Competition, ownership and bank performance in transition

by

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Abstract

This paper examines how competition among banks and their ownership influence the margins and costs of banks in the post-communist transition. To allow the parameters of the margin and cost functions to change over time, we divide the entire sample period in half (1995 to 1998 and 1999 to 2001). In the earlier period, we find that privatised banks earned higher margins than newly established banks or state-owned banks, while newly established foreign banks had significantly lower marginal costs. In the later period, the differences in margins and costs among private banks were no long significant, but state-owned banks earned significantly lower margins. These findings suggest that initially the privatisation of state-owned banks was associated with greater demand for lending and deposit taking services and the entry of new foreign banks with lower costs. However, these effects did not endure and private banks became more similar over time. At the same time, the performance of remaining state-owned bank weakened.

JEL codes: G2, L1, L8, P2
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1. Introduction

Since its start in 1989, the post-communist transition has transformed fundamentally Eastern European banking systems. Under the command economy, state authorities directed credit allocation with scant regard for capacity to repay, using state banks to channel funds to state (or socially) owned enterprises for inputs and investments authorised under planning. To direct resources in this way, banks specialised by economic sectors (or foreign trade), rather than diversified across them. State savings banks specialised in collecting deposits from households, although most savings was forced and done by the state. The payment system consisted of a cash circuit for households and commercial transfers among enterprises handled by the central bank. At the same time, without a profit incentive, state banks were not encouraged to compete for loans and deposits or to control costs. Because of this structure of socialist banking systems, and with the start of transition towards a market economy, banks had to restructure fundamentally their outputs and use of inputs.

Governments and central banks in Eastern Europe have implemented several types of policies aimed at transforming socialist banking systems into market-oriented ones (see, for example, Anderson, Berglöf and Mizsei, 1996, EBRD, 1998, and Berglöf and Bolton, 2002). Banking systems were liberalised by freeing interest rates and decentralised by transferring commercial banking activities from the central bank to state banks. State banks were restructured and privatised and new private banks, both domestic and foreign, were allowed to enter the markets. Moreover, to support arms-length lending relationships between banks and their borrowers and to foster confidence of depositors in banks, legal frameworks were overhauled (including the
strengthening of creditor rights) and systems of prudential regulation and supervision were initiated. In broad terms, the main policy instruments to promote the transformation of banking were therefore liberalisation, privatisation, competition and fundamental institutional change.

To understand this process of change in post-communist countries, we examine the associations between competition among banks and their ownership on the one hand and their behaviour and performance on the other. To do so, we model and investigate empirically the structure of margins on loans and deposits and the costs of providing these services. Given the starting point of transition, attracting demand for loans and deposits and controlling their costs are central to the process of developing market-oriented banks. This requires effective competition among banks, as well as the incentive of profitability and the constraint of effective prudential regulation.

In this paper, we develop a model of monopolistic competition in banking and use it to investigate the equilibrium structure of margins earned on loans and deposits. This model enables us to identify the associations among the extent of competition in banking, the origin and ownership of banks, and their margins. The origin and ownership variable is used as a proxy measure for the incentive and capacity of a bank to attract demand for its loans and deposits and to control its costs. The model also allows us to test directly for the intensity of competition associated with the number of banks in a market and indirectly for product differentiation among banks.

This approach builds on the extensive empirical studies of competition in banking in industrialised economies beginning with Shaffer (1982). Recent studies by Gelos and Roldós (2002), Yildirim and Philippatos (2002b) and Drakos and

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1 This literature includes several recent studies by Bikkar and Groeneveld (2000), De Bandt and Davis
Konstantinou (2003) extend this literature to developing countries and transition economies. The studies of competition in banking find that systems are often characterised by imperfect competition. In a world-wide study of the factors that influence the extent of competition in banking, Claessens and Laeven (2003) shows that banking systems with greater foreign entry and fewer activity restrictions tend to be more competitive.

Theoretical analyses of banking in transition economies, moreover, emphasise the important link between competition and institutional development in banking. In a model of collateralised lending by oligopolistic banks, Hainz (2003a) shows that, if creditor rights are weakly protected, banks have more market power other factors being equal and are able to extract more rents from their borrowers, thereby holding back the scale of intermediation. Hainz (2003b) also demonstrates that in model of spatial competition among banks the intensity of competition depends not only on the number of banks (that is, the average distance between them), but also on the extent and effectiveness of creditor rights. A key feature of both models is that a better institutional framework (that is, the more effective protection of creditor rights) strengthens competitive pressures among banks.

In addition to the analysis of bank revenues, we estimate a standard trans-log cost function. The estimated parameters of the cost function together with the underlying data on costs, deposits and loans enable us to calculate the marginal costs of deposit taking and lending by bank origin and ownership. This provides a basis for examining variations in margins and marginal costs across bank types and over time.

To implement empirically our model of monopolistic competition in banking and to investigate the structure of bank costs, we use a panel dataset consisting of 270
banks in 15 East European countries (Bulgaria, Croatia, the Czech Republic, Estonia, FYR Macedonia, Hungary, Kazakhstan, Latvia, Lithuania, Poland, Romania, Russia, the Slovak Republic, Slovenia and Ukraine) and covering the years 1995 to 2001. Fries and Taci (2004) developed the data set, which is unique in its coverage of time-varying bank ownership in transition economies. Their related study examines the relative cost efficiency of banks (that is, their relative productivity).

The empirical estimations of our monopolistic competition model of bank revenues and of the cost function allow for structural changes between two sub-periods that divide the entire sample approximately in half. They yield a number of interesting results regarding the performance of banks by their origin and ownership. In the earlier sub-period, the average margins on loans and deposits earned by privatised banks are significantly higher than those of newly established banks or state-owned banks. In the later sub-period, the differences in margins among private banks declines, but the margins of all types of private banks are significantly above those of state-owned banks. This pattern in margins suggests that privatised banks initially had either an advantage in attracting demand for their loans and deposits (for example, due to service improvements and established reputations) or a cost disadvantage in providing loans and deposits. The evidence on costs points primarily to the former interpretation.

Evidence from the estimated cost equation indicates that only newly established foreign banks had significantly lower marginal costs than other types of banks in the earlier sub-period. Moreover, there are no significant differences in marginal costs among the five types of banks in the second sub-period. The evidence on marginal costs by bank origin and ownership is therefore consistent with that on margins. Newly foreign established banks appear to have fostered competition
through lower marginal costs, while privatised banks appear to have done so by attracting more customers, possibly through improvements to lending and deposit taking services and their established reputations.

In comparison with private banks, state-owned banks operated in both sub-periods with margins that were low relative to their estimated marginal costs. The low margins of state-owned banks may reflect the absence of a profit motive for such banks and the lack of capabilities to attract demand for their services. At the same time, the relatively poor performance of state-owned banks has necessarily not forced them to exit from the market.

The analysis of bank margins, moreover, indicates that competitive pressures among banks increased with the number of banks in the market. The analysis of bank margins is also consistent with the hypothesis that the loan and deposits markets are monopolistically competitive, a basic assumption of our model.

2. Literature on competition, profitability and costs of banks in transition

The existing empirical literature on transition banking that is closely related to this study consists of three strands. The first examines the extent of competition in these banking markets. The second strand studies the relative profit and cost efficiency of banks within transition economies. The third considers factors that influence net interest margins in transition banking.

