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Competencia Bancaria en Argentina: 1997-1999

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Abstract

Over the last decade the Argentine banking industry has been subject to important regulatory changes, increased internationalization and restructuring. The way in which this process has affected the degree of competition is subject to discussion in Argentina, and it has been argued, along the lines of the structure-conduct-performance paradigm (SCP), that increased concentration could have undermined competition in banking markets. But, while according to the former approach concentration is necessarily related to poor competition, the new industrial organization (NIO) approach, that relies on firms profit maximization behavior, has emphasized the weaknesses of relying on concentration measures to draw conclusions about market structure.

This paper evaluates the competitiveness of Argentine banking markets by extending the Conjectural Variations (CV) approach to the case of multi-product firms. We model Argentine banks as multi-output firms, operating in two markets: retail and corporate, an adequate classification to describe the characteristics of the Argentine banking system, where some banks are more retail oriented and have a broad network of branches, mainly offering liquidity services while others have very few branches and are more specialized in giving credit to firms. We measure the degree of market power by estimating a CV model for a panel of banks from 1997 to 1999. Rather than evaluating a specific market structure, we construct a market power index that varies in a continuum interval. This measure permits to determine the extent to which prices deviate from marginal costs, which is the relevant question from the welfare point of view. We find that for both markets, retail and corporate, are very close to the competitive solution. Finally, these results are confronted with the predictions that could be drawn from concentration measures, according to the SCP approach.

JEL Classification codes: L1, G21, C30

Key words: conjectural variations, multi-outputs firms, market power index.

1 Introduction

Over the last decade the Argentine banking industry has been subject to important regulatory changes, increased internationalization and restructuring. The way in which this process has affected the degree of competition is subject to discussion in Argentina, and it has been argued, along the lines of the Structure–Conduct–Performance paradigm (SCP), that increased concentration could have undermined competition in banking markets. While according to the SCP approach, larger concentration necessary leads to weaker competition, the New Industrial Organization (NIO) approach that relies on firms profit maximization behavior, emphasizes the shortcomings of relying on concentration measures to draw conclusions about market structure.

More specifically, the NIO literature has usually relied on the concept of Conjectural Variations (CV) to model and measure market power. The basic idea, developed by Bowley (1924), is that firms acting in oligopolistic markets choose their output as to maximize profits according to their expectations about other firms' reaction. As stressed by Tirole (1997) and Shapiro (1989), the CV is as an attempt to introduce dynamics into a static context (Cournot's model). This attempts suffers a theoretical weaknesses in the sense that reaction to others strategies are introduced in a model in which firms cannot react, because of the timing of the game. Cabrál (1995), however, has shown that for a linear oligopoly, the CV solution has an exact correspondence with a quantity-setting dynamic game with minimax punishments.

Furthermore, Tirole (1997) argues that CV are a useful tool to test market power due to the lack of alternative methodologies to empirically test dynamic models. Bresnahan (1989) emphasizes two main advantages of CV. The first one is that empirical estimations are based on a theoretical model, contrary to the more traditional empirical methodology, based on the structure-conduct-performance paradigm, that generally estimates reduced form of a profit equations. The second advantage is that the estimated parameters, which describe the expected reaction of competitors can vary in a continuum between competition and monopoly, thus not restricting the data to fit a particular non-competitive model.

With regards to the empirical banking literature, although studies which deal with the technological and efficiency aspects of the banking industry usually incorporate the multi–output character of banks, most studies on market structure and competition neglect this important characteristic of banks. The existence of more than one product in the production function of banks complicates the analysis of market structure. The reason is that even if one assumes independence on the demand side (in the sense that customers are not able to substitute among different bank products) there is still room for cross–market effects, since firms can move resources from one market to the other. Notable exceptions are Gelfand and Spiller (1987) and more recently Berg and Kim (1998), who have studied the Norwegian banking industry considering them as multi-output oligopolistic firms offering two services or products: retail and corporate loans.

