Squeezing both Sides? Bank Concentration and Market Power

Ariel A. Casarin*
Universidad Adolfo Ibáñez

María Eugenia Delfino‡
ESE Business School

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Abstract

We consider the dual nature of the banking industry and estimate a structural model that examines market power both in the loan market and the deposit market in Argentina. We find that a substantial concentration of the industry led to reduced competition and higher bank profitability, which based on significant reductions in marginal costs despite lower loan rates and higher deposit rates. We also find that the usual assumption of exogenous deposit interest rates provides a downward assessment of the extent of market power in the loan market, and that banks price deposits above their standalone marginal benefit to take advantage of imperfect competition in the loan market.

Key Words: market power; cost economies; conduct parameters; banks
JEL: L10, D22; C23, G21

*Escuela de Negocios, Universidad Adolfo Ibáñez, Chile. ariel.casarin@uai.cl.
†ESE Business School, Universidad de los Andes, Chile. mdelfino.ese@uandes.cl
‡Corresponding author

1 Introduction

Financial and economic crises highlight the decisive role of banks in the provision of credit, the functioning of the payment system, the transmission of monetary policy, and the maintenance of financial stability. This pivotal role of banks in the economy encourages governments and supranational institutions to adopt prudential regulations aimed at securing bank solvency, but also to react to random or systemic shocks using market interventions (Claessens et al., 2005; Borio, 2020). In either case, preventive regulatory involvement and bank resolution programs typically lead to consolidation processes that, in the end, accelerate industry concentration. This may eventually cause temporary or permanent distortions of the market's level playing field.[1] The resulting rapid consolidation of banks around the globe has intensified public policy debates on the effects of concentration and competition in the financial industry.[2]

Concentration by itself does not imply uncompetitive behavior.[3] On the one hand, a high level of concentration could allow banks to take advantage of oligopoly and oligopsony power by raising the interest rate on loans and reducing the rate on deposits, leading to excess profits. On the other hand, the increasing size of banks, eased by the scalability of tech-based resources, may allow larger banks to increase their cost efficiency. These efficiency gains can be transferred to borrowers and depositors if competition limits the exploitation of market power. Thus, a detailed consideration of the oligopoly and oligopsony nature of the market requires modeling and measuring both the loan market and the deposit market, as well as the cost structure of the industry. Such a model facilitates the evaluation of whether any efficiency gains are translated to customers, or if the exploitation of market power at either side of the market results in excess profits.

We consider the dual nature of the banking industry and estimate a structural model to jointly examine market power in both the markets for loans (i.e., output) and the market for deposits (i.e., input). Our empirical model augments the conjectural variation method using Morrison's (2001) restricted cost function approach. This allows us to test for market power in the output and input markets. We therefore relax the usual—but quite unrealistic—assumption that banks are price takers in deposit markets and thus limit the possibility of misestimating the level of (any) market power in loans if banks have market power in deposits.[4] Therefore, our measurement of cost economies is not independent of the market structure in input markets, and allows us to disentangle whether deviations from marginal cost pricing (if any) originate in pricing power or cost efficiencies (Spierdijka and Zaourasa, 2018).

Our empirical setting is the Argentine banking industry in the 1990s. As in many other markets, the country's longstanding policies associated with financial repression gave way to changes in entry and exit conditions, the privatization of banks, and the adoption of international regulatory standards. However, the Argentine empiri-

[1]See, for example, "Concentrating binds" (The Economist, 2013a) and "Cracking the Oligopoly" (The Economist, 2013b).

[2]Bank competition is multifaceted (see Berger et al., 2004). Our focus here is on market power.

[3]Competition policy in the nonfinancial sector largely focuses on competitive pricing. In financial markets, however, concentration also raises concerns related to issues of moral hazard and excessive risk taking. In general, the evidence suggests an inverse U-shaped relationship between bank competition and stability (Ratnovski, 2013). See also Hasan and Marinc (2013) for the particularities of competition policy in banking.

[4]This point is raised by Shaffer (1999) and Toolsema (2002).

cal setting is unique in at least three ways. First, the one-peso-one-dollar rule of the "convertibility" currency board adopted in 1991 enabled an atypically rapid regeneration of financial intermediation: the fixed-exchange regime changed the competitive landscape dramatically as inflationary revenues approached to zero.[5] Both macro- and micro-reforms prompted the industry to grow in a more competitive environment, which in turn led towards greater consolidation. Between 1993 and 2000, the number of banks almost halved, and the concentration of deposits and loans increased sharply among the largest institutions.[6] Despite a profound financial market liberalization—and supposedly rapid technological changes, the spread between the cost of funds and the interest rates on loans remained (relatively) high.[7]

Second, the Argentine banking industry epitomizes the traditional financial intermediation model that is typical in less-developed countries where both private savings and borrowers who seek funding have few options outside retail banking. In such a market, high intermediation margins are not *prima facie* evidence of uncompetitive behavior. On the one hand, following the liberalization of a repressed financial system, banks might be unable to supply intermediation services efficiently due to increased regulatory costs or due to a lack of expertise, qualified resources, or adequate technology. On the other hand, banks predictably stand to develop market power in both the deposit and the loan markets because they are the main buyer of private savings and the main seller of loans. Hence, the measurement of market power must acknowledge both the extent of cost economies and the potential for joint rent extraction in the loan and deposit markets. If the evidence favors cost efficiencies, then concentration could increase welfare. However, if the evidence validates market power, an argument for pursuing antitrust policies emerges.

Finally, our empirical setting is also unique because of the accidental nature of the deposit shock that followed the adoption of the currency board. Beginning in 1991, an exceptional wave of nationwide privatizations in disparate economic sectors (from utilities to manufacturing to real estate) triggered an unparalleled increase in net capital inflows from the nonfinancial private sector. In only a few years, these inflows more than doubled the Central Bank's liabilities, and they manifested in an unprecedented significant increase in bank deposits (Calcagno, 1997). The accidental nature of the deposit shock is plausibly exogenous to lending opportunities and, as we document below, was well in excess of the country's economic activity. We exploit these unsolicited shocks in the supply of deposits to address the endogeneity between bank lending and financing (see Gilje (2017) for a related identification strategy).[8]

Our paper contributes to the literature in several ways. First, we believe our study

[5]Our study period follows Argentina's hyperinflation of 1989 and 1990, one of the world's largest ever. We do not expand our study beyond 2000 due to the severity of the financial crisis of 2002, which triggered the word's largest default in history. Instead, our empirical analysis covers the country's most stable economic and financial decade over the last hundred years.

[6]Between 1994 and 2000, the number of banks fell by 45% in Argentina, 21% in Brazil, 22% in Chile, and 36% in Mexico (Williams, 2012). In the last two decades, the total number of banks in Argentina has remained fairly invariant.

[7]The depth of the industry's transformation positioned Argentina's reforms as one of the most radical attempts to overhaul a banking system. By the end of the 1990s, Argentina ranked second in terms of the quality of its banking regulatory environment (after Singapore, tied with Hong Kong, and ahead of Chile) (World Bank, 1998).

[8]A shortfall of our approach is the inability to identify which banks initially received the privatization revenues. Therefore, our specifications below assume that such revenues were redistributed via market forces.

is one of the few that adopts the intermediation approach to examine joint market power in both the loan and deposit markets.[9] Instead of considering banks as price takers in the market for deposits (e.g., Shaffer, 1993; Neven and Roller, 1999; Cocoresse 2005, 2009; Spierdijka and Zaourasa, 2018), we include the stock of deposits (and not their supposedly exogenous price) as an argument in the cost function, along with an equation to reflect pricing behavior in this input market.[10] We believe this approach in banking studies is novel.[11] Marrouch and Turk-Ariss (2014) address joint market power, but their test relies on very simple equilibrium comparative statistics, which they apply to aggregate country-level data; they do not consider cost issues. Our assessment of the sources of market power on both sides of the market should then expand the competition policy debates in the industry as well as the policy options that authorities consider when confronted by a financial crisis (see Maudos and Vives, 2019).

We also add to the sparse empirical evidence on market power in Latin American banking markets, whose presumably high profitability remains under recurrent scrutiny.[12]. To a large extent, such evidence focuses on cross-country comparisons. For the most part, these studies find that (a) industry concentration does not weaken competition (Yeyati and Micco, 2007; Yildirim and Philippatos, 2007; Gelos and Roldos, 2004), (b) the entry of foreign banks after restructuring improved competition (Martinez Peria and Mody, 2004; Jeon et al., 2011), and (c) concentration improves efficiency (Williams, 2012). Very few studies provide evidence on market power (Ariss, 2010; Apergis, 2015). Country-specific evidence indicates that liberalization and private bank entry enhanced competition in Mexico (Gruben and McComb, 2003) and Brazil (Coelho et al., 2013). However, Maudos and Solis (2009) find post-liberalization cost-inefficiency and market power in Mexico. To the best of our knowledge, ours is the first attempt to examine the degree of competition in Argentine banking.