In the first strand, Gelos and Roldós (2002), Yildirim and Philippatos (2002b) and Drakos and Konstantinou (2003) use the methodology of Panzar and Rosse (1987) to assess the competitive conditions in transition banking. The Panzar-Rosse H-statistic measures the percentage change in a bank’s equilibrium revenues associated with a one per cent change in all the bank’s input prices. This statistic can
be used to infer the competitive structure of the industry in which the bank operates. An H-statistic value of one is associated with perfect competition and a value of zero or less with monopoly or perfect collusion. Values in the range between zero and one characterise cases of monopolistic competition.

The Gelos and Roldós study covers three transition economies (the Czech Republic, Hungary and Poland, as well as five Latin American countries) and the period 1994 to 1999. For the transition economies, the estimated values of the H-statistics lie between the values of one (perfect competition) and zero (monopoly); although, in the case of Hungary the H-statistic is sufficiently close to one that the hypothesis of perfect competition cannot be rejected. Moreover, this study finds that the competitive conditions remain broadly stable between two sub-periods, 1994 to 1996 and 1997 to 1999.

The studies of Yildirim and Philippatos and of Drakos and Konstantinou cover most of the transition economies covered in this paper. Their respective sample periods are also broadly similar. Both find that most banking markets in Eastern Europe are characterised by monopolistic competition. However, for FYR Macedonia and the Slovak Republic, Yildirim and Philippatos cannot reject the hypothesis that banks act as if they were monopolies or perfectly collusive oligopolies. Drakos and Konstantinou cannot reject this hypothesis in the case of Estonia and Latvia. Unlike Gelos and Roldós, Yildirim and Philippatos also find that the extent of competition in transition banking has increased over time.

Studies of the relative profit and cost efficiency of banks within transition economies include Grigorian and Manole (2002), Yildirim and Philippatos (2002a), Bonin, Hasan and Wachtel (2004) and Fries and Taci (2004). Again, they cover most of countries covered by this study and their sample periods are broadly similar. The
efficiency measures and estimation methodologies used in these studies vary. The studies of Fries and Taci and of Grigorian and Manole examine cost efficiency using the stochastic frontier approach and data envelopment analysis, respectively. Yildirim and Philippatos and Bonin, Hasan and Wachtel use the stochastic frontier approach to analyse both cost and profit efficiency. Yildirim and Philippatos also employ the distribution free approach.

Each of these studies finds significant variation across countries in bank efficiency and Fries and Taci, Grigorian and Manole, and Yildirim and Philippatos seek to explain this variation by examining country-level variables as correlates of bank efficiency or costs. Bonin, Hasan and Wachtel, which focuses primarily on the effects of foreign ownership, simply allow for fixed effects for both country and time. Grigorian and Manole observe that bank cost efficiency is significantly and positively associated with GDP per capita and weakly and positively associated with a measure of progress in institutional reform. Fries and Taci find no association between cost efficiency and GDP per capita, but a significant non-linear association between progress in institutional reform and costs (declining early in the process of banking reform and then increasing). Regarding the association with measures of market competition, the findings are mixed. Fries and Taci and Yildirim and Philippatos find that greater competition in a banking market (measured by the share of foreign banks in total assets and the Panzar-Rosse H-statistic, respectively) is associated with greater cost efficiency. Yildirim and Philippatos find that greater competition is negatively associated with profit efficiency, a finding consistent with competition reducing margins. In contrast, Grigorian and Manole observe that higher banking market concentration is associated with great cost efficiency.

The association between ownership and efficiency is broadly consistent across
the four studies. All find that banks with majority foreign ownership are more cost efficient than those with majority domestic ownership. However, Yildirim and Philippatos and Bonin, Hasan and Wachtel observe that majority foreign ownership of banks is not associated with greater profit efficiency. In addition, Fries and Taci find that private banks newly established after the start of transition (new established banks) are more cost efficient than state-owned banks and privatised banks with majority domestic ownership, but less efficient that privatised banks with majority foreign ownership. However, Grigorian and Manole observe no difference in the cost efficiency of newly established banks and that of old banks (privatised and state owned).

In the third strand of existing empirical research on transition banking, Drakos (2003) examines the net interest margins of banks in eleven post-communist countries over period 1993 to 1999. This study finds that net interest margins decrease significantly over time and that bank ownership has a significant effect. In particular, Drakos observes that state-owned banks set significantly lower net interest margins that do other banks.

3. A model of monopolistic competition in banking

In this section, we derive a model of banking market equilibrium under monopolistic competition that is used to examine the structure of revenues earned by banks and their costs. A bank is regarded as multi-product firm that manages both its assets and liabilities, including lending and deposit taking. A bank can also invest in non-loan assets, such as securities. At the same time, a bank faces the balance sheet constraint that total assets must be equal to total liabilities plus equity capital. To satisfy the balance sheet constraint, it has the opportunity of borrowing or lending in
The profit of a bank therefore includes the returns obtained from its lending activities and non-loan assets, the interest paid on its deposits, and the interest earned from or paid out on its net position in the inter-bank market, as well as the operating cost of undertaking its activities. Let $D_{ijt}$, $L_{ijt}$ and $N_{ijt}$ denote deposits, loans and non-loan financial assets of bank $i$ in country $j$ at time $t$, excluding its gross inter-bank positions. $R_{jt}$ is the inter-bank rate in country $j$ at time $t$, while $r_{ijt}^d$, $r_{ijt}^l$ and $r_{ijt}^n$ are respectively the interest paid on deposits and the interest earned on loans and non-loan assets. The expression $C(D_{ijt}, L_{ijt}, N_{ijt}, W_{ijt})$ refers to operating costs, where $W_{ijt}$ is a set of factor prices. $E_{ijt}$ is the equity capital of a bank.

The profit of a bank, $\Pi_{ijt}$ can accordingly be written as

$$\Pi_{ijt} = r_{ijt}^l L_{ijt} + r_{ijt}^n N_{ijt} - r_{ijt}^d D_{ijt} - R_{jt} \cdot (L_{ijt} + N_{ijt} - D_{ijt} - E_{ijt})$$

$$- C(D_{ijt}, L_{ijt}, N_{ijt}, W_{ijt}),$$

(1)

where the expression $(L_{ijt} + N_{ijt} - D_{ijt} - E_{ijt})$ represents the net debtor position of the bank in the inter-bank market. With a view to empirical estimation, the profit function of a bank can be rewritten as

$$\Pi_{ijt} = (r_{ijt}^l - R_{jt}) L_{ijt} + (r_{ijt}^n - R_{jt}) N_{ijt} - (R_{jt} - r_{ijt}^d) D_{ijt} + R_{jt} E_{ijt}$$

$$- C(D_{ijt}, L_{ijt}, N_{ijt}, W_{ijt}),$$

(2)

In order to examine how a bank earns its profits, we consider separately the revenues
Given equation (2), the revenues of a bank, $\text{REV}_{ij}$, are simply

$$\text{REV}_{ij} = (r_{ij}^l - R_{ij})L_{ij} + (r_{ij}^n - R_{ij})N_{ij} - (R_{ij} - r_{ij}^d)D_{ij} + R_{ij}E_{ij}. \quad (3)$$

Since revenues, loans, non-loan assets, deposits and equity are observable, this equation can be estimated directly. If this were done for our sample of banks, the coefficients on the loan, non-loan financial asset and deposit variables would be estimates of the average margins that the banks have earned on these activities. The coefficient for bank equity would be an estimate of the inter-bank rate.