This paper evaluates the competitiveness of Argentine banking markets by extending the CV approach to the case of multi–product firms. More specifically, we follow Berg and Kim (1998) and model Argentine banks as multi–output firms, operating in two distinct markets: corporate and retail.[1] We evaluate market structure in both segments by estimating a conjectural variations model for a panel of banks from 1997 to 1999. Rather than evaluating an specific market structure, a strategy that can lead to ambiguous results in the case of multi–output firms, we construct a market power index. This measure allows us to evaluate the extent to which prices deviate from marginal costs, which is the relevant question from a welfare point of view. We find that both markets, retail and corporate, are very close to the competitive solution. Finally, this results are confronted with the predictions that could be drawn from concentration measures, according to the SCP approach.

The paper is organized as follows. Section 2 describes the stylized facts for the Argentine banking industry over last decade. Section 3 presents a CV theorethical model in a multi-output setting. Section 4 presents the empirical results. Section 5 concludes.

2 The Argentine Banking Sector over the last decade: New Regulations, Restructuring and Internationalization

The Argentine banking sector changed deeply during the 90's. Following the successful macroeconomic stabilization induced by the Convertibility Plan,

[1] As we argue below, this classification adequately describes the characteristics of the Argentine banking system.

the economy remonetized very rapidly. The M3 to GDP ratio grew from 9.9% in 1991, to 21.8% in 1994 and to 32.6% in 1999. This was reflected in a very rapid and steady growth in banking output throughout the decade.[2]

At the same time profound reforms were implemented regarding banking regulations, mainly during the first part of the decade. Free entrance was allowed for domestic as well as foreign financial institutions. The Central Bank introduced capital requirements linked to both counterparty and market risk.[3], at standards even higher than Basle recommendations. A comprehensive liquidity policy was put in place in order to ensure systemic liquidity, given the limited lender of last resort capabilities of the Central Bank under the currency board regime. The role of the Superintendency of banks was also reinforced.

Following the Tequila banking crisis of 1995 a profound restructuring process took place. An important number of financial institutions in trouble during this episode were either acquired or merged. There was also an important process of provincial banks privatization, which lead to important efficiency gains at the banking sector. [4] Futhermore, after 1996 large international banks entered the system. The number of financial institutions decreased during these years, from 147 in 1996 to 116 in 1999, while their average size (measured by assets) increased significantly, from $737 million in 1996 to $1308 million in 1999.

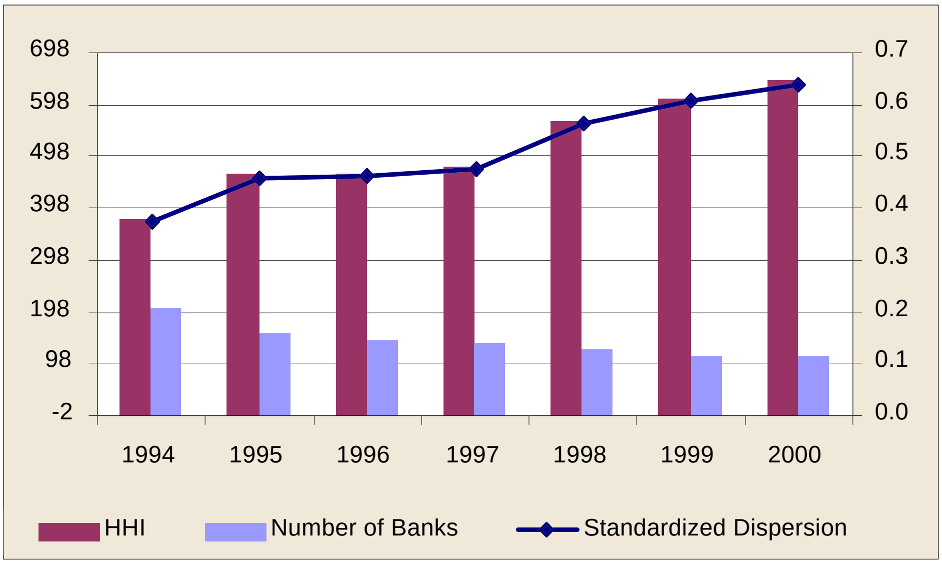
However, in spite of this significant reduction in the number of participants in the market, concentration measures give evidence of a non-concentrated banking industry. Figure 1 shows the evolution of the conventional Herfindahl-Hirschman Index from 1994 to 1999. Although the index increased from nearly 400 in 1994 to 600 in 1999, it is still far below 1800, which is considered an indication of concentrated markets (see Rhoades (1993)). Figure 1 also presents a decomposition of the HHI into the two factors that determine concentration: the number of firms and the disparity in size among them, the latter measured by the standarized market share dispersion (see Kelly (1981)). Both a decrease in the number of firms and an increase in firms size disparity lead to a higher HHI, i.e. an increase

[2]The M3 monetary aggregate is composed of domestic currency, and domestic and foreign currency (dollars) demand deposits, saving and time deposits.