Our results indicate that industry concentration led to an increased exploitation of market power and resulting bank profitability. Despite lower loan rates, this profitability rested on a proportionally larger reduction in both deposit rates and marginal costs. We also find that, in our setting, the assumption of exogenous deposit interest rates yields both lower estimates of loan marginal costs and a downward assessment of the extent of market power in the loan market. This paper is organized as follows. Section 2 introduces our empirical setting. Section 3 presents a brief review of empirical studies that measure market power in banking. Section 4 outlines our model and our empirical approach, and Section 5 describes the data. Section 6 presents our findings and elaborates on the results. The last section presents our concluding remarks.

[9] Studies in banking rely on either the *production* approach or the *intermediation* approach. The production approach considers banks as producers of services to depositors and borrowers, and it considers deposits as bank outputs. The intermediation approach assumes that banks transform the money borrowed from depositors into funds that are then lent to borrowers, hence treating deposits as a bank input; see Shaffer (2004).

[10] See Morrison (2001) for a related approach in other empirical settings.

[11] Adams et al. (2002) test for market power in deposits (input), and they find that the measurement of market power on one side of the market is not affected by assuming that the other side of the market is perfectly competitive. Shaffer (1999) and Toolsema (2002), however, show that if banks have monopsony power in the market for deposits, this would lead to overestimation of market power in the loan market.

[12] See, for instance, www.celag.org/la-mano-visible-de-la-banca-invisible/, accessed January 2021.

2 Empirical setting

The banking system has traditionally experienced a reduced role within the Argentine economy because of financial repression, political uncertainty, and macroeconomic instability. Before the 1990s, the country's financial system was underdeveloped relative to other countries that had comparable income levels (Clarke et al., 1999). Large bank rescues were common, and quality banking services were virtually nonexistent. However, the imposition of a currency board (enshrined in the Convertibility Law of 1991), as well as the significant opening and further liberalization of the economy that followed, paved the way for a decade of unprecedented macroeconomic stability and recovery, which included the banking system. Macroeconomic policy operated hand-in-hand with sectoral reforms grounded on the elements of private market discipline.

The privatization of state-owned enterprises (endorsed by the 1989 State Reform Law) was a central pillar of the new market-oriented economic policy. Between 1990 and 1999, the sale of federal and provincial assets totaled USD 24 billion, an amount that practically equaled the increase in the total stock of deposits observed during the decade. About 70% of the privatization income came from foreign investors in the form of cash (Gobierno de la Nación Argentina, 2005). During this decade, privatization revenues represented 40% of the total flows in the balance of payments' capital accounts, which peaked at unprecedented levels relative to the four decades that preceded our study period. See Figure 1.

[Insert Figure 1 about here]

Private market discipline in the banking industry was enhanced by several policies. A new Central Bank Charter limited re-discounting and public sector loans, and it forbade the use of money supply to finance public deficits. The (newly independent) Central Bank improved the regulation and supervision of capital and reserve requirements as well as the inspection of financial entities through the Superintendence of Financial Institutions. More severe norms concerning capital adequacy, diversification of credit risk, provisions for non-performing loans, and minimum auditing standards were adopted. In addition, foreign entry restrictions were loosened, and a process towards the privatization of state-owned banks was initiated. Not least, the reaction of banking authorities, who eschewed bailouts when external shocks triggered bank runs, reinforced the policymakers' commitment with market discipline.

As a whole, these reforms led to bank failures, mergers and acquisitions, and to the privatization of about half of all state-owned banks. This consolidation was accelerated by a marked increase in the entry of additional foreign banks. As a result, between 1993 and 2000, the total number of banks decreased from 169 to 89, while branches only increased from 4,245 to 4,523, and the share of foreign banks' assets increased from 10% to more than 30%.[13] Despite the noteworthy reduction in the number of banks, financial intermediation increased significantly. The volume of loans and deposits increased by 60% and 77%, respectively. Still, intermediation margins decreased from 13.8% to 11%. The concentration of deposits and loans also increased sharply,[14] as well as the inequality in their size distribution.

[13] These data include second-floor banks. Our empirical analysis concerns retail banks only. Section 5 outlines summary statistics for these data.

[14] The Herfindhal–Hirschman Index (HHI) for loans increased noticeably, but it remained low in absolute terms, as it rose from about 453 in 1993 to 664 in 2000. Similarly, the share of total banking assets held by the five largest banks increased from 38% to 45%.

In 2001, concerns about the sustainability of the currency board led to a pronounced bank run. In the second half of 2001, deposits fell by 20%, with more than 80% of banks facing deposit losses. Foreign banks experienced proportionally higher deposit withdrawals than domestic banks. In the face of increasing capital flight, on December 1, 2001, the government imposed a deposit freeze that limited cash withdrawals from all bank accounts. In January of 2002, Argentina ended its decade-long peg to the dollar and defaulted on its USD 141 billion in foreign debt outstanding. This public default resulted in heavy losses to the banking system and a devastating economic crisis, which in turn led to significant declines in credit. Between 2002 and 2016, the country suffered exclusion from international financial markets.

3 Market power in banking

Empirical studies use various techniques to assess the nature of competition in banking. These methods can be divided into the traditional approach and approaches based on the New Empirical Industrial Organization (NEIO). Traditional methods stem from the structure-conduct-performance (SCP) paradigm, which predicts that more concentrated markets are more collusive. This literature explores different relationships between structural concentration measures and profit margins or price levels. The mismatch between the findings of SCP studies (which is not exclusive to banking) reveals the ambiguity of causation, which shows that concentration is an unreliable predictor of performance (Bikker et al., 2012).

The SCP was then enriched in two ways. On the one hand, the relative-market power hypothesis relativizes market structure and proposes that product differentiation manifests in high market shares, which ultimately lead to higher profits. On the other hand, the quiet-life hypothesis posits that firms with market power incur inefficiencies rather than reap monopolist rents (see Berger and Hannan, 1998). Still, the positive link between concentration and performance may be spurious if cost efficiency, rather than market structure, explains higher profits (Demsetz, 1973). Several studies have since tested *viz-a-viz* these competing hypotheses, and they have mostly found evidence in favor of the efficient-structure hypothesis (Maudos and de Guevara, 2007; Koetter et al., 2012; Williams, 2012).

The NEIO approach explores the behavior of output or prices as formally derived from profit-maximizing equilibrium conditions. The Panzar–Rosse reduced-form revenue test relies on the fact that an individual firm will price differently in response to a change in its costs depending on whether it operates in a competitive market or a monopolistic market (Rosse and Panzar, 1977; Panzar and Rosse, 1982). This test uses information on shifts in revenue in response to shifts in factor prices to test for market power. Goddard and Wilson (2009) show that this test is not free from bias, while Bikker et al. (2012) and Shaffer and Spierdijka (2015) relativize the empirical validity of this approach by showing that neither the sign nor the magnitude of the test can reliably identify the degree of market power (see also Maudos and Vives, 2019).

The Breshnahan–Lau method assumes that firms maximize profits by setting prices or quantities based on cost considerations and on the degree of competition, which depends on demand conditions and the nature of interaction between firms. This method rests on (static) profit-maximizing conditions to capture firms' behavior through derived conduct parameters, which can be interpreted as conjectural coefficients or as the deviation of a firm's perceived marginal revenue from the demand schedule (Breshnahan 1982; Lau, 1982). This method focuses on firms' conduct, as opposed to the traditional approaches that concentrate on the overall market structure. Corts (1999) warns that this method can lead to inconsistent estimates if firms engage in efficient (dynamic) tacit collusion. Nonetheless, Puller (2009) shows that static pricing and imperfect collusion are special cases of a more general model. Puller also demonstrates that, when panel data are available, Corts' critique can be addressed econometrically with time fixed effects in the pricing equations.

Banking studies that rely on a Breshnahan–Lau type of model initially relied on aggregate data and/or considered that banking products as homogenous (Spiller and Favaro, 1984; Shaffer, 1993; Berg and Kim, 1994, 1998; Neven and Roller, 1999; Angelini and Cetorelli, 2003; Rezitis, 2010). Subsequent empirical studies assumed heterogeneity among banks, but they differed in their treatment of deposits. Canhoto (2004), Uchida and Tsutsui (2005), and Brissimis et al. (2008) embrace the production approach and consider deposits as outputs,[15] In contrast, Coccorese (2005, 2009) and Wong et al. (2008) adopt the intermediation approach. They assume a relationship between product differentiation and bank features (as opposed to product features), and they treat deposits as a price-taking input. Dick (2008), Molnar (2008), Ho (2012), and Martin-Oliver (2018) also assume product differentiation in loans and/or deposits, but they rely on utility-derived discrete choice demand models. However, their identification strategy still reduces the extent of product differentiation to exceedingly few and broad bank features. Ho (2010) also relies on discrete choice models but treats deposits as a price-taking input.

4 Method

Our empirical analysis is based on a price-setting model that assumes product differentiation between banks (Coccoresse, 2005, 2009).[16] In contrast to past studies, which restrict price competition to the loan or deposit market only, we adopt the intermediation approach and consider simultaneous competition in both loans (output) and deposits (input). Our empirical analysis therefore takes into account that (potential) oligopoly and oligopsony power reflects "the reality of financial intermediation," especially in developing markets where "banks operate on and extract rents from two markets simultaneously, the deposit and loan markets" (Marrouch and Turk-Ariss, 2014).