We now assume that each bank sets the rates for its loans and deposits to determine the respective margins, but that the returns on non-loan financial assets and the inter-bank rate are exogenous to each bank. This assumption reflects the empirical evidence that banking markets in most countries are characterised by monopolistic competition, including the post-communist countries in Eastern Europe (see Gelos and Roldós, 2002, Yildirim and Philippatos, 2002, and Drakos and Konstantinou, 2003). Accordingly, we allow for the loan and deposit margins charged by each bank and the amount of its loans and deposits to be determined jointly by the interaction between a bank’s supply curve and the demand that it faces. In other words, we focus on lending and deposit taking as the activities in which banks can potentially exercise market power. Banks are assumed to be price takers in the market for non-loan assets, such as government securities, and in the inter-bank market.

The estimated coefficients for loans and deposits in the revenue equation can therefore be seen as equilibrium margins and variation in these equilibrium margins across banks and countries and over time can be further explored. In particular, the
effects of exogenous variables on equilibrium margins can be identified by specifying an equilibrium margin function. In what follows, we specify a model of monopolistic competition among banks, derive equilibrium margins as a function of the underlying parameters of the model and examine the comparative static properties of the equilibrium margins.

It is important to emphasize that this estimation allows for neither the direct identification of market power nor the estimation of supply functions. This would require the estimation of a structural model where demand and supply functions are jointly estimated, using observed margins and quantities (see Bresnahan, 1989, for an exposition of this approach and Neven and Röller, 1999, for applications to banking). This cannot be done in this paper because we do not have data on loan and deposit margins. Nevertheless, the structure of the equilibrium margins may give some indirect insight into the nature of competition in transition banking.

Consider now the loan market (the analysis can be applied in the same way to the deposit market). Assume that a bank takes the inter-bank rate and the rate on non-loan assets as given and that its loan policy is independent of its strategy with respect to deposits. This will be the case if the cost function is separable in loans and deposits. Assume that its marginal operating costs with respect to loans is constant (a linear marginal cost could also be accommodated). The profit of the bank in the loan market is then given by

\[ \Pi_{ijt} = \left( M_{ijt} - c_{ijt} \right) L_{ijt}, \]

where \( M_{ijt} = r_{ij} - R_{ijt} \) is the bank’s margin in the loan market and \( c_{ijt} \) is the marginal

\[ \text{(4)} \]
cost of making a loan. Assume further that each bank faces an inverse demand function of the type

\[ M_{ijt} = a_{ijt} - L_{ijt} - \lambda_{ijt} L_{-ijt}, \tag{5} \]

where \( L_{-ijt} \) denotes the total volume of loans sold by all other banks in the same country and time period and where \( 0 < \lambda_{ijt} < 1 \).

This demand specification is adapted from Shubik and Levitan (1980) and allows for product differentiation. A bank may be able to differentiate its loans in such a way that the demand curve is shifted out and the intercept \( a_{ijt} \) increases. The specification also allows for reduced substitution between a bank’s loans and those of its competitors in the market (that is, \( \lambda_{ijt} \) falls). Such reduced substitution can be associated with product differentiation (for example, through advertising) or market segmentation (for example, because of geographical distance among competitors). The characteristics of each bank’s loans that determine such differentiation cannot be observed directly.

Faced with this demand specification, each bank will maximise profit by solving the following first order condition

\[ a_{ijt} - 2L_{ijt} - \lambda_{ijt} L_{-ijt} - c_{ijt} = 0. \tag{6} \]

Summing up the first-order conditions for all banks in country \( j \) at time \( t \) yields

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2 This approach is therefore semi-structural and similar in this respect to Panzar and Rosse (1987).
3 The model can accommodate marginal costs that are in general a linear function of the amount of loans.
\[
(a^l_{jt} - c^l_{jt}) - 2L^l_{jt} - \lambda^l_{jt} (n^l_{jt} - 1)L^l_{jt} = 0,
\]

(7)

where \((a^l_{jt} - c^l_{jt}) = \sum_t (a^l_{jt} - c^l_{jt})\), \(L^l_{jt}\) is total loans provided by the banking system in country \(j\) at time \(t\) and \(n^l_{jt}\) is the number of banks in the country at that time. The volume of total loans in equilibrium is therefore given by

\[
L^l_{jt} = \frac{a^l_{jt} - c^l_{jt}}{2 + \lambda^l_{jt} (n^l_{jt} - 1)}. \tag{8}
\]

Combining equation (8) with the first order condition for each bank yields as the equilibrium amount of loans made by bank \(i\) in country \(j\) at time \(t\)

\[
L^l_{ijt} = \frac{(a^l_{ijt} - c^l_{ijt})}{2 - \lambda^l_{ijt}} \left(\frac{\lambda^l_{ijt} (a^l_{ijt} - c^l_{ijt})}{2 - \lambda^l_{ijt} \left[2 + \lambda^l_{ijt} (n^l_{jt} - 1)\right]}\right). \tag{9}
\]

From equations (5) and (9) a bank’s equilibrium loan margin can therefore be expressed as

\[
M^l_{ijt} = a^l_{ijt} - \left(1 - \lambda^l_{ijt}\right) \left(a^l_{ijt} - c^l_{ijt}\right) \left(2 - \lambda^l_{ijt}\right) \left[2 + \lambda^l_{ijt} \left(n^l_{jt} - 1\right)\right]. \tag{10}
\]

The comparative static properties of the model with respect to the fundamental parameters, \(a^l_{ijt}\), \(c^l_{ijt}\) and \(n^l_{jt}\), are straightforward to calculate. For the equilibrium loan
margins it is possible to show that \( \frac{\partial M_{ijt}^l}{\partial a_{ijt}^l} > 0 \), \( \frac{\partial M_{ijt}^l}{\partial c_{ijt}^l} > 0 \) and \( \frac{\partial M_{ijt}^l}{\partial n_{ijt}} < 0 \). In other words, a bank’s equilibrium loan margin increases with its ability to increase the demand for its loans and with its inability to control the marginal costs of loans and decreases with the number of competitors in the market. It can also be shown that a bank’s profits in a market equilibrium are increasing in its ability to shift out its demand curve and to control its costs; that is, \( \frac{\partial \Pi_{ijt}^l}{\partial a_{ijt}^l} > 0 \) and \( \frac{\partial \Pi_{ijt}^l}{\partial c_{ijt}^l} < 0 \). A profit maximising bank would therefore seek to control its marginal cost and reduce its margins in order to boost its market share and profits. Such a bank would also aim to expand demand for its loans and its market share.

It is in addition possible to express the equilibrium loan margin as a function of the equilibrium loan market share, \( \frac{L_{ijt}}{L_{ijt}} \), which is observable but depends on the underlying model parameters. In this expression, it is straightforward to show that, provided \( \lambda_{ijt}^l < 1 \), the loan margin is an increasing function of the market share.

Moreover, the strength of the association between loan market share and margin increases as the value of \( \lambda_{ijt}^l \) decreases. A positive correlation between loan margin and market shares is therefore an indirect test that the loans provided by banks are imperfect substitutes.