[3]These requirements where more stringent than those recomended by the 1988 Basle accord.

[4]For a detailed description of the privatization process see Burdisso, D'Amato and Molinari (1998).

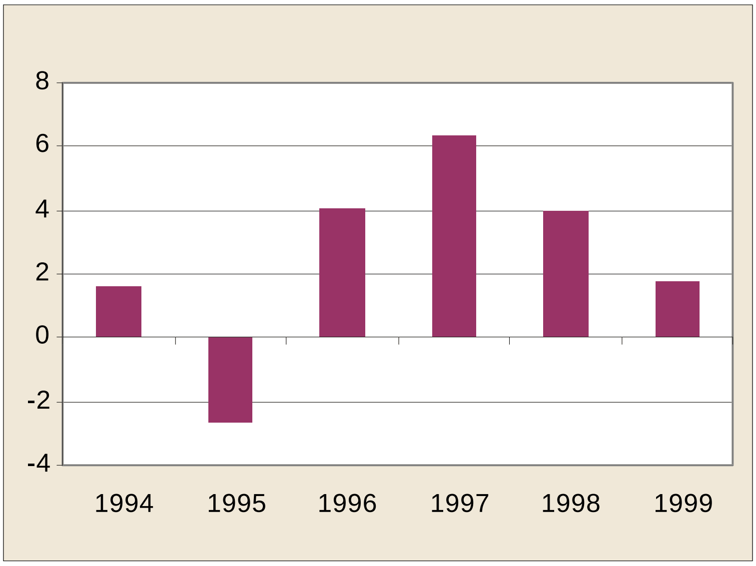
Figure 1: HHI, Number of Firms and Standardized Dispersion



in concentration. It can be observed from Figure 1, that both effects were present in the Argentine banking industry from 1994 to 1999: there was a reduction in the number of firms while at the same time the disparity in size among banks increased. However, the HHI Index still continues to be small. At the same time, average bank profits, measured by the return on equity (ROE), were significantly low over the period 1994-1999, as can be seen from Figure 2. Summing up, aggregate figures at the industry level suggest that the consolidation should not have undermined competition in the industry.

Although relatively little research has been developed to test for market power in the Argentine banking industry, two papers using different approaches indicate the prevalence of competitive behavior. On the one hand, Ahumada, Burdisso, Nicolini and Powell (1998), who study the determinants of banks loan interest rates for the period 1993 -1996, develop a market power test which consists on measuring the extent to which individual banks costs increases translate into loan interest rates increases. They find that individual banks have very little ability to translate costs increases into prices and interpret their finding as an evidence of little if none market power by Argentine banks.

Figure 2: Return on Equity



Furthermore, a recent paper by Burdisso and D'Amato (2000), studies competition in the Argentine banking sector using individual banks Herfindahl-Hirschman Indices, in order to measure concentration in local markets. They estimate a reduced form of a profit equation which incorporates an X-efficiency measures as a relevant factor explaining differences in profits among firms, additionally to concentration measures. They find that, although there is some evidence of local concentration in some rural areas of the country, due to poorly developed financial markets, competition prevails at the banking industry, in spite of the consolidation process of the 1990's.

3 Conjectural Variations in a multi–output setting

We model Argentine banks as multi–output firms, operating in two distinct markets: corporate and retail. This modelling strategy adequately captures the characteristics of the Argentine banking system, where some banks are more retail oriented and have a broad network of branches, mainly offering

Table 1

T- test for dependent samples

Cases: 70

Year	Retail price*	Corporate price*	Difference	Std. Dv.	t	p-value
1997	0.262	0.193	0.069	0.118	4.893	0.000
1998	0.269	0.226	0.043	0.128	2.805	0.007
1999	0.276	0.234	0.043	0.135	2.647	0.010

*Calculated as an average of individual bank rates.

liquidity services while others have very few branches and are more specialized in giving credit to firms. Table 1 presents some evidence of the relevance of this disaggregation of banks output, where a T–test comparing mean prices in both markets indicates that they are significantly different for the three years of analysis, confirming the adequacy of our classification of banks activity into retail and corporate.

