Total equity capital (mil CNY)	17247.18	61125.37	-510021.6	430124.7	342
BY	The 10-year government bond yield (%)	4.669	1.082	3.495	6.344	342
W	Wang-risk premium (%)	4.662	1.172	0.000	6.830	342
CAPCOST	Cost of capital	0.198	0.014	0.140	0.237	342
T-COST	Total costs (mil CNY)	11430.740	29094.910	41.620	157101.300	342

Sources: Bankscope, Datastream, IMF, Almanac of China's Finance and Banking, China Statistical Yearbook, individual bank's annual reports, Wang (2006).

**Table 2 Correlation Matrix**

	EVA	ROAA	ROAE	NIM	CI	EA	LIQ	LLR	NLA	OIA	DL	FEI	LOGTA	DR	LU	LRGDP
ROAA	0.5895**															
ROAE	0.4929**	0.7152**														
NIM	0.1431**	0.3390**	0.2126**													
CI	0.4413**	-0.468**	-0.332**	-0.352**												
EA	-0.735**		-0.186**	0.1145**	0.2612**											
LIQ		0.1254**	0.1652**	0.1934**		0.1302**										
LLR	0.2490**	0.1468**	0.1335**	0.1270**	-0.1829**	-0.212**										
NLA		-0.170**	-0.109**	0.3269**	-0.1764**		-0.166**									
OIA				-0.553**	0.1239**				-0.289**							
DL			0.0943*		-0.1096**	-0.093*		0.1969**	0.2216**	-0.156**						
FEI					-0.1379**	0.1043*		0.1921**		-0.162**	0.1476**					
LOGTA	0.1155**	-0.0931*	-0.094*	-0.125**	-0.1396**	-0.175**	-0.215**	0.2691**	0.1454**	-0.236**	0.3301**	0.2033**				
DR	0.093	0.2027**	0.1655**	0.3685**	-0.3879**			0.1081**	0.1962**	-0.136**		0.1835**	-0.1226**			
U <sub>t-1</sub>	0.1099**	0.1077**	0.1466**	0.2495**	-0.3908**				0.1947**	-0.0941*		0.1374**	-0.1316**	0.8111**		
RGDP <sub>t-1</sub>	0.1070**	0.1789**	0.1778**	0.3340**	-0.4180**			0.0921*	0.2233**	-0.117**		0.1812**	-0.1286**	0.9140**	0.9296**	
INFL <sub>t-1</sub>	0.1128**	0.1965**	0.1442**	0.3256**	-0.3620**				0.1556**			0.1651**	-0.1149**	0.8010**	0.6225**	0.7457**

Note: \*\* and \* denotes significant at 5% and 10% significance levels, respectively. If blank, no significant correlation was found.

**Table 3 Mean Difference t-test<sup>1</sup> on Bank Performance Measures**

	EVA			ROAA			ROAE			NIM			Obs.
	Mean	Difference	t statistic	Mean	Difference	t statistic	Mean	Difference	t statistic	Mean	Difference	t statistic	
<b>Bank Type(DB)</b>													
Big four <sup>2</sup>	-0.142	0.008	0.172	0.356	-0.146**	-2.101	4.622	-8.083***	-4.687	2.159	-0.259***	-2.867	31
National joint stocks	-0.164			0.407			13.037			2.432			80
City commercial banks	-0.161			0.495			11.325			2.377			210
Rural commercial banks <sup>3</sup>	0.019	0.179***	4.488	0.932	0.472***	5.071	25.238	14.134***	3.869	2.758	0.388**	2.448	21
<b>Dummy –listed banks (DL)</b>													
Not listed	-0.156			0.483			11.670			2.373			307
Listed	-0.090	0.066***	3.382	0.536	0.053*	1.275	14.624	2.954***	3.298	2.575	0.203***	2.618	35
<b>Foreign ownership</b>													
No foreign ownership	-0.146			0.478			11.766			2.368			289
Foreign ownership	-0.166	-0.020	-0.4449	0.546	0.068	1.116	13.097	1.331	1.185	2.534	0.166**	2.048	53
<b>Reform stages</b>													
Stage 2 (1999-2003)	-0.171			0.416			10.391			2.091			170
Stage 3 (2004-2006)	-0.128	0.043**	1.729	0.561	0.145***	3.825	13.535	3.144***	3.102	2.692	0.602***	7.318	172