In the empirical implementation of the revenue model, we use observable variables that may be correlated with the underlying structural parameters of the model, since the parameters, \( a_{ijt}^l \), \( c_{ijt}^l \) and \( \lambda_{ijt}^l \), cannot be observed directly. In particular, we use the origin and ownership of banks as a variable that may be correlated with the incentive and capability of banks to increase the demand for their
loans and to control their costs, that is $a_{jt}^{\ell}$ and $c_{jt}^{l}$. The number of banks in a country $j$ at time $t$ (relative to the country’s population), $N_{jt}$, is used as measures of market competition. In addition, we include the market share of a bank in the loan market to test indirectly that $\lambda_{jt}^{l} < 1$. We control for other country level factors using fixed effects for countries and time, including their interaction.

For costs, we use a standard trans-log specification. In particular, the cost function takes the form

$$\ln C_{jt} = \alpha_0 + \sum_{i} \beta_i \ln Q_{s,ijt} + \sum_{m} \chi_m \ln W_{m,ijt} + \frac{1}{2} \sum_{i} \sum_{s} \beta_{s,ijt} \ln Q_{s,ijt} \ln W_{s,ijt}$$

$$+ \frac{1}{2} \sum_{m} \sum_{s} \delta_{s,m} \ln W_{m,ijt} \ln W_{s,ijt} + \sum_{n} \sum_{m} \delta_{s,m} \ln Q_{s,ijt} \ln W_{m},$$

where $Q_{s,ijt}$ are output quantities (that is, the amounts of loans, non-loan financial assets and deposits) and $W_{s,ijt}$ are input prices (wages and the cost of physical capital). In estimating equation (12), we impose constraints on symmetry, $\beta_{s,t} = \beta_{t,s}$ and $\chi_{m,n} = \chi_{n,m}$, and, homogeneity in input prices, $\sum_{m} \chi_{m} = 1$, and adding-up,

$$\sum_{m} \chi_{m,n} = \sum_{n} \chi_{n,m} = \sum_{m} \delta_{m,s} = 0.$$

In the empirical implementation of this cost function, we allow for estimated parameters to vary with bank origin and ownership to make possible comparisons with the estimated revenue function, in which the equilibrium loan and deposit margins vary with this observable characteristic of banks. This specification for the cost function enables us to compare the marginal costs of loans and deposit across different types of banks, one of the factors that may contribute to the variation in equilibrium margins. Again, we control for country level factors using fixed effects.
for countries and time, including their interaction.

4. Empirical implementation

In the empirical implementation of revenue equation, we express revenues in the general form of equation (3) and assume that banks engage in monopolistic competition for loans and deposits. The returns earned on non-loan assets and the inter-bank interest rates are assumed to be exogenous to individual banks. The equation for bank revenues therefore takes the form

$$REV_{ijt} = M^{l}_{ijt}(L_{ikt}) + M^{d}_{ijt}(D_{ikt}) + \rho N_{ijt} + \sigma E_{ijt} + \epsilon_{ijt}, \quad (13)$$

where $\rho$ and $\sigma$ are the average return that banks can earn on non-loan financial assets and the average inter-bank rate, respectively.

We write individual equilibrium loan and deposit margins as a function of the observable characteristics of banks that may be correlated with the underlying parameters of the model and measures of the intensity of competition in the banking market. Specifically, the equilibrium loan margin of bank $i$ in country $j$ at time $t$ is

$$M^{l}_{ijt} = \sum_{p}^{q} \phi_{p}^{l} own_{p,ijt} + \phi^{l} S^{i}_{ijt} + \gamma^{l} N_{ijt} + \epsilon^{l}_{ijt} \phi, \quad (14)$$

where $own_{p}$ is a vector of time-varying origin and ownership dummy variables (privatised with majority foreign ownership, privatised with majority domestic ownership, newly established bank with majority domestic ownership, newly established bank with majority foreign ownership, and majority state owned), $S^{i}_{ijt}$ is
the loan market share of bank \( i \) in country \( j \) at time \( t \), and \( N_j \) is the total number of banks. The error term is assumed to have the usual properties.

This specification allows us to examine whether the comparative static properties of the equilibrium margins in monopolistic competition model are consistent with the data. The anticipated association between the origin and ownership of banks and their margins depends on both the variation in marginal costs across bank types and that of the capacity of banks to increase demand for their services. For example, newly established banks may have both lower marginal costs and less capacity to increase demand for their services than old banks. On the cost side, newly established banks would have benefited from not having to restructure existing banking organisations, while on the revenue side they may have faced the disadvantage of not having established reputations in the market. We would in addition anticipate that margins are negatively correlated with the measures of market competition and positively associated with market shares.

The same specification can be used for the equilibrium margins in the deposit market, simply substituting the superscript \( d \) for \( l \). However, because the costs of deposit taking and lending are not separable and because the amounts of loans and deposits by bank are highly correlated, we examine the comparative static properties of the model using a single scale variable equal to the combined value of loans and deposit rather than estimate separately the structure of margins for both loans and deposits. In the estimation, the origin and ownership dummy variables, number of banks (scaled by population) and market share (weighted average of the loan and deposit market shares) are interacted with the single scale variable. The estimated coefficients on these variables show how the average margin on loans plus deposits varies across banks with different observable characteristics and with the measure of
the intensity of competition in the banking market. The coefficients on the non-loan assets and the equity variables are estimates of the average rates of return and the risk-free interest rate, respectively.

Given that we introduce disturbances on the margin equation, the overall error term takes the form

\[ \varepsilon_{gt}^{d} (L_{gt} + D_{gt}) + \varepsilon_{gt}, \]  

(15)

To account for the induced heteroscedasticity of the errors, we estimate equation (14) using generalised least squares, and because of the presence of an error term in the coefficients on loans plus deposits, we instrument the scale variable using its own lagged value, the bank origin and ownership variables, the proxy measures of banking market competition and the country and time fixed-effects. We also instrument the average loan and deposit market share variable since it is endogenous. A Durbin-Wu-Hausman test indicates that it is appropriate to instrument these variables in the estimations reported below.

To estimate the revenue equation, we use the Baltagi (1981) error-components two-stage least squares estimator (EC2SLS) (see Baltagi, 1995, Chapter 7). Country and time fixed effects are used to control for other country level factors. We also allow for bank-specific random effects in the estimations reported below. A Hausman test clearly rejects a bank fixed-effects specification in favour of the EC2SLS estimation with random effects.

In the empirical implementation of the trans-log cost function, we allow the estimated parameters of the cost function to vary with the origin and ownership of banks, but omit most of the higher order terms in the final trans-log specification. In
preliminary estimations most of these terms were not statistically significant.
Consistent with the estimation of the revenue equation, we use as the output variables the values of deposits and loans, as well as the value of non-loan financial assets. The two input prices are the average US dollar wages in the financial sectors of the countries included in the sample and the real interest. The real interest is the ex-post real interest rate that prevailed in the country at the beginning of each year. As with the revenue equation, we use country and time fixed effects to control for other country level factors. The error term is assumed to have the usual properties.

We estimate the revenue and cost equations while allowing for bank specific effects and using both fixed and random effects specifications. As with the revenue equation, we report only the random-effects specification because the Hausman test rejects the fixed-effects model in favour of this specification.