Our empirical setup assumes that banks use deposits in conjunction with other inputs to offer loans and to invest in securities. We characterize the markets for loans and deposits by price competition and product differentiation, as inferred from bank features.[17] We assume that, in the (output) market for securities, individual banks are price-takers, given their small share in this market.[18] This assumption also holds for non-deposit input markets. In this setting, bank i faces the following individual demand for loans (output) and supply of deposits (input):

[15] Canhoto (2004) overlooks loans and examines the market for deposits only.

[16] See also Freixas and Rochet (2008).

[17] We follow Canhoto (2004) and assume that "when banks set interest rates, product differentiation is already established."

[18] Institutional investors such as pension funds, mutual funds, and insurance firms were the main players in the local capital markets (Center for Financial Stability, 2008).

$$q^l_{it} = q_{it}(p^l_{it}, p^l_{jt}, S^l_{it}) \tag{1}$$

$$x^d_{it} = x_{it}(w^d_{it}, w^d_{jt}, S^d_{it}) \tag{2}$$

where q^l_{it} (x^d_{it}) is the quantity of loans demanded (deposits supplied) at time t, p^l_{it} (w^d_{it}) is the price of loans (deposits) of bank i, p^l_{jt} (w^d_{jt}) represents competitors' prices, S^l_{it} (S^d_{it}) is a vector of exogenous factors that shift demand (supply) and i, j=1, ..., N is the number of banks.

The characterization of market power in the loan and deposit market requires the empirical estimation of potential deviations from competitive markets. If banks compete on price, the profit function of bank i is $\pi_{it} = \sum q^m_{it}(\cdot)p^m_{it} - C_{it}(q^m_{it}(\cdot), x^d_{it}(\cdot), w^k_{it})$, where m represents loans (l) and securities (b), d are deposits, k represents non-deposit inputs, and $C_{it}(\cdot)$ is the minimum cost of producing output vector q^m_{it}, given deposits and input prices w^k_{it}. Then, the first-order condition for profit maximization in the loan (output) market is:

$$p^l_{it} = mc^l_{it} + \theta^l_{it} \tag{3}$$

where $mc^l_{it} = (\partial C_{it}/\partial q^l_{it})$ is the marginal cost and $\theta^l_{it} = -1/(\eta^l_{ii} + \eta^l_{ij} \cdot \lambda^l_{it})$ measures the average deviation of banks' pricing behavior from perfect competition. This parameter depends on the own-price semi-elasticity of the demand for loans for bank i ($\eta^l_{ii} = (\partial q^l_{it}/\partial p^l_{it}) \cdot (1/q^l_{it})$) and on the cross-price semi-elasticity ($\eta^l_{ij} = (\partial q^l_{it}/\partial p^l_{jt}) \cdot (1/q^l_{it})$), and it is also a function of the so-called conjectural variation parameter of bank i ($\lambda^l_{it} = \partial p^l_{jt}/\partial p^l_{it}$). A positive value of λ indicates a certain degree of coordination in price changes among banks. A zero value of λ implies that banks do not react to rivals' price changes (i.e., a Nash equilibrium in prices), while non-positive values of λ suggest that banks react more competitively to rivals' price movements by reducing their own prices. In the extreme, a value of $-\infty$ implies perfect competition and $p^l_{it} = mc^l_{it}$. The identification of λ^l and η^l requires estimating Equation (3) simultaneously with the demand function (Equation 1) and the cost function.

As in O'Donnell et al. (2007), we can characterize market power in the deposit (input) market by rewriting the profit function as $\pi_{it} = R_{it}(p^m_{it}, x^k_{it}, x^d_{it}(\cdot)) - \sum x^k_{it} w^k_{it} - x^d_{it}(\cdot) w^d_{it}$, where $R_i(\cdot)$ is the maximum revenue that can be obtained from input vector x_{it} and output prices p_{it}. After some manipulation, the profit-maximizing condition in the deposits (input) market is:

$$w^d_{it} = mrp^d_{it} + \theta^d_{it} \tag{4}$$

where $mrp^d_{it} = (\partial R_{it}/\partial x^d_{it})$ is the marginal revenue product of deposits, and $\theta^d_{it} = -1/(\eta^d_{ii} + \eta^d_{ij} \cdot \lambda^d_{it})$ captures the deviation of bank i's pricing of deposits from perfect competition. As before, this parameter depends on the own-price semi-elasticity ($\eta^d_{ii} = (\partial x^d_{it}/\partial w^d_{it}) \cdot (1/x^d_{it})$) and the cross-price semi-elasticity of the deposit supply ($\eta^d_{ij} = (\partial x^d_{it}/\partial w^d_{jt}) \cdot (1/x^d_{it})$), and it also is a function of $\lambda^d_{it} = \partial w^d_{jt}/\partial w^d_{it}$ for bank i. The interpretation of λ^d is equivalent to that of the output market.

In our setting, the potential existence of market power in the market for deposits invalidates Shephard's lemma, thus $\partial C_{it}/\partial w^d_{it} \neq x^d_{it}$. To represent this deviation, the cost function is expressed in terms of the level of deposits instead of their prices, as is the case with fixed inputs. However, the wedge in this case arise from potential market power rather than fixity (Morrison, 1999, p. 162). We incorporate this distinction using a restricted cost function, thus we rewrite Equation 4 as:

$$w_{it}^d = Z_{it}^d + \theta_{it}^d \tag{4'}$$

where the primal-based mrp_{it}^d is replaced by the shadow value of deposits $Z_{it}^d = -\partial C_{it}/\partial x_{it}^d$, which is its dual equivalent. Thus, our characterization of market power in the markets for loans and deposits rests on the cost structure because it involves comparing the prices of loans and deposits to their associated marginal valuation (i.e. the marginal cost of loans and the shadow value of deposits, respectively). As above, identification of λ^d and η^d requires simultaneous estimation of Equation 4', the cost function, and the deposits supply function (Equation 2).

Our estimation strategy relies on the simultaneous estimation of a system that consists of (a) the banks' cost function (and the resultant input share equations), (b) the demand for loans and the supply of deposits, and (c) the corresponding pricing equations. The cost function takes the following translog functional form:

$$\begin{aligned} lnC_{it}(\boldsymbol{q},\boldsymbol{x},\boldsymbol{w},\boldsymbol{v}) = \alpha_0 + \sum_k \alpha_k lnw_{it}^k + \sum_m \alpha_m lnq_{it}^m + \alpha_d lnx_{it}^d + \alpha_{it} + \\ \frac{1}{2}\sum_k\sum_h \alpha_{kh} lnw_{it}^k lnw_{it}^h + \frac{1}{2}\sum_m\sum_n \alpha_{mn} lnq_{it}^m lnq_{it}^n + \\ \frac{1}{2}\alpha_{dd} lnx_{it}^d lnx_{it}^d + \frac{1}{2}\alpha_{tt}t^2 + \sum_k\sum_m \alpha_{km} lnw_{it}^k lnq_{it}^m + \\ \sum_k \alpha_{kd} lnw_{it}^k lnx_{it}^d + \sum_k \alpha_{kt} lnw_{it}^k t + \sum_m \alpha_{md} lnq_{it}^m lnx_{it}^d + \\ \sum_m \alpha_{mt} lnq_{it}^m t + \alpha_{dt} lnx_{it}^d t + \alpha_{np} lnnp_{it} + \sum_r \alpha_r D_{type} \\ m,n = l,b \quad k,h = e,c,f,o \end{aligned} \tag{5}$$

where C_{it} is the cost of firm i in period t (excluding the cost of deposits), w_{ijt}^k denotes non-deposit input prices (i.e., labor, capital, other funds and inputs), q_{it}^m represents the volume of outputs (i.e., loans and securities), and x_{it}^d is the volume of deposits. We also add a time trend t to serve as an indicator of technological progress, a variable to capture the quality of each banks loan portfolio (np), and a set of dummy variables D_{type} to capture bank ownership differences. By partially differentiating the cost function with respect to each (non-deposit) input price and using Shephard's lemma, the input share equations become:

$$s_{it}^k = \alpha_k + \sum_h \alpha_{kh} lnw_{it}^h + \sum_m \alpha_{km} lnq_{it}^m + \alpha_{kd} lnx_{it}^d + \alpha_{kt} \tag{6}$$

where $s_{it}^k = \partial lnC_{it}/\partial w_{it}^k = (x_{it}^k \cdot w_{it}^k)/C_{it}$ is the share of input k in total cost.

We operationalize the loan demand function (1) and the deposit supply function (2) using the following general forms:

$$lnq_{it}^l = \beta_0 + \beta_p p_{it}^l + \beta_{pr} p_{it}^{lr} + \beta_s lnS_{it}^l \tag{7}$$

where q^l_{it} and p^l_{it} represent the quantity and the price of loans, respectively, for firm i; p^{lr}_{it} is the average price of bank i's competitors, and S^l_{it} is a vector of demand shifters. We specify the supply function for deposits as:

$$lnx^d_{it} = \gamma_0 + \gamma_w w^d_{dit} + \gamma_{wr} w^{dr}_{it} + \gamma_s lnS^d_{it} \tag{8}$$

where x^d_{it} and w^d_{it} are the quantity and the price of deposits, respectively, for firm i; w^{dr}_{it} is the average price of bank i's rivals, and S^d_{it} is a vector of supply shifters.