More specifically, consider a banking industry composed of I firms indexed by i. We will assume that we can aggregate the different types of banking services offered by each firm i into two products: retail and corporate loans, referred as Y_1^i and Y_2^i respectively[5]. The empirical definition of these markets is presented in Section 4.

3.1 Demand

We will assume that the retail and corporate markets are separate in the sense that the cross elasticities of demand are nil. On the other hand, we will assume that in each market the (representative) consumer views firms as perfect substitutes. Consequently, we can write the inverse demand function in each market as:

$$P_k = P(Y_k) \quad k = 1, 2 \tag{1}$$

[5]We will use subscripts to denote markets and superscripts to denote individuals (banks).

where:

$$Y_k \equiv \sum_{i=1}^{I} Y_k^i \tag{2}$$

is the aggregate supply of banking services in market k.

3.2 Production Technology

The technology of the industry can be described by a cost function of the form

$$C = \quad C(Y^i, W^i) \tag{3}$$

where $Y^i = (Y_1^i, Y_2^i)'$ is the output vector, $W^i = (W_1^i, W_2^i, ..., W_M^i)'$ is the vector of factor prices. In order for the problem to be well defined the cost function $C(\cdot)$ must be homogeneous of degree one and concave in factor prices.[6]

3.3 Profit Maximization

The main objective of the present paper is to understand the degree of strategic interaction among firms. We capture this interaction by introducing conjectural variation parameters. Specifically, we will assume that all banks face the same expectations about their competitors reaction to changes in their own output and that these expectations can be captured by the conjectural variations parameter θ_{kl}:

$$\theta_{kl} \equiv \frac{\partial \log \sum_{j \neq i} Y_k^j}{\partial \log (Y_l^i)} \quad \forall k, l \in \{1, 2\} \tag{4}$$

which is the relative aggregate response of the rest of the participants in market k to a unit percent increase in the production of good l by producer i.

Consequently, the profit maximization problem faced by firm i can be expressed as:

$$\max_{y_1^i, y_2^i} \pi^i = P_1 \cdot Y_1^i + P_2 \cdot Y_2^i - C\left(Y^i, W^i\right) \tag{5}$$

[6]For a discussion of the properties of the multi–product cost and profit functions see, for example, Lau (1972), Hall (1973), and Brown, Cave and Christensen (1979).

subject to (1) and (4).

Profit maximization yields the familiar relationship between marginal revenue and marginal cost:

$$MR_k^i\left(Y^i, W^i\right) = MC_k^i\left(Y^i, W^i\right) \tag{6}$$

where:

$$\begin{aligned} MR_k^i\left(Y^i, W^i\right) \equiv\; & P_k\left[1 - \frac{1}{\eta_k}\left(\frac{Y_k^i}{Y_k} + \left(1 - \frac{Y_k^i}{Y_k}\right)\theta_{kk}\right)\right] \\ & -P_l\frac{1}{\eta_l}\frac{Y_l^i}{Y_k^i}(1 - \frac{Y_l^i}{Y_l})\theta_{lk} \end{aligned} \tag{7}$$

$$MC_k^i\left(Y^i, W^i\right) \equiv \frac{\partial C^i\left(Y^i, W^i\right)}{\partial Y^i} \tag{8}$$

$$k, l \in \{1, 2\}\ ,\ k \neq l,\ i = 1, ...I$$

MR_k^i and MC_k^i are, respectively, marginal revenue and marginal cost of firm i in market k and $\eta_k \equiv -\frac{\partial \log P_k(y_k)}{\partial \log Y_k}$ is the elasticity of demand in market k respectively.

3.4 Measuring Market Power in a Multi-output Setting

Financial intermediation is essentially a multi-output production process. Significant efforts have been done in the empirical literature that concentrates on the technological aspects of banks to deal with the multi-output character of banks. Several flexible functional forms that allow for multiple production have been used to estimate, for example, cost functions. The *IO* literature that studies market power has witnessed less progress.