5. Data sources and variable descriptions

The primary source of data on the banks’ balance sheets, income statements and ownership is the BankScope database produced by the Bureau van Dijk, which includes data on 10,227 banks world-wide. The database is updated monthly and the latest issue of the BankScope database used in this study was May 2003. The BankScope data are supplemented with the data and information from annual reports of the banks and from EBRD staff research on bank ownership. The central banks and the national statistical agencies of the countries provided aggregate data on their banking systems, including the total loans and deposits and the total number of banks in the banking systems.

In our sample, we include all banks in the BankScope database for which at least three years of data are available between 1994 and 2001. In addition, where
banks report according to both local accounting standards and international accounting standards for at least five years, we select data in international accounting standard rather than national accounting standards for banks. This accounts for 57 percent of the banks in the sample.

The sample includes 270 banks from 15 transition countries (see Table 1), 18 banks in Bulgaria, 34 in Croatia, 23 in the Czech Republic, four in Estonia, eight in FYR Macedonia, 23 in Hungary, nine in Kazakhstan, 17 in Latvia, 10 in Lithuania, 35 in Poland, 4 in Romania, 41 in Russia, 14 in the Slovak Republic, 17 in Slovenia and 13 in Ukraine. All bank accounting data are in nominal terms in US dollars converted at current exchange rates.

The composition of banks in our sample also varies over the sample period of 1995 to 2001. There are 81 banks for which data are available for the entire sample, while there are 189 banks that enter the sample after 1994 and/or exit from the sample before 2001. The additions to the sample are not necessarily new market entrants, but rather successful banks that are added to the BankScope database over time. Exits from the sample are due primarily to either bank failures or mergers with other banks. This method of selecting banks from the BankScope database introduces selection bias in the data, as does the selection by BankScope of banks to include in the data set, which are primarily the larger and financially sounder banks in the region. The estimation results are therefore representative not of the entire population of banks in transition economies, but rather of the relatively successful top tier of banks in the region.

The data on total revenues and operating costs of banks come from the income statement and balance sheets of the sample banks, as reported in the BankScope database. Total bank revenues include net interest income plus non interest income.
Costs include general operating expenses, but not interest expenses. Bank dividend payments are also excluded from the measure of total cost.

We use four items from the balance sheets of banks included in the BankScope database. Customer loans and customer deposits include all loans made to and deposits received from non-bank entities. Non-loan financial assets are the other earning assets of a bank less inter-bank deposits placed with other banks. This amount includes the securities held by a bank. Bank equity includes total paid-in capital plus retained earnings.

Bank origin and ownership are divided into five separate types. Private banks with no state-owned antecedents are referred to as newly established banks and they are distinguished by whether their majority owners are domestic or foreign entities. Private banks that were formerly state-owned or part of a state-owned bank are referred to as privatised banks. They too are distinguished by whether their majority owners are domestic or foreign entities. The fifth bank ownership type is state owned. Data on the origin and ownership is from EBRD staff research and varies over time for each bank.

Regarding measures of competition and market structure, the central banks of the countries covered by the study provided data on the number of banks and the total amounts of loans and deposits in the banking systems. These data on total amounts of loans and deposits, together with the bank-level data, were used in calculating the loan and deposit market shares of individual banks.

For input prices, we use the local currency wages in the financial sectors as reported by the national statistical agencies of the countries included in the sample and convert these amounts into US dollars using period average exchange rates. We also use the real interest rate as measure of the opportunity cost of using physical
capital in the production of banking services. The real interest rate is measured ex post as the difference between the nominal interest in the money market at the beginning of the year and the consumer price inflation rate in that year.

In the cost equation, we also include the equity to asset ratio as proxy measure for other unobservable characteristics of banks that relate to their ability to control costs. A higher equity ratio, for example, may be positively correlated with the capabilities of bank managers.

Table 2 summarises the dataset that we use in the analysis. It reports sample means for the dependent and explanatory variables for each of the five bank origin and ownership categories used in the estimations. The table also provides average ratios to total assets for revenues, operating costs and profits before taxes. These data indicate that privatised banks and state banks tend to be larger than newly established banks with greater market shares. They also show that foreign banks tend to have lower revenues and operating costs relative to total assets than do domestic banks and that state banks are on average the least profitable banks.

6. Results

Revenue equation

Table 3 reports the results of the estimations of the revenue equation for the two sub-periods, 1995 to 1998 and 1999 to 2001. Our preliminary investigations of bank margins indicated that they vary significantly over time. Partitioning the sample in this way divides it roughly in half in terms of numbers of observations and this allow us to see how any effects of competition and bank origin and ownership change over time. We in addition report two versions of the revenue equation. In one

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4 While the data set includes observations from 1994, this year is dropped from the sample period for
specification the dependent variable is total revenue and in the other it is total revenue less an adjustment for the effect of inflation on bank capital. This adjustment subtracts from bank revenue the extent to which the real value of bank capital at the mid-point of each year has been eroded by inflation over that year. The reason for making this adjustment is that in inflationary environments banks tend to increase their margins in order to maintain the real value of bank capital. Therefore, the estimated coefficient on bank capital may reflect both the inter-bank interest rate and the effect of inflation on the real value of bank capital. In the estimations without this adjustment to revenues, the estimated coefficient on bank capital is significantly above its theoretically predicted value.

The estimations yield a number of interesting results regarding the effects of bank origin and ownership. The estimated coefficients on the value of loans and deposits are the average margins earned by state-owned banks above a set of constants that control for country and time fixed effects. The estimated coefficients on the other explanatory variables indicate how their margins change from this base value. The comparative static properties of the model are investigated using the combined value of loans and deposits rather than these variables separately because they are highly collinear. In the earlier sub-period and with unadjusted revenue as the dependent variable, the average margin earned on loans is 3.6 per cent, while that on deposits is not significantly different from zero. Other factors being equal, the average margins on the combined value of loans and deposits of newly established domestic and foreign banks are not significantly different from those of state banks. However, the average margins of privatised banks with majority domestic and foreign ownership are about one to 1.5 percentage points above those of state-owned banks.

the estimations because lagged explanatory variable values are included in the regressions as instrumental variables.
and newly established banks. In the estimations with revenues adjusted for the erosion of bank capital by inflation as the dependent variable, we obtain similar parameter estimates.

If bank origin and ownership are associated with the incentive and capability of a bank to increase the demand for its loans and deposits and to control its costs, this pattern of margins in the earlier sub-period suggests that privatised banks increased their margins relative to those of state-owned banks either because they were able to increase the demand for their loans and deposits or because their costs rose. Similarly, newly established banks may have been able to reduce their margins below those of state-owned banks because they were either able to control their costs or unable to increase demand for their loans and deposits. While evidence on costs reported below show that newly established foreign banks have marginal costs that were significantly lower than those of other types of banks in the earlier sub-period, privatised banks may have had a greater incentive and capacity to attract demand for their loans and deposits because of their more established reputations in the market and their private ownership relative to those of newly established banks and state-owned banks.

In the later sub-period and the estimation that does not adjust revenues for inflation, the average margin earned by state-owned banks on loans is -2.7 per cent, while that on deposits is not significantly different from zero. The margins earned by all private banks are significantly above those of state-owned banks. Other factors being equal, the margins earned by newly established domestic and foreign banks on their loans plus deposits are 3.2 percentage points and 2.3 percentage points higher, respectively, than those of state-owned banks. At the same time, the margins of privatised banks, both domestic and foreign, are about 2 percentage points higher. Again, in the estimations that use inflation-adjusted revenues as the dependent

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variable, similar variation in average margins by bank ownership is observed.