We obtain the marginal cost function for loans and the marginal shadow price function for deposits by partially differentiating Equation 5 with respect to q^l_i and x^d_i, respectively.[19] Then, the pricing equations for loans and deposits stemming from Equations 3 and 4' become:

$$\begin{aligned} p^l_{it} = \Big(-\frac{1}{\beta_p + \beta_{pr}\lambda^l}\Big) + \Big(\frac{C_{it}}{q^l_{it}}\Big) \cdot (\alpha_l + \alpha_{ll} lnq^l_{it} + \alpha_{lb} lnq^b_{it} + \sum_j \alpha_{lk} lnw^k_{it} \\ + \alpha_{kd} lnx^d_{it} + \alpha_{lt} t) \end{aligned} \tag{9}$$

$$\begin{aligned} w^d_{it} = \Big(-\frac{1}{\gamma_w + \gamma_{wr}\lambda^d}\Big) - \Big(\frac{C_{it}}{x^d_{it}}\Big) \cdot (\alpha_d + \sum_m \alpha_{dm} lnq^m_{it} + \sum_k \alpha_{dk} lnw^k_{it} \\ + \alpha_{dd} lnx^d_{it} + \alpha_{dt} t) \end{aligned} \tag{10}$$

where β_p (γ_w) is the price semi-elasticity of loan (deposit) demand (supply), and β_{pr} (γ_{wr}) is the cross-price semi-elasticity of demand (supply) from Equations 7 and 8. Hence, the estimated system (which we label Model 1) is formed using equations 5–10. The λs capture the average behavior of the banks in the system. The presence of collusive (competitive) behavior should manifest in positive (negative) values of λ^l and λ^d.

For comparative purposes, we also estimate additional models that assume output heterogeneity and quantity setting (Uchida and Tsutsui, 2005; Brissimis et al., 2008) and output homogeneity and quantity setting (Rezitis, 2010). We label these specifications as Model 2 and Model 3, respectively. In an additional set of estimates, we also account for the possibility of differences in behavior across bank types and over time. Hence, we allow the conduct parameters in Equations 9 and 10 to vary with banks' size, multimarket presence, and also over two-year intervals.

5 Data and variables

We use annual data gathered from the Report of Condition and Income Statement for each bank over the period 1993–2000 (Banco Central de la República Argentina, 2001). Our focus is on retail banking, therefore, we remove all observations on wholesale banks.[20] We consider that banks use labor (e), other operational inputs (o), physical capital (c), and other funds (f) to attract deposits. This input is then used to fund

[19] Equation 9 refers only to the loan market because banks are price-takers in the securities market.

[20] Wholesale banks provide sophisticated services to large corporate customers. Retail banking is more likely than wholesale banking to exercise market power due to larger information asymmetries, switching costs, and the prevalence of local rather than international markets.

loans and other earning assets. We use three variables to capture banks' activities: q^l is the volume of loans, q^b refers to a bank's total assets minus loans, property, equipment, and other fixed assets (hereafter, we refer to q^b as securities), and x^d is the volume of deposits. We aggregate loans in domestic currency (pesos) and foreign currency (dollars) using a Divisia index,[21] and we use the same approach to compute quantity indices for securities and deposits. We then estimate the price of loans p^l, securities p^b, and deposits w^d, dividing the interest income on loans and securities and the interest paid on deposits by their corresponding quantity indices.[22]

We estimate input prices as follows. The price of labor (w^e) is the ratio of personnel expenses (i.e., wages, labor taxes, job benefits, and insurance payments) to the number of full-time employees. The price of capital (w^c)—property, equipment, and other fixed assets—is the sum of firm-specific depreciation rates and the opportunity costs of capital. The price of operational inputs (w^o) is the ratio of non-labor operational expenses to the value of total assets. Finally, the price of non-deposit funds (w^f) is the ratio of interest expenses on non-deposit funds to the corresponding stock of funds borrowed. The cost variable (C) is therefore the sum of all operating expenses and the interest payments on non-deposit funds. We control for the effect of the quality of the loan portfolio (np) on costs by using a variable that relates provisions for bad loans to total loans. Finally, we use a dummy variable (D_{soe}) that identifies state-owned banks, and another dummy to account for foreign-owned banks (D_{for}).

The demand and supply equations (Equations 7 and 8) combine firm-level and economy-wide data. For consistency, the variables that capture firms' loans (q^l) and deposits (x^d) and the price of loans (p^l) and deposits (w^d) are equivalent to the variables we use when estimating the cost function. The demand and supply equations account for price competition effects with a variable that captures, for each bank, the average price of loans (p^{lr}) and the average price of deposits (w^{dr}) for all other banks that operate in the same region. To keep the number of parameters tractable, we replace the $n-1$ individual rivals' prices by a weighted average price of the other banks that compete in same region as bank i.[23] The demand and supply equations also include variables that remain constant across banks but vary over time. The price of a substitute for bank loans (p^{ls}) is proxied by the sum of the LIBOR rate and the level of sovereign credit risk, as reflected in the price of bonds issued by the Argentine government. We compute the price of a substitute for deposits (w^{ds}) using the simple average of the return on private pensions funds and real estate investments. All economy-wide series come from the Ministerio de Economía y Obras y Servicios Públicos (2001).

The demand and supply equations also account for the level of economic activity (GDP) with a per-capita GDP series. Our key deposit supply shifter is the series of privatization flows ($PRIV$), which we obtain from disaggregated balance of payment data from the National Institute of Statistics and Censuses (INDEC). We account for differences across banks using the number of branches (BR), which captures network size effects,[24] and the number of provinces in which the bank operates branches (COV),

[21] We cannot disaggregate loans further into retail or corporate loans because interest rates on these types of loans, by currency, are available only from 1998.

[22] At this stage, we omitted seven firms due to negative prices. We also omitted 26 observations in which the values for the interest rates on loans and the interest rates on deposits exceeded the mean value by three standard deviations; these thresholds were 0.49 and 0.25, respectively.

[23] The country is divided into 23 provinces that can be grouped into seven regions.

[24] The insertion of this variable does not cause endogeneity bias if we assume that, in any given

to consider geographical coverage. Both specifications control for ownership differences using SOE and FOR. In the demand specification, we include the ratio of bad loans to total loans to control for bank-specific credit risk (CR). However, in the supply specification, we include the ratio of equity to total assets (KR) to control for the possible effect of market discipline. Finally, the supply function also includes the one-period lagged value of total assets to account for the impact of banks' size on deposits.[25] Table 2 provides summary statistics.

[Insert Table 1 about here]

6 Estimation and results

Our estimates develop in several steps. For background comparison, our first set of results displays the behavior of banks in the loans (output) market by adopting the oft-made assumption of price-taking in the deposits (input) market. Thus, the estimates in Table 2 are based on the system of Equations 5–7 and Equation 9, where we replace the quantity of deposits by its price in the cost, input share, and pricing equations (i.e., Model 2.1). We also estimate other two specifications that supplant the assumption of price competition by quantity setting in the loan market, but we retain price-taking behavior in regard to deposits: Model 2.2 supposes that output is heterogeneous (as in Uchida and Tsutsui, 2005, and Brissimis et al., 2008), while Model 2.3 considers output is homogeneous (as in Rezitis, 2010). We estimate all models using the generalized method of moments (GMM) to account for the endogeneity of quantity and prices in both loans and deposits.[26] We also impose linear homogeneity on input prices and symmetry restrictions across equations, and we omit one share equation to avoid singularity.

Our results show that most parameters are statistically significant, and that their signs and magnitudes have economic meaning. The Table 2 also shows that there are no meaningful differences in parameters across all three specifications. Our parameter of interest is λ^l. The theory that guides the estimation of Model 2.1 predicts that perfectly collusive behavior is characterized by a unit value of λ^l, while perfect competition implies that λ^l approaches -∞. In this case, our λ^l estimate of -25.33 indicates that the loans market is largely competitive, though it is not perfect (for example, Coccorese (2005) accounts for in an imperfect competitive outcome with conduct parameters that vary between -3.15 and -4.59). The theoretical specification behind Models 2.2 and 2.3 predicts that λ^l varies in the interval [0-1], and that its value signals oligopoly power by its overall deviation from 0. Hence, our findings of small λ^ls are also consistent with a fairly competitive loan market (the confidence levels of λ^l in Models 2.2 and 2.3 comprise the perfect competition outcome). Altogether, these three models reveal a highly competitive loan market.

[Insert Table 2 about here]

year, the number of branches of each bank is predetermined. Actually, a high correlation between branches and GDP might weaken the significance of the coefficient of both variables due to multicollinearity. In our case, this bias should be minor, since the correlation coefficient between BR and Y is 0.158 (Coccoresse, 2005).

[25] In all cases, monetary variables are converted into 2000 prices using the wholesale price index.

[26] For each bank-year observation, we instrument the price of loans by the difference between its price and the system's average.