Notes:

1. The null hypothesis of the mean difference t test is that the mean of the two variables are equal.
2. The difference in this category is between the mean EVA of the state-owned commercial banks and mean of other bank types.
3. The difference in this category is between the mean EVA of the rural commercial banks and mean of other banks.
4. \*\*\*, \*\*, \* are significant at 1, 5, and 10 per cent significance levels, respectively.

Sources: Bankscope, Datastream, IMF, Almanac of China's Finance and Banking, China Statistical Yearbook, individual bank's annual reports, Wang (2006).

Table 4 Empirical Results

System GMM Model								
Independent Variables	EVA		ROAA		ROAE		NIM	
	coefficient	t statistic	coefficient	t statistic	coefficient	t statistic	coefficient	t statistic
L <sub>t-1</sub>	<b>0.069**</b>	2.180	<b>0.840***</b>	4.730	<b>0.632***</b>	3.770	<b>0.559***</b>	3.930
CI	<b>-0.003***</b>	-4.400	-0.002	-0.750	<b>-0.091*</b>	-1.740	<b>-0.005*</b>	-1.770
EA	<b>-0.053***</b>	-8.230	0.010	0.890	-0.601	-0.840	<b>0.061***</b>	3.280
LIQ	0.000	-0.370	0.003	1.360	<b>0.117*</b>	1.790	0.004	1.260
LLR	<b>0.013**</b>	2.340	<b>0.021*</b>	1.810	-0.085	-0.170	<b>0.052***</b>	3.230
NLA	-0.001	-0.470	0.001	0.200	-0.019	-0.260	<b>0.016***</b>	3.890
OIA	0.005	0.220	0.048	1.040	0.376	0.320	<b>-0.521***</b>	-2.640
DL	0.023	1.210	-0.023	-0.330	1.207	0.690	-0.030	-0.420
FEI	-0.001	-1.010	-0.002	-0.680	0.019	0.240	<b>-0.011***</b>	-3.430
U <sub>t-1</sub>	<b>-0.085***</b>	-2.800	-0.042	-0.390	-1.970	-0.730	-0.044	-0.280
RGDP <sub>t-1</sub>	<b>0.053***</b>	3.980	<b>0.071*</b>	1.670	0.944	0.730	<b>0.108*</b>	1.670
DB1	0.006	0.200	0.046	0.730	-1.115	-0.570	<b>-0.312***</b>	-3.390
DB2	-0.023	-0.950	-0.014	-0.160	-0.542	-0.270	<b>-0.255***</b>	-2.790
DB4	<b>0.120***</b>	3.110	-0.037	-0.280	3.647	0.670	<b>0.237***</b>	2.780
CONSTANT	0.079	0.720	-0.485	-1.030	9.623	0.870	-0.438	-0.680
F test1	<b>15.870***</b>		<b>56.160***</b>		<b>49.660***</b>		<b>52.11***</b>	
Hansen test	28.710		27.290		20.470		28.74	
AR(1) test	<b>-2.890***</b>		<b>-4.230***</b>		<b>-1.770*</b>		<b>-2.19**</b>	
AR(2) test	-0.670		-0.840		-0.400		-0.41	
Observations	265		265		265		265	