There is therefore significant convergence in the later sub-period among the average margins earned by private banks above a set of constants that control for country and time effects. The convergence in margins among private banks may reflect either a convergence in marginal costs among banks (considered below) or in the ability of newly established banks to attract greater demand for their loans and deposits over time. For example, newly established banks that remained in the market may have developed reputations that enabled them to compete more effectively for customers with the privatised banks. In contrast, state-owned banks may have had neither the incentive nor capacity to increase the demand for their lending and deposit taking services, while the absence of a profitability constraint may have allowed these banks to remain in the market despite depressed loan margins.

Regarding the effects of competitive pressure as measured by the number of banks per population in a country, there is evidence of competitive pressures associated with the number of banks per million of population. While in all regression specifications the estimated coefficient is negatively signed, it is statistically significant only in the specifications that use inflation-adjusted revenues. In earlier sub-period, as the number of banks per million of population increased by one the average margin on loans plus deposits declined by about 1.4 basis points. In the later sub-period the magnitude of this effect is somewhat smaller, at about 0.9 basis points. This finding is consistent with our model of monopolistic competition in which competitive pressures increase with the number of banks in the market, but it inconsistent with the empirical findings of Yildirim and Philippatos (2002b), which finds that competitive pressures increased over time in transition banking.

The correlation between the weighted average market share of loans and
deposits and the average margin earned on them is positive and significant in all the estimations. In each, an increase in market share of one percentage point is associated with a one to 1.5 basis point increase in the margin earned on loans and deposits. This is consistent with the loans and deposits of banks being imperfect substitutes, a basic assumption of our model of monopolistic competition in banking. This finding is also consistent with the previous empirical results of Gelos and Roldós (2002), Yildirim and Philippatos (2002b) and Drakos and Konstantinou (2003).

The average margin on non-loan financial assets in the earlier sub-period is not significantly different from zero, while that in the later sub-period is in the range 5.6 per cent to 8.0 per cent. With the possible exception of the earlier sub-sample, which includes periods of macroeconomic instability in most of the countries included in the sample, these are plausible estimate values.

In the estimation with use unadjusted revenues, coefficient on bank equity for the earlier sub-period is 32.7 per cent, while that for the later sub-period is 29.8 per cent. These coefficients are estimates of the inter-bank rate, but are somewhat high compared to the actual rates. In the estimations that adjust revenues for inflation, the coefficient on bank equity in the earlier sub-period is 25.5 per cent, while that for the later sub-period is 18.3 per cent.

The estimated revenue equations also include a dummy variable that indicates whether a bank reported according to international accounting standards. In the three estimations in which this variable is statistically significant, the average margin on loans plus deposits earned by banks that report according to international standards is about one percentage point lower, other factors being equal.

*Cost equation*
Table 4 reports the estimation results for the trans-log cost equation for the two sub-periods, 1995 to 1998 and 1999 to 2001. As with the revenue equation, this partitioning of the dataset allows us to see how the costs of providing banking services changes over time.

The reported form of the estimated trans-log cost function includes the first- and second-order terms of the value of loans and deposits. The explanatory variables also include the value non-loan financial assets, the two input prices (US dollar wages and the real ex post interest rate at the country level), the ratio of bank equity to total assets and dummy variables for bank origin and ownership. An initial specification of the trans-log cost function included all of the higher order terms and those that allowed for interactions with bank origin and ownership and with the two sub-periods, but most were eliminated because they were statistically insignificant. Because the value of loans and deposits are highly collinear, we also estimate a cost function in which their values are combined into a single scale variable as a consistency check.

The estimation provides a number of interesting results regarding the association between bank origin and ownership and cost efficiency. Compared with state-owned banks, most types of private banks are more cost efficient. This effect can be seen from the fact that the dummy variables for bank origin and ownership are significantly negative for the three of the four types of private banks in the earlier sub-period, newly established banks and privatised banks with majority domestic ownership. The effect is largest for newly established foreign banks. Perhaps surprisingly, privatised banks with majority foreign ownership do not appear to exploit potential cost savings relative to state-owned banks. In the later sub-period, newly established banks (particularly those with majority foreign ownership) continue to be more cost efficient than other banks, although this competitive advantage is
smaller in size compared with that in the earlier period. At the same time, there are no differences in the cost of efficiency of privatised and state-owned banks.

For the purpose of comparison with the variation in average margins on loans plus deposits estimated from the bank revenue equation, the marginal costs can be calculated from the estimated coefficients of the cost equation (that is, the estimated cost elasticities) and from the average costs and the average values of loans and deposits for the different types of banks. In the earlier sub-period and the specification of costs that in which combines value of loans and deposits, the marginal cost evaluated at the sample mean of a newly established foreign bank in providing a unit of loans plus deposits is 2.6 per cent and that of a privatised bank with majority foreign ownership was 3.9 per cent. The marginal costs evaluated at the sample means for domestic banks are somewhat higher, 4.4 per cent for newly established banks and 5.1 per cent for privatised banks. The marginal cost evaluated at the sample means of state-owned banks is 5.4 per cent. The marginal costs of newly established foreign banks are significantly lower than those of state-owned banks. The differences in marginal costs among other banks are not statistically significant. This finding is consistent with the entry of new foreign banks introducing lower marginal costs in the provision of banking services and increasing competitive pressure on other banks, at least in the short-run.

In the later sub-period, the differentiation among banks in terms of their marginal costs evaluated at the sample means diminishes. The marginal cost of newly established foreign banks remains broadly unchanged at 2.3 per cent and somewhat below that of other banks. The marginal costs of other types of banks were 3.1 per

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5 We calculate the marginal costs by bank origin and ownership based on the cost function using the combined value of loans and deposits because multicollinearity leads to high standard errors of the estimated parameters of the cost function when their values are entered separately. The estimated marginal costs by bank origin and ownership are approximately the same in these two specifications,
cent for newly established domestic banks and for state-owned banks, 3.3 per cent for
privatised banks with majority domestic ownerships and 3.4 per cent for privatised
banks with majority foreign ownership. The differences in marginal costs among the
various types of bank are not statistically significant.

This finding is consistent with the entry of newly established foreign banks
introducing marginal costs significantly lower than those of other banks in the earlier
sub-period and with competitive pressures promoting similar costs structures among
banks over time, including state-owned banks. In the later sub-period, the
convergence in marginal costs among banks is mirrored in the relative convergence in
the margins earned by banks, expect for those of state-owned banks. State-owned
banks operated with a relatively low average margin, which suggests that these banks
do not have the incentive or capacity to attract demand for their services and that low
profitability did not force them to exit from the market.

The estimated cost equations can also provide evidence of the elasticity of
operating costs with respect to input prices. However, the estimated coefficients on
the input costs, which are time-varying country-level variables, are statistically
insignificant except for that on real interest rate in the earlier sub-period. One reason
for this general lack of significance may be that the country and time fixed-effects
variables are capturing the variation in input prices at the country level.

The cost equation also includes the value of non-loan financial assets and the
ratio of equity to total assets. Like the value of loans and deposits, the value of non-
loan financial assets is positively and significantly correlated with operating costs.
The estimated elasticity of operating costs with respect to non-loan financial is about
0.10. The ratio of equity to total assets is included as a proxy for non-observable

however the standard errors the estimates are much lower when the combined scale variable is used.
characteristics of banks that may be associated with their ability to control costs. The estimated coefficient on the ratio of equity to total assets in the cost equation in the earlier sub-period indicates that the operating costs of banks are negatively correlated with their equity to total assets ratios. However, in the later sub-period, there is no such association.