Our focal estimates allow for market power in both loans (output) and deposits (input), and they are based on the full system of Equations 5–10. Table 3 presents these results. As before, most parameters are highly significant, their signs and magnitudes are consistent with economic expectations, and the differences between the models are negligible.[27] At the sample mean, the own-price elasticity is -0.70 for the demand for loans and 0.77 for the supply of deposits. Our results also show that the cross-price semi-elasticity is positive for loans and negative for deposits,[28] and that consumers are indifferent to our constructs that intend to capture the effect of substitutes. Our estimates reveal that privatization flows are statistically significant in both specifications, but their impact on the supply of deposits triples the effect on the demand for loans. These empirical findings also suggest that (a) the demand for loans and the supply of deposits increase with the size of the branch network and the number of markets where banks operate, and (b) bank ownership has an influence on the level of loans and deposits.

[Insert Table 3 about here]

The bottom of Table 3 displays the conduct parameters for loans and deposits. In all cases, the estimates are statistically significant at stringent confidence levels. In the loan market, the value of λ^l in Model 3.1 is below the Nash value of 0 but significantly higher than the more competitive value of Model 2.1 (p-value of difference < 0.01). Thus, our estimates of the conduct parameter thus suggests that banks' pricing behavior in the loan market is more competitive than a Nash equilibrium in prices, but it is still far from perfect competition. The values of λ^l in Models 3.2 and 3.3 also depict a less competitive loan market, with values of λ^l that triple those shown in Table 2. All together, these results suggest that the assumption of exogenous deposit interest rates is not immaterial, as it leads to different conclusions—under estimation in our case—about the extent of market power in the loan market.

Turning to the deposit market, Table 3 shows that the value of λ^d in Model 3.1 is positive and statistically significant at the 1% level. This estimate is above the perfect collusion value of 1, which implies that banks appear to overreact to rivals' price changes: a 1% increase in bank i's deposit rate triggers an increase of 1.1% in bank j's deposit rate. Moreover, the estimated λ^ds in Models 3.2 and 3.3 are statistically significant but negative, which is contrary to the exertion of market power. These results imply that, in our setting, banks paid more than the full value of their marginal benefit for increases in deposits. Other studies also find negative λs, which indicates that actual input (output) exceeds the competitive equilibrium level.[29] Our findings suggest that banks set interest rates on deposits above their (standalone) marginal benefit, perhaps not only to deprive competing banks of this key input away

[27] We checked the regularity conditions on the cost function, and these were satisfied in almost all cases. Monotonicity in output and input prices was satisfied for almost all data points, while concavity in input prices was satisfied in all cases. Estimated costs were positive for all output values, and continuity followed from the flexible functional form. We tested for homotheticity, homogeneity with respect to output, unitary elasticity of substitution between inputs, and a generalized Cobb-Douglas form. All the restricted functional forms were strongly rejected.

[28] Model 3.3 assumes product homogeneity and therefore excludes the price of competitors in the demand and supply functions.

[29] See Morrison (2001) for evidence on inputs, and Gruben and McComb (2003) for output hyper-competition in banking

from competing banks but also because a higher market share in the deposit market leverages a bank to exploit the imperfection of competition in the loan market.

We also look for differences in behavior between banks of different sizes and market coverage as well as behavioral differences between banks over time. We approached this analysis by adding parameters to Equations 9 and 10 that interact the λs with (the log of) assets, the number of geographic markets in which a bank operates, and a time variable. The findings are shown in Table 4, where we add the estimates of Table 3 for a base case comparison.[30] The estimates in Model 4.1 suggest that larger banks compete more intensively than smaller institutions in the loan market: the negative bank size coefficient indicates that larger banks appear to price more competitively than their smaller counterparts. However, a positive bank size coefficient for the deposit market implies that larger banks overreact more to rivals' price changes than smaller institutions. Note that the statistical and economic significance of these effects is more meaningful for deposits than for loans.

[Insert Table 4 about here]

The results in Table 4 also show that banks with a wider geographic coverage seem to be less competitive in pricing loans than those operating in fewer markets. For instance, the value of λ^l in Model 4.1 for a bank operating in three markets is -1.4, but λ^l increases to -1.0 for a bank established in 15 markets. However, the estimates indicate that, in our setting, competition in deposits is unrelated to the geographical scope of banks. Finally, our findings reveal that banks' competitive behavior became less intense over time in the loan market, perhaps because industry concentration increased significantly over our study period. In this case, the value of λ^l in Model 4.1 at the beginning of the period is -2, while λ^l increases to -0.8 by the end of the period. However, we do not capture related effects in the market for deposits, which signals that hypercompetion for deposits remained invariant over the full period. Again, this finding suggests that a larger share of the deposit market leverages the exploitation of market imperfections in the loan market. This table also shows that our findings hold when we replace the assumption of price competition for alternative forms of output competition.

6.1 Market power, cost economies, and profitability

The market power estimates that we obtain from the system (Equations 5–10) may alternatively be transformed into a Lerner index, which is another oft-used indicator of market power (see De Guevara et. al, 2007; Solis and Maudos, 2008; Carbo et al., 2009; Lapteacru, 2014; Leroy and Lucotte, 2017). However, Spierdijka and Zaourasa (2018) underline the imperfection of this index in the presence of scale economies. We build on this point and follow Morrison (2001) to make additional inferences of market power by examining the (disaggregated) contribution of markups/markdowns and scale economies on banks' profitability in our study period.

However, our use of a restricted cost function necessitates correcting marginal costs to accommodate the adjustment response of x^d to a change in q^l. The resulting adjusted marginal cost equals $mc^{la} = (\partial C_{it}/\partial q^l_{it}) + [(\partial TC_{it}/\partial x^d_{it}) \cdot (\partial x^{d*}_{it}/\partial q^l_{it})]$, where

[30]For brevity, we report only lambda estimates. Other parameters remain economically and statistically invariant.

$TC_{it} = C_{it}(q, x, w, v) + x^{d*}_{it}(\cdot)w^d_{it}$ and x^{d*}_{it} results from solving for x^d from the deposit pricing equation (Equation 10).[31] Then, the markup ratio for loans (output) is $\tau^l_{it} = p^l_{it}/mc^{la}_{it}$, while the markdown ratio for deposits (input) is $\tau^d_{it} = w^d_{it}/Z^d_{it}$, where $Z^d_{it} = -(\partial C_{it}/\partial x^d_{it})$ is the shadow value of deposits. We repeat this adjustment process to compute scale economies from Equation 5 for each output, as $\varepsilon^{ma}_{it} = [(\partial TC_{it}/\partial q^m_{it}) + (\partial TC_{it}/\partial x^d_{it} \cdot (\partial x^{d*}_{it}/\partial q^m_{it})] \cdot (q^m_{it}/TC_{it})$. Therefore, the overall scale measure is $\varepsilon^a_{it} = \sum_m \varepsilon^{ma}_{it}$.[32]

The inference of (abuse of) market power is typically based on observing whether $p > mc$, or equivalently, that $\tau >1$. However, if cost economies exist, and the average cost curve is above marginal cost, the price must cover the average cost for long term feasibility. In this case, $p > mc$ is not necessarily an indication of exploitation of market power (Morrison, 2001). Hence, with the focus on a single output, we could combine the cost economy and markup ratios into a profitability measure as follows: $prof = \tau \cdot \varepsilon = (p/mc) \cdot (mc/ac) = p/ac$, where ac is the average cost. If $prof$ equals 1, then price equals ac, and the average cost curve may be nearly tangent to the demand curve, similar to a monopolistically competitive market. But if $prof$ exceeds 1, then the price is above ac, which invariably suggests excess profitability due to market power in input and/or output markets. In the case of multiple outputs, the profitability measure becomes $prof_{it} = \sum_m p^m_{it} \cdot q^m_{it}/TC_{it}$ (Paul, 2000).

[Insert Table 5 about here]

Table 5 summarizes our computation of markups, cost economies, and the profitability indicator using the estimates of Model 3.1. Our estimates reveal that banks operate under increasing returns to scale, that marginal costs decrease significantly with bank size, and that differences in marginal costs are nontrivial, as the average marginal costs of large banks are two-thirds those of mid- and small-sized banks. Our results also show that average marginal costs on loans declined notably with time, and the parameters in Table 3 indicate that this reduction was due largely to technological change and the decrease of (non-deposit) input prices. These results also reveal that the marginal shadow price of deposits is low, although it increased over the sample period.

Our key finding, however, is that banks set prices well above marginal costs, and that markups increased with industry concentration. In our setting, the average loan markup was 1.911 (note that a value of 1 is well below a stringent confidence interval), with large banks having higher markups than their smaller counterparts. However, note that the loan markups by bank size display a U-shaped pattern, with mid-sized banks staked between large and small banks. Our estimates indicate that the average markup on loans increased 50% in the second half of our sample period, when the industry became more concentrated into fewer banks. These estimates also reveal that scale economies for the average bank increased slightly over time.

The bottom of Table 5 presents our profitability estimates. Our findings for the average bank across our full sample indicate excessive profits, with larger banks exhibiting higher profitability. In relative terms, this profitability originates largely from

[31] If x^d is close to its optimal level and if the adjustment is endogenous to the model structure (as it is in this case), this difference will tend to be small unless large discrete changes are approximated (Morrison, 2001).