Fixed Effects Model								
Independent Variables	EVA		ROAA		ROAE		NIM	
	coefficient	t statistic	coefficient	t statistic	coefficient	t statistic	coefficient	t statistic
CI	<b>-0.004***</b>	-4.830	<b>-0.010***</b>	-6.030	<b>-0.152***</b>	-2.960	<b>-0.018***</b>	-6.310
EA	<b>-0.077***</b>	-14.050	0.007	0.660	-0.455	-1.440	<b>0.067***</b>	3.880
LIQ	-0.002	-1.410	<b>-0.004*</b>	-1.620	<b>-0.128*</b>	-1.650	0.000	-0.030
LLR	0.007	1.260	<b>0.022**</b>	2.180	0.144	0.480	<b>0.061***</b>	3.660
NLA	0.000	0.010	<b>-0.006**</b>	-2.160	-0.049	-0.560	0.003	0.670
OIA	-0.006	-0.210	-0.040	-0.680	<b>-3.328*</b>	-1.890	<b>-0.934***</b>	-9.630
DL	<b>0.109**</b>	2.140	<b>0.253***</b>	2.620	-0.579	-0.200	0.026	0.160
FEI	-0.001	-0.470	-0.003	-0.770	-0.029	-0.290	-0.005	-0.880
$U_{t-1}$	<b>-0.182***</b>	-4.310	<b>-0.337***</b>	-4.180	<b>-4.794**</b>	-1.970	<b>-0.409***</b>	-3.050
$RGDP_{t-1}$	<b>0.068***</b>	2.950	<b>0.118***</b>	2.700	1.232	0.930	<b>0.350***</b>	4.800
LOGTA	-0.063	-0.820	-0.057	-0.390	3.866	0.870	<b>-0.984***</b>	-4.020
CONSTANT	<b>0.812**</b>	2.390	<b>1.832***</b>	2.840	17.004	0.870	<b>6.082***</b>	5.670
F test1	<b>28.960***</b>		<b>7.310***</b>		<b>2.980***</b>		<b>25.1***</b>	
F test2	<b>2.810***</b>		<b>3.780***</b>		<b>3.320***</b>		<b>5.380***</b>	
R square	0.555		0.240		0.114		0.519	
Observations	342		342		342		342	

Notes: 1. The results reported in table 4 are based on the estimation of equation (4), for both the system GMM and fixed effects models. The panel contains 70 banks over 8 years, which is consistent with the "small T and large N" criteria to employ the system GMM model. The exogenous variables and the difference of the lagged dependent variable are used as instruments in the level equation; the lagged dependent variable is the instrument in the first-difference equation.  $L_{t-1}$  denotes one-year lag of the dependent variable.

- The robust standard errors corrected for heteroscedasticity are applied.
- \*\*\*, \*\*, \* are significant at 1, 5, and 10 per cent significance levels, respectively.
- Significant F statistic (1) confirms the joint significance of all independent variables.
- Significant F statistic (2) indicates that there are significant individual (group level) effects, implying that fixed effects model is appropriate.
- The Hansen statistics are insignificant, suggesting joint validity of the instruments in all three system GMM models.
- Arellano-Bond test for AR(1) in first differences rejects the null of no first-order serial correlation, but the test for AR(2) does not reject the null that there is no second-order serial correlation. This is consistent with what one expects in a first-differenced equation with the original untransformed disturbances assumed to be not serially correlated.
- In the system GMM models, all variables are instrumented through the system GMM procedure.
- Small sample adjustments to the covariance matrix estimate are applied.
- For system GMM models, the number of instruments is less than that of groups, which avoids the biases caused by too many instruments, since they can overfit endogenous variables and fail to expunge their endogenous components. It also weakens the power of the Hansen test to detect overidentification.
- Substituting the macro variables ( $U_{t-1}$  and  $RGDP_{t-1}$ ) with time dummies provides qualitatively similar results, which are available on request.
- Arellano-Bond tests for AR(1) and AR(2) in first differences. The test for no second-order serial correlation of the disturbances of the first-differenced equation is important for the consistency of the GMM estimator. In addition, the Hansen (1982) J test for the joint validity of the moment conditions (the presence of over-identification) is crucial to the validity of GMM estimates.
- The lagged inflation rate and the reform dummy variable were dropped from the final estimating equation because both were highly correlated with each other (see table 2) and when run in separate estimations, provided insignificant.
- LOGTA was estimated in the fixed effects model but dropped from the final version of the systems GMM because it was insignificant and those versions of GMM which included it did less well (in terms of diagnostics and the number of significant variables) than the results reported in table 4.