7. Conclusion

Our paper examines factors that affect the margins and costs of banks in the post-communist transition. The analysis of bank revenues is based on an equilibrium model of monopolistic competition in banking. Our analysis of costs uses a standard trans-log specification. Given the starting point of transition, attracting demand for loans and deposits and controlling their costs are central to the process of change in these banking systems. This requires competition among banks, including effective legal institutions to support banking activities, as well as the incentive of profitability and the constraint of effective prudential regulation.

The analysis of bank revenues and costs yields several key findings. First, the average margins on loans and deposits earned by banks grouped by their origin and ownership indicate that in the earlier sub-period, privatised banks had significantly higher margins than newly established banks or state owned banks. In terms of our model of monopolistic competition, this finding indicates that privatised banks had either a greater capacity to attract demand for their services (due possibly to service improvements and established reputations) or higher marginal costs. In the later sub-period, the variation in margins among banks diminished significantly, although state-owned banks earned significantly lower margins than private banks.

Evidence from the estimated cost equation indicates that newly established
foreign banks initially had significantly lower marginal costs than state-owned banks, but that the differences in marginal costs among the other types of banks are not significant. Bank privatisation was therefore associated with neither higher nor lower marginal costs. However, as with margins, the differences in costs among banks diminished significantly over time, possibly due to the effects of competition among banks and market selection.

Taken together, the evidence on margins and costs suggests that bank privatisation suggests that initially the privatisation of state-owned banks was associated with greater demand for lending and deposit taking services and the entry of new foreign banks with lower costs. However, these effects did not endure and private banks became more similar over time. At the same time, the performance of remaining state-owned bank weakened and operated with relatively low margins. This suggests that state-owned banks did not face the same constraints on profitability as private banks that remained in the market.
References


Gelos, R.G., and J. Roldós (2002). ‘Consolidation and market structure in emerging
markets banking systems’, International Monetary Fund Working Paper 02/186, November.


### Table 1: Frequency distribution of data by country and by bank origin and ownership

<table>
<thead>
<tr>
<th></th>
<th>Total sample</th>
<th>Bulgaria</th>
<th>Croatia</th>
<th>Czech Republic</th>
<th>Estonia</th>
<th>FYR Macedonia</th>
<th>Hungary</th>
<th>Kazakhstan</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total number of observations</strong></td>
<td>1190</td>
<td>76</td>
<td>154</td>
<td>90</td>
<td>16</td>
<td>41</td>
<td>123</td>
<td>31</td>
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<tr>
<td><strong>Total number of banks</strong></td>
<td>270</td>
<td>18</td>
<td>34</td>
<td>23</td>
<td>4</td>
<td>8</td>
<td>23</td>
<td>9</td>
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<td><strong>Percentage of observations by bank origin and ownership</strong></td>
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<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Newly established, domestic</td>
<td>30.6</td>
<td>30.3</td>
<td>50.0</td>
<td>13.3</td>
<td>37.5</td>
<td>43.9</td>
<td>0.0</td>
<td>29.0</td>
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<tr>
<td>Newly established, foreign</td>
<td>25.9</td>
<td>19.7</td>
<td>13.6</td>
<td>56.7</td>
<td>6.3</td>
<td>0.0</td>
<td>52.8</td>
<td>16.1</td>
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<tr>
<td>Privatised, domestic</td>
<td>18.0</td>
<td>3.9</td>
<td>18.8</td>
<td>8.9</td>
<td>12.5</td>
<td>24.4</td>
<td>6.5</td>
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<td>10.5</td>
<td>5.2</td>
<td>10.0</td>
<td>31.3</td>
<td>4.9</td>
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<td>State owned</td>
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<td>35.5</td>
<td>12.3</td>
<td>11.1</td>
<td>12.5</td>
<td>26.8</td>
<td>13.8</td>
<td>22.6</td>
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<table>
<thead>
<tr>
<th></th>
<th>Latvia</th>
<th>Lithuania</th>
<th>Poland</th>
<th>Romania</th>
<th>Russia</th>
<th>Slovak Republic</th>
<th>Slovenia</th>
<th>Ukraine</th>
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<td>45</td>
<td>164</td>
<td>15</td>
<td>144</td>
<td>71</td>
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<td>51</td>
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<tr>
<td><strong>Total number of banks</strong></td>
<td>17</td>
<td>10</td>
<td>35</td>
<td>4</td>
<td>41</td>
<td>14</td>
<td>17</td>
<td>13</td>
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<tr>
<td><strong>Percentage of observations by bank origin and ownership</strong></td>
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<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Newly established, domestic</td>
<td>47.9</td>
<td>55.6</td>
<td>22.6</td>
<td>13.3</td>
<td>47.9</td>
<td>0.0</td>
<td>28.6</td>
<td>47.1</td>
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<td>Newly established, foreign</td>
<td>39.4</td>
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<td>60.0</td>
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<td>35.2</td>
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<td>Privatised, domestic</td>
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<td>24.4</td>
<td>14.6</td>
<td>0.0</td>
<td>31.3</td>
<td>22.5</td>
<td>30.6</td>
<td>35.3</td>
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<td>Privatised, foreign</td>
<td>5.6</td>
<td>8.9</td>
<td>7.3</td>
<td>0.0</td>
<td>0.0</td>
<td>11.3</td>
<td>0.0</td>
<td>9.8</td>
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<tr>
<td>State owned</td>
<td>7.0</td>
<td>11.1</td>
<td>21.3</td>
<td>26.7</td>
<td>12.5</td>
<td>31.0</td>
<td>24.5</td>
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Table 2: Descriptive statistics of the dataset – averages by bank origin and ownership