[32] This measure also embodies information on scope economies, since each ε^{ma}_{it} includes cross-terms with other outputs. But our main interest is in the overall cost economy estimate.

lower marginal costs, despite setting lower loan rates. The estimates show that small banks also enjoyed a sizeable degree of profitability, while their medium-size counterparts did not. Note that this difference stems primarily from differences in interest rates, as marginal costs are similar. Our results also reveal that aggregated profitability increased with industry concentration. Between our sample end points, profitability increased from 1.200 to 1.492, or 25%. This increase in profitability is explained largely by the increase in markups. In sum, the evidence suggests that, in our setting, industry concentration led to an increased exploitation of market power.

7 Concluding remarks

Over the past quarter of a century, fundamental shifts in public policy have led to a reconfiguration of the industrial structure of Latin American banking markets. Similar to other contexts, a liberalization process involving deregulation, openness to foreign bank entry, and privatization led to industry concentration, which accelerated with government resolution of banking crises. Unlike advanced economies and other emerging markets, the degree of financial intermediation in the region remains limited, and bank spreads remain high. Imperfect competition, eased by industry concentration, is claimed to explain high loan spreads (IMF, 2016).

We estimate a nonlinear simultaneous equation model to assess the degree of competitiveness of banks in Argentina in the 1990s. We find that the demand for bank loans and the supply of bank deposits are both price inelastic. We find that bank loans and deposits exhibit low cross-price elasticities, which implies that consumers regard other banks' offerings as imperfect substitutes. We also find that consumers do do not regard other financial products as close substitutes for bank offerings. Our results are consistent with imperfect competition in the loan market. Last, we find that banks paid more than the marginal benefit for increases in deposits, most likely because larger market shares on this side of the market leverages the exploitation of imperfections on the other side (i.e., the loan market). Alongside these findings, we document empirically that the oft-made assumption of exogenous deposit interest rates underestimates market power in the loans market, and such a difference is statistically significant, economically meaningful, and also robust to alternative specifications of bank competition models.

Our results show that banks operate under increasing returns to scale, and that marginal costs decrease significantly with bank size. They also show that these differences in marginal costs are non-trivial, as the average marginal costs of large banks are significantly lower than those of mid- and small-sized banks. Still, we find that banks priced well above marginal costs, and that markups increased with industry concentration and bank size. Market imperfections and increased concentration led to excess profits. Larger banks, however, exhibited higher profitability, which in relative terms originated largely from lower marginal costs, despite setting lower loan rates. Our results also reveal that aggregated profitability increased substantially with industry concentration. This finding reinforces recurrent concerns about the effects of industry concentration on allocative efficiency.

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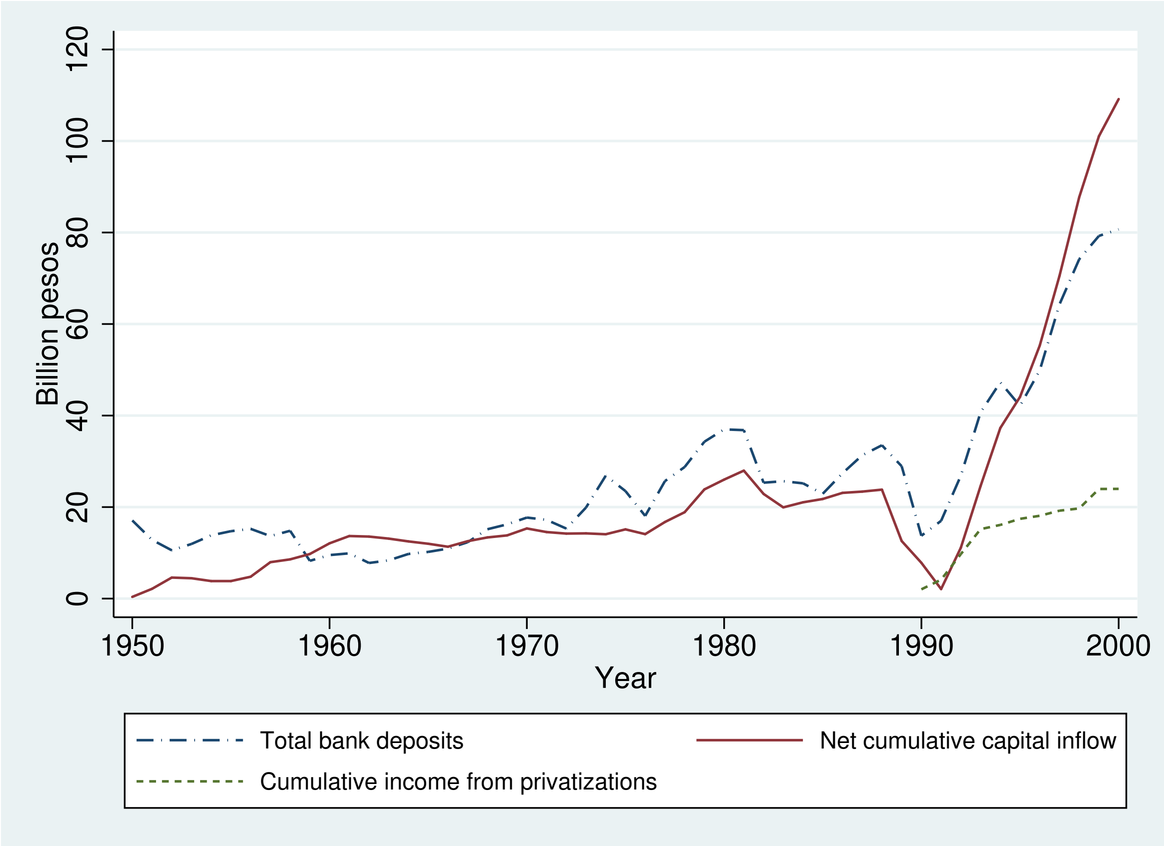
Figure 1: Bank Deposits and Privatization Income



This figure plots the evolution of total bank deposits, the cumulative income from privatizations and the net cumulative inflows in the capital accounts in Argentina between 1950 and 2000. The series are in constant argentine pesos, in billions. Source: National Institute of Statistics and Censuses (INDEC), various years.

Table 1: Summary Statistics

Variable		Mean	Std. Dev.	Min.	Max	Mean values	
		1993-2000				1993-1996	1997-2000
Assets ($M)	A	1 210.6	2 672.2	5.6	17 700.0	704.9	2 027.4
Loans ($M)	q^l	741.5	1589.2	4.5	11 154.4	459.9	1 196.2
Securities ($M)	q^b	343.2	874.6	0.1	6 678.0	124.6	696.2
Deposits ($M)	x^d	622.2	1359.1	3.4	13 102.0	323.2	1 105.1
Loan credit risk (%)	CR	8.3	7.4	1.0	89.3	7.9	9.0
Bank capital risk (%)	KR	20.4	9.5	2.8	79.5	21.6	18.6
Branches (#)	BR	48.9	81.9	1.0	591.0	37.9	66.6
Coverage (#)	COV	4.8	5.6	1.0	22.0	4.1	5.9
Interest rates (%)							
Loan rates	p^l	20.6	9.3	3.1	88.0	22.2	17.9
Deposit rates	w^d	8.5	3.8	1.1	24.5	9.3	7.1
Other input prices							
Labor ($th)	w^e	29.8	10.9	2.6	91.7	28.9	31.1
Capital (%)	w^c	25.2	10.5	0.7	102.9	25.9	23.9
Other inputs (%)	w^o	3.5	2.0	0.2	16.5	3.8	3.0
Other funds (%)	w^f	3.3	3.1	1.0	23.0	3.8	2.5
Total costs (excluding deposits ($M)	C	83.9	148.4	1.0	953.9	65.3	114.1
Total operational and funding costs ($M)	TC	127.9	243.5	1.3	1 339.0	91.6	186.8
Input cost shares (%)							
Labor	s^e	44.7	9.1	10.6	72.2	46.3	42.2
Capital	s^c	15.2	6.7	1.1	49.3	15.0	15.5
Other inputs	s^o	31.0	8.9	6.5	82.7	29.6	33.2
Other funds	s^f	9.1	8.8	1.1	75.1	9.1	9.1
Number of banks	N	78	25	48	115	97	60
Public banks	SOE	14	4.5	9	20	17	10
Foreign banks	FOR	17	2.2	13	19	16	17

This table presents summary statistics at the firm level for the retail banks in our sample for the full estimation period, and also for two sub-period of equal length. Monetary figures in constant December 2000 pesos. Between 1993 and 2000, the Argentine peso was fixed at par to the dollar. † Excludes the cost of deposits. ‡Initial and final year, in square brackets. Source: Own calculations based on Banco Central de la República Argentina, 2001

Table 2: Parameter Estimates

	Model (1) Price competition		Model (2) Heterogeneous output		Model (3) Homogeneous output	
Parameter	Coefficient	S.E.	Coefficient	S.E.	Coefficient	S.E.
Cost function						
α_0	1.703	(0.186)***	1.703	(0.186)***	1.699	(0.186)***
α_l	0.959	(0.050)***	0.959	(0.050)***	0.959	(0.050)***
α_b	0.111	(0.042)***	0.111	(0.042)***	0.111	(0.042)***
α_{w^d}	0.053	(0.024)**	0.053	(0.024)**	0.053	(0.024)**
α_e	0.487	(0.040)***	0.487	(0.040)***	0.487	(0.040)***
α_c	0.033	(0.016)**	0.033	(0.016)**	0.033	(0.016)**
α_o	0.351	(0.024)***	0.351	(0.024)***	0.351	(0.024)***
α_f	0.077	(0.014)***	0.077	(0.014)***	0.077	(0.014)***
α_t	−0.115	(0.052)**	−0.115	(0.052)**	−0.112	(0.052)**
α_{ll}	−0.001	(0.008)	−0.001	(0.008)	−0.001	(0.008)
α_{lb}	−0.028	(0.009)***	−0.028	(0.009)***	−0.028	(0.009)***
α_{ee}	0.225	(0.016)***	0.225	(0.016)***	0.225	(0.016)***
α_{ec}	−0.013	(0.005)***	−0.013	(0.005)***	−0.013	(0.005)***
α_{eo}	−0.224	(0.013)***	−0.224	(0.013)***	−0.224	(0.013)***
α_{ef}	0.012	(0.004)***	0.012	(0.004)***	0.012	(0.004)***
α_{ew^d}	−0.052	(0.007)***	−0.052	(0.007)***	−0.052	(0.007)***
α_{cc}	0.032	(0.004)***	0.032	(0.004)***	0.032	(0.004)***
α_{co}	−0.032	(0.004)***	−0.032	(0.004)***	−0.032	(0.004)***
α_{cf}	−0.004	(0.001)**	−0.004	(0.001)**	−0.004	(0.001)**
α_{cw^d}	−0.082	(0.005)***	−0.082	(0.005)***	−0.082	(0.005)***
α_{oo}	0.144	(0.007)***	0.144	(0.007)***	0.144	(0.007)***
α_{of}	−0.016	(0.003)***	−0.016	(0.003)***	−0.016	(0.003)***
α_{ow^d}	0.016	(0.005)***	0.016	(0.005)***	0.016	(0.005)***
α_{ff}	0.02	(0.002)***	0.02	(0.002)***	0.02	(0.002)***
α_{fw^d}	0.128	(0.008)***	0.128	(0.008)***	0.128	(0.008)***
$\alpha_{w^dw^d}$	0.017	(0.004)***	0.017	(0.004)***	0.017	(0.004)***
α_{el}	−0.010	(0.009)	−0.010	(0.009)	−0.010	(0.009)
α_{eb}	−0.002	(0.008)	−0.002	(0.008)	−0.002	(0.008)
α_{cl}	−0.001	(0.003)	−0.001	(0.003)	−0.001	(0.003)
α_{cb}	−0.005	(0.003)**	−0.005	(0.003)**	−0.005	(0.003)**
α_{ol}	−0.006	(0.005)	−0.006	(0.005)	−0.006	(0.005)
α_{ob}	0.012	(0.005)***	0.012	(0.005)***	0.012	(0.005)***
α_{fl}	0.001	(0.003)	0.001	(0.003)	0.001	(0.003)
α_{fb}	0.009	(0.003)***	0.009	(0.003)***	0.01	(0.003)***
α_{w^dl}	−0.012	(0.002)***	−0.012	(0.002)***	−0.012	(0.002)***
α_{w^db}	−0.015	(0.004)***	−0.015	(0.004)***	−0.014	(0.004)***
α_{et}	−0.012	(0.004)***	−0.012	(0.004)***	−0.012	(0.004)***
α_{ct}	0.003	(0.001)*	0.003	(0.001)*	0.003	(0.001)**
α_{ot}	−0.002	(0.003)	−0.002	(0.003)	−0.002	(0.003)
α_{ft}	−0.006	(0.002)***	−0.006	(0.002)***	−0.006	(0.002)***
α_{w^dt}	0.017	(0.002)***	0.017	(0.002)***	0.017	(0.002)***
α_{tt}	0.014	(0.009)	0.014	(0.009)	0.014	(0.009)
α_{lt}	−0.021	(0.008)***	−0.021	(0.008)***	−0.021	(0.008)***
α_{bt}	0.018	(0.008)**	0.018	(0.008)**	0.018	(0.008)**
α_{NP}	1.046	(0.227)***	1.046	(0.227)***	1.037	(0.227)***
α_{SOE}	−0.047	(0.040)	−0.047	(0.04)	−0.046	(0.04)
α_{FOR}	−0.175	(0.036)***	−0.175	(0.036)***	−0.175	(0.036)***

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Table 2: Parameter Estimates - (cont.)

	Model (1) Price competition		Model (2) Heterogeneous output		Model (3) Homogeneous output	
Parameter	Coefficient	S.E.	Coefficient	S.E.	Coefficient	S.E.
Demand function						
β_0	0.046	(3.603)	0.046	(3.603)	2.203	(2.200)
β_{p^l}	−3.880	(0.432)***	−3.880	(0.432)***	−3.989	(0.434)***
$\beta_{p^{lr}}$	1.772	(2.633)	1.772	(2.633)		
$\beta_{p^{ls}}$	−0.058	(0.288)	−0.058	(0.288)	0.086	(0.201)
β_{PRIV}	0.171	(0.182)	0.171	(0.182)	0.079	(0.136)
β_{CR}	−0.140	(0.056)**	−0.140	(0.056)**	−0.134	(0.056)**
β_{BR}	0.711	(0.034)***	0.711	(0.034)***	0.709	(0.034)***
β_{COV}	0.239	(0.046)***	0.239	(0.046)***	0.238	(0.046)***
β_{SOE}	0.538	(0.104)***	0.538	(0.104)***	0.529	(0.104)***
β_{FOR}	0.683	(0.089)***	0.683	(0.089)***	0.678	(0.089)***
Pricing function						
λ^l	−25.329	(13.103)*	0.080	(0.043)*	0.081	(0.044)*

This table presents coefficients of the system of Equations 5–7 and Equation 9, where we replace the quantity of deposits by its price in the cost, input share, and pricing equations. Model 1 assumes price competition, Model 2 supposes that output is heterogeneous, while Model 2.3 considers output is homogeneous. Standard errors in parentheses. Asterisks indicate significance at 10% (*), 5% (**), and 1% (***) or better.

Table 3: Parameter Estimates

	Model (1) Price competition		Model (2) Heterogeneous output		Model (3) Homogeneous output	
Parameter	Coefficient	S.E.	Coefficient	S.E.	Coefficient	S.E.
Cost function						
α_0	2.248	(0.222)***	2.247	(0.222)***	2.251	(0.222)***
α_l	0.607	(0.089)***	0.607	(0.089)***	0.608	(0.089)***
α_b	0.228	(0.061)***	0.228	(0.061)***	0.227	(0.061)***
α_{x^d}	0.071	(0.056)	0.071	(0.056)	0.069	(0.056)
α_e	0.526	(0.042)***	0.526	(0.042)***	0.526	(0.042)***
α_c	−0.012	(0.023)	−0.012	(0.023)	−0.012	(0.023)
α_o	0.376	(0.030)***	0.376	(0.030)***	0.376	(0.030)***
α_f	0.11	(0.017)***	0.110	(0.017)***	0.110	(0.017)***
α_t	−0.052	(0.054)	−0.052	(0.054)	−0.052	(0.054)
α_{ll}	0.159	(0.028)***	0.159	(0.028)***	0.159	(0.028)***
α_{lb}	−0.100	(0.015)***	−0.100	(0.015)***	−0.100	(0.015)***
α_{bb}	0.078	(0.015)***	0.078	(0.015)***	0.078	(0.015)***
$\alpha_{x^dx^d}$	0.042	(0.021)**	0.042	(0.021)**	0.042	(0.021)**
α_{x^dl}	−0.063	(0.020)***	−0.063	(0.020)***	−0.063	(0.020)***
α_{x^db}	0.032	(0.010)***	0.032	(0.010)***	0.032	(0.010)***
α_{ee}	0.098	(0.015)***	0.098	(0.015)***	0.098	(0.015)***
α_{ec}	−0.022	(0.006)***	−0.022	(0.006)***	−0.022	(0.006)***
α_{eo}	−0.081	(0.010)***	−0.081	(0.010)***	−0.081	(0.010)***
α_{ef}	0.006	(0.004)	0.006	(0.004)	0.006	(0.004)
α_{cc}	0.075	(0.007)***	0.075	(0.007)***	0.075	(0.007)***
α_{co}	−0.046	(0.005)***	−0.046	(0.005)***	−0.046	(0.005)***
α_{cf}	−0.006	(0.002)***	−0.006	(0.002)***	−0.006	(0.002)***
α_{oo}	0.156	(0.008)***	0.156	(0.008)***	0.156	(0.008)***
α_{of}	−0.029	(0.003)***	−0.029	(0.003)***	−0.029	(0.003)***
α_{ff}	0.030	(0.002)***	0.030	(0.002)***	0.030	(0.002)***
α_{el}	−0.056	(0.016)***	−0.056	(0.016)***	−0.056	(0.016)***
α_{eb}	−0.029	(0.008)***	−0.029	(0.008)***	−0.029	(0.008)***
α_{cl}	0.025	(0.009)***	0.025	(0.009)***	0.025	(0.009)***
α_{cb}	−0.014	(0.004)***	−0.014	(0.004)***	−0.014	(0.004)***
α_{ol}	−0.001	(0.011)	−0.001	(0.011)	−0.001	(0.011)
α_{ob}	0.021	(0.006)***	0.021	(0.006)***	0.021	(0.006)***
α_{fl}	0.032	(0.007)***	0.032	(0.007)***	0.032	(0.007)***
α_{fb}	0.022	(0.003)***	0.022	(0.003)***	0.022	(0.003)***
α_{ex^d}	0.077	(0.015)***	0.077	(0.015)***	0.077	(0.015)***
α_{cx^d}	−0.021	(0.009)**	−0.021	(0.009)**	−0.021	(0.009)**
α_{ox^d}	−0.013	(0.011)	−0.013	(0.011)	−0.013	(0.011)
α_{fx^d}	−0.043	(0.006)***	−0.044	(0.006)***	−0.044	(0.006)***
α_{et}	−0.007	(0.004)*	−0.007	(0.004)*	−0.007	(0.004)*
α_{ct}	0.009	(0.002)***	0.009	(0.002)***	0.009	(0.002)***
α_{ot}	0.003	(0.003)	0.003	(0.003)	0.003	(0.003)
α_{ft}	−0.005	(0.002)***	−0.005	(0.002)***	−0.005	(0.002)***
α_{tt}	−0.006	(0.009)	−0.006	(0.009)	−0.006	(0.009)
α_{lt}	−0.003	(0.010)	−0.003	(0.010)	−0.003	(0.010)
α_{bt}	0.002	(0.009)	0.002	(0.009)	0.002	(0.009)
α_{x^dt}	0.002	(0.008)	0.002	(0.008)	0.001	(0.008)
α_{NP}	1.162	(0.223)***	1.162	(0.223)***	1.159	(0.223)***
α_{SOE}	−0.067	(0.037)*	−0.067	(0.037)*	−0.066	(0.037)*
α_{FOR}	−0.237	(0.035)***	−0.237	(0.035)***	−0.236	(0.035)***