<table>
<thead>
<tr>
<th>Variable</th>
<th>Total Sample</th>
<th>Newly established, domestic</th>
<th>Newly established, foreign</th>
<th>Privatised, domestic</th>
<th>Privatised, foreign</th>
<th>State owned</th>
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<tr>
<td><strong>Bank balance sheets (in US$ millions)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total assets</td>
<td>789.0</td>
<td>246.0</td>
<td>501.6</td>
<td>933.1</td>
<td>1952.6</td>
<td>1474.8</td>
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<td>Total customer loans</td>
<td>338.2</td>
<td>120.0</td>
<td>216.3</td>
<td>397.6</td>
<td>814.9</td>
<td>617.6</td>
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<tr>
<td>Total non-loan financial assets less inter-bank deposits</td>
<td>202.2</td>
<td>52.2</td>
<td>92.6</td>
<td>255.0</td>
<td>526.1</td>
<td>419.7</td>
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<tr>
<td>Total customer deposits</td>
<td>476.1</td>
<td>142.1</td>
<td>250.9</td>
<td>625.0</td>
<td>1272.0</td>
<td>869.5</td>
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<tr>
<td>Total equity</td>
<td>77.9</td>
<td>32.1</td>
<td>48.0</td>
<td>91.7</td>
<td>177.2</td>
<td>142.0</td>
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<td><strong>Bank income statements (in US$ millions)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total revenues (net interest income + non-interest income)</td>
<td>49.8</td>
<td>18.0</td>
<td>25.0</td>
<td>68.6</td>
<td>115.6</td>
<td>92.4</td>
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<tr>
<td>Total operating costs</td>
<td>40.8</td>
<td>15.4</td>
<td>17.1</td>
<td>53.4</td>
<td>88.8</td>
<td>85.4</td>
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<td><strong>Market structure</strong></td>
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<td></td>
<td></td>
<td></td>
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<tr>
<td>Number of banks per million of population</td>
<td>7.2</td>
<td>8.6</td>
<td>5.7</td>
<td>8.4</td>
<td>4.8</td>
<td>7.0</td>
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<tr>
<td>Share of foreign banks in total bank assets (in per cent)</td>
<td>33.1</td>
<td>29.4</td>
<td>40.9</td>
<td>22.6</td>
<td>56.4</td>
<td>28.1</td>
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<tr>
<td>Average loan market share (in per cent)</td>
<td>3.1</td>
<td>1.2</td>
<td>1.9</td>
<td>4.4</td>
<td>6.3</td>
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<td>Average deposit market share (in per cent)</td>
<td>5.1</td>
<td>2.0</td>
<td>3.0</td>
<td>6.6</td>
<td>10.2</td>
<td>9.5</td>
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<td><strong>Performance ratios (in per cent)</strong></td>
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<td></td>
<td></td>
<td></td>
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<tr>
<td>Net profit before taxes to total assets</td>
<td>1.1</td>
<td>1.0</td>
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<td>1.7</td>
<td>1.3</td>
<td>0.5</td>
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<td>Revenues to total assets</td>
<td>6.3</td>
<td>7.3</td>
<td>5.0</td>
<td>7.4</td>
<td>5.9</td>
<td>6.3</td>
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<td>Operating costs to total assets</td>
<td>5.2</td>
<td>6.3</td>
<td>3.4</td>
<td>5.7</td>
<td>4.6</td>
<td>5.8</td>
</tr>
</tbody>
</table>

Note: Sample means are for bank-year observations.
Table 3: Panel Estimations of Bank Revenue Functions using an Error Components Two-stage Least Squares Estimator

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Dependent variable</td>
<td>Total revenues</td>
<td>Total revenues – eroded equity</td>
</tr>
<tr>
<td>Explanatory variables</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Loans</td>
<td>0.0391*** (0.0131)</td>
<td>0.0342** (0.0138)</td>
</tr>
<tr>
<td>Deposits</td>
<td>-0.0058 (0.0147)</td>
<td>-0.0133 (0.0156)</td>
</tr>
<tr>
<td>Interacted with loans plus deposits</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Newly established, domestic</td>
<td>-0.0054 (0.0104)</td>
<td>-0.0085 (0.0126)</td>
</tr>
<tr>
<td>Newly established, foreign</td>
<td>-0.0134 (0.0127)</td>
<td>-0.0122 (0.0134)</td>
</tr>
<tr>
<td>Privatised, domestic</td>
<td>0.0145*** (0.0052)</td>
<td>0.0172*** (0.0044)</td>
</tr>
<tr>
<td>Privatised, foreign</td>
<td>0.0118** (0.0062)</td>
<td>0.0153** (0.0063)</td>
</tr>
<tr>
<td>Number of banks per million of population</td>
<td>-0.0009 (0.0006)</td>
<td>-0.0014** (0.0007)</td>
</tr>
<tr>
<td>Share of loan and deposit market</td>
<td>0.0014*** (0.0002)</td>
<td>0.0015*** (0.0002)</td>
</tr>
<tr>
<td>IAS dummy variable</td>
<td>-0.0088*** (0.0045)</td>
<td>-0.0044 (0.0048)</td>
</tr>
<tr>
<td>Non-loan financial assets</td>
<td>0.0043 (0.0197)</td>
<td>0.0064 (0.0209)</td>
</tr>
<tr>
<td>Equity</td>
<td>0.3243*** (0.0321)</td>
<td>0.2550*** (0.0340)</td>
</tr>
<tr>
<td>No. of observations</td>
<td>627</td>
<td>627</td>
</tr>
<tr>
<td>No. of groups</td>
<td>245</td>
<td>245</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.70</td>
<td>0.62</td>
</tr>
</tbody>
</table>

Note: Standard errors are in parentheses. *** indicates significance at the 1 per cent level, ** at the five per cent level and * at the 10 per cent level. Coefficients on the country and time fixed-effects are not reported.
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Dependent variable</strong></td>
<td><strong>Ln (operating costs)</strong></td>
<td><strong>Ln (operating costs)</strong></td>
</tr>
<tr>
<td>Ln (loans)</td>
<td>0.3991*** (0.1333)</td>
<td>0.3590*** (0.1198)</td>
</tr>
<tr>
<td>Ln (loans) ^ 2</td>
<td>-0.0289 (0.0315)</td>
<td>-0.0320 (0.0277)</td>
</tr>
<tr>
<td>Ln (deposits)</td>
<td>-0.0809 (0.1297)</td>
<td>-0.0258 (0.1359)</td>
</tr>
<tr>
<td>Ln (deposits) ^ 2</td>
<td>0.0470*** (0.0148)</td>
<td>0.0466*** (0.0139)</td>
</tr>
<tr>
<td>Ln (loans + deposits)</td>
<td>0.3264*** (0.1243)</td>
<td>0.2794** (0.1313)</td>
</tr>
<tr>
<td>Ln (loans + deposits) ^ 2</td>
<td>0.0307*** (0.0105)</td>
<td>0.0340*** (0.0109)</td>
</tr>
<tr>
<td>Ln (non-loan financial assets)</td>
<td>0.0952*** (0.0323)</td>
<td>0.1151*** (0.0309)</td>
</tr>
<tr>
<td>Ln (borrowing)</td>
<td>0.0204 (0.0596)</td>
<td>0.1011 (1.1932)</td>
</tr>
<tr>
<td>Ln (1+ real interest rate)</td>
<td>1.242*** (0.4744)</td>
<td>-1.4695 (4.3242)</td>
</tr>
<tr>
<td>Equity to total assets ratio</td>
<td>-0.0103*** (0.0023)</td>
<td>0.0048 (0.0033)</td>
</tr>
<tr>
<td>Newly established, domestic</td>
<td>-0.2857*** (0.1033)</td>
<td>-0.2026* (0.1059)</td>
</tr>
<tr>
<td>Newly established, foreign</td>
<td>-0.4402*** (0.1076)</td>
<td>-0.2604*** (0.1079)</td>
</tr>
<tr>
<td>Privatised, domestic</td>
<td>-0.2642*** (0.1001)</td>
<td>-0.0212 (0.1089)</td>
</tr>
<tr>
<td>Privatised, foreign</td>
<td>0.0745 (0.1452)</td>
<td>0.1328 (0.1100)</td>
</tr>
<tr>
<td>No. of observations</td>
<td>605</td>
<td>605</td>
</tr>
<tr>
<td>No. of groups</td>
<td>244</td>
<td>244</td>
</tr>
<tr>
<td>R-squared</td>
<td>0.84</td>
<td>0.85</td>
</tr>
</tbody>
</table>

Note: Standard errors are in parentheses. *** indicates statistical significance at the 1 per cent level, ** at the five per cent level and * at the 10 per cent level. Coefficients on the country and time fixed-effects are not reported.