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Table 3: Parameter Estimates - (cont.)

	Model (1) Price competition		Model (2) Heterogeneous output		Model (3) Homogeneous output	
Parameter	Coefficient	S.E.	Coefficient	S.E.	Coefficient	S.E.
Demand function						
β_0	−6.21	(4.220)	−6.211	(4.220)	1.299	(2.205)
β_{p^l}	−3.318	(0.438)***	−3.318	(0.438)***	−3.355	(0.440)***
$\beta_{p^{lr}}$	7.023	(3.462)**	7.023	(3.462)**		
$\beta_{p^{ls}}$	−0.453	(0.335)	−0.453	(0.335)	0.100	(0.197)
β_{PRIV}	0.438	(0.202)**	0.438	(0.202)**	0.126	(0.136)
β_{CR}	−0.110	(0.058)	−0.110	(0.058)*	−0.105	(0.058)*
β_{BR}	0.750	(0.035)***	0.750	(0.035)***	0.748	(0.035)***
β_{COV}	0.240	(0.048)***	0.240	(0.048)***	0.236	(0.048)***
β_{SOE}	0.527	(0.106)***	0.527	(0.106)***	0.527	(0.106)***
β_{FOR}	0.722	(0.095)***	0.722	(0.095)***	0.728	(0.095)***
Supply function						
γ_0	−40.346	(13.540)***	−40.347	(13.540)***	−40.452	(12.900)***
γ_{w^d}	9.088	(5.220)*	9.088	(5.220)*	7.137	(4.536)*
$\gamma_{w^{dr}}$	−18.041	(14.688)	−18.040	(14.688)		
$\gamma_{w^{ds}}$	−0.100	(0.366)	−0.100	(0.366)	−0.122	(0.344)
γ_{PRIV}	1.477	(0.676)**	1.477	(0.676)**	1.410	(0.628)**
γ_{KR}	0.940	(0.553)*	0.940	(0.553)*	0.869	(0.500)*
γ_{BR}	0.991	(0.359)***	0.991	(0.359)***	0.887	(0.297)***
γ_{COV}	8.857	(3.114)***	8.857	(3.114)***	8.338	(2.747)***
γ_{BR*COV}	−2.215	(0.784)***	−2.215	(0.784)***	−2.070	(0.684)***
γ_A	1.686	(0.368)***	1.686	(0.368)***	1.670	(0.344)***
γ_{SOE}	−0.148	(0.424)	−0.148	(0.424)	−0.078	(0.396)
γ_{FOR}	−0.877	(0.472)*	−0.877	(0.472)*	−0.817	(0.434)*
Pricing function						
λ^l	−1.339	(0.000)***	0.261	(0.041)***	0.264	(0.041)***
λ^d	1.108	(0.000)***	−0.834	(0.481)*	−0.654	(0.401)*

This table presents coefficients of the system of Equations 5–10. Model 1 assumes price competition, Model 2 supposes that output is heterogeneous, while Model 2.3 considers output is homogeneous. Standard errors in parentheses. Asterisks indicate significance at 10% (*), 5% (**), and 1% (***) or better.

Table 4: Market Power Estimates by Bank Size, Coverage and Period

	Model 1 Price competition				Model 2 Heterogeneous output				Model 3 Homogeneous output			
Measure	Base Case	Size	Coverage	Time	Base Case	Size	Coverage	Time	Base Case	Size	Coverage	Time
λ^l	−1.339	25.597	−1.586	−2.394	0.261	1.234	0.228	0.109	0.264	1.245	0.231	0.110
	(0.153)***	(15.518)*	(0.222)***	(0.451)***	(0.041)***	(0.220)***	(0.04)***	(0.047)**	(0.041)***	(0.221)***	(0.040)***	(0.048)**
$\lambda^l \cdot \ln A$		−2.519*				−0.068				−0.069		
		(1.553)				(0.015)***				(0.015)***		
$\lambda^l \cdot COV$			0.210				0.032				0.033	
			(0.154)**				(0.015)**				(0.015)**	
$\lambda^l \cdot TIME$				0.384				0.061				0.062
				(0.103)***				(0.018)***				(0.018)***
λ^d	−3.960	−0.613	1.089	1.076	−0.834	−2.438	−0.886	−0.849	−0.654	−1.916	−0.694	−0.664
	(0.231)***	(0.372)*	(0.152)***	(0.203)***	(0.481)*	(1.432)*	(0.505)*	(0.487)*	(0.401)	(1.243)	(0.438)	(0.421)
$\lambda^d \cdot \ln A$		0.155				0.122				0.096		
		(0.095)***				(0.074)*				(0.064)		
$\lambda^d \cdot COV$			0.027				0.038				0.029	
			(0.020)				(0.034)				(0.028)	
$\lambda^d \cdot TIME$				0.007				0.004				0.003
				(0.002)				(0.038)				(0.030)

This table presents coefficients of the system of Equations 5–10. Model 1 assumes price competition, Model 2 supposes that output is heterogeneous, while Model 2.3 considers output is homogeneous. The base case refers to Model 1 in Table 3. Size represents bank size as measured with (the log of) assets. Coverage measures the number of geographic markets in which a bank operates, and time is a variable that identifies four two-year periods. Standard errors in parentheses. Asterisks indicate significance at 10% (*), 5% (**), and 1% (***) or better.

Table 5: Markups, Cost Elasticities and Profitability

		Average	Bank Size			Period	
Measure		Bank	Large	Medium	Small	1993-1996	1997-2000
Interest rate on loans	p^l	0.206	0.166	0.188	0.239	0.222	0.179
		(0.095)	(0.131)	(0.081)	(0.082)	(0.098)	(0.079)
Interest rate on deposits	w^d	0.085	0.068	0.079	0.097	0.093	0.071
		(0.055)	(0.026)	(0.059)	(0.042)	(0.039)	(0.031)
Marginal cost of loans	mc^{la}	0.108	0.101	0.143	0.154	0.141	0.075
		(0.009)***	(0.017)***	(0.016)***	(0.016)***	(0.009)***	(0.006)***
Shadow value of deposits	z^d	0.006	0.012	0.009	0.003	0.002	0.012
		(0.003) **	(0.004)***	(0.004) **	(0.004)***	(0.006)***	(0.003)***
Scale elasticity	ε^a	0.680	0.707	0.693	0.669	0.755	0.592
		(0.021)***	(0.046)***	(0.027)***	(0.019)***	(0.021)***	(0.021)***
Markup	p^l/mc^{la}	1.911	1.644	1.321	1.548	1.590	2.411
		(0.153)***	(0.292)***	(0.480)***	(0.157)***	(0.105)***	(0.189)***
Profitability	$Prof$	1.300	1.162	0.915	1.035	1.200	1.492
		(0.080)***	(0.146)***	(0.078)***	(0.093)***	(0.065)***	(0.083)***
Average number of banks	$N^\dagger$	[78]	[15]	[29]	[34]	[97]	[60]

This table presents markups, cost economies, and the profitability indicator for the average bank in our sample, and also for different bank sizes and sub-periods. All estimates are based on Model 1 in Table 3. Standard errors in parentheses, except for p_L and w_D, where figures refer to standard deviations. Asterisks indicate significance at 10% (*), 5% (**), and 1% (***) or better. † Refers to the average number of banks in a period or bank type.