As mentioned previously, Gelfand and Spiller (1987) Berg and Kim (1998), are important efforts in the direction of studying market power in a multi-output setting. They test for specific market structures using individual *CV* parameters combinations. A shortcoming of this approach is that in the case of multiple production there exist more than one combination of the *CV* parameters for each specific market structure. In order to deal with this problem we develop a market power measure that recovers the original *CV* idea of measuring market power in a continuum between competition and collusion.

With respect to the market power measure we propose, we have that in the single output case, the value of the conjectural variations parameter, assuming equal responses for all individual firms is given by:

$$\theta = \frac{\partial \log \sum_{j \neq i} Y^j}{\partial \log (Y^i)}$$

which can be used as a sufficient statistic for the degree of competition.

Since according to 3.2 all firms share the same technology, we are implicitly assuming that they are equal in size. [7] Under this assumption, the equilibrium will be symmetric.. Specifically, $\theta = \frac{-1}{I-1}$ represents Bertrand conjectures (i.e. perfect competition), $\theta = 0$ are Cournot conjectures and $\theta = 1$ represents perfect collusion.[8]

In the case of multi–product firms, the existence of the θ_{kl}'s, (i.e. the cross conjectural variation parameters) makes it harder to asses the degree of competition. Suppose, for example, that we observe $\theta_{11} = \frac{-1}{I-1}$. Does this imply that there exists perfect competition in market 1? The answer is not necessarily. For example, if we simultaneously observe $\theta_{21} > 0$, inspection of equation (7) would indicate that $P_1 > MC_1^i(\cdot)$ for any i which would imply that market 1 is not perfectly competitive.

To deal with this problem, we suggest using:

$$m_k \equiv \eta_k \left(1 - \frac{MR_k(\cdot)}{P_k}\right) \tag{9}$$

as a sufficient statistic for the degree of market power in industry k.

In order to motivate our market power measure, notice that in the case in which a single firm competes in each market (i.e. perfect collusion) marginal revenue would be given by $P_k \left[1 - \frac{1}{\eta_k}\right]$ which implies that $m_k = 1$. In the case in which the representative firm takes product prices as given (i.e. perfect competition) we have $P_k = MR_k(Y, W)$ so that $m_k = 0$. Similarly, when $m_k = 1/I$ we have Cournot conjectures.

Finally, notice that from a welfare point what matters is how much do prices deviate from marginal cost and not the way prices are determined.

[7] Altough this is a quite strong simplifying assumption , we choose here to adopt it in order to deal with the issue of multiple production.

[8] See Iwata (1974) for a detailed interpretation of the θ parameter in the case of single output firms.

4 Empirical Results

4.1 Specification

For estimation purposes we adopt a translog specification for the cost function:

$$\log\left(C\left(y^i, w^i\right)\right) = c\left(y^i, w^i\right) = \alpha_0 + \sum_{k=1}^{2}\alpha_k y_k^i + \sum_{m=1}^{M}\beta_m w_m^i + \frac{1}{2}\sum_{k=1}^{2}\sum_{l=1}^{2}\delta_{kl} y_l^i y_k^i + \frac{1}{2}\sum_{m=1}^{M}\sum_{n=1}^{M}\gamma_{mn} w_m^i w_n^i + \sum_{k=1}^{2}\sum_{m=1}^{M}\rho_{km} y_k^i w_m^i. \quad (10)$$

where lower case variables denote natural logs of the corresponding upper–case variables (e.g. $y_k^i = \log(Y_k^i)$). Note that the existence of cross order terms in outputs (i.e. the δ's) allows for jointness in production.

In addition, we impose homogeneity of degree one in factor prices as well as symmetry on the cost function,

$$\begin{aligned}
\sum_{m=1}^{M}\beta_m &= 1, \\
\sum_{n=1}^{M}\gamma_{mn} &= 0,\ m = 1, 2, ...M, \\
\sum_{m=1}^{M}\rho_{km} &= 0,\ k = 1, 2 \\
\delta_{kl} &= \delta_{lk}\,, \forall\, k, l, \\
\gamma_{mn} &= \gamma_{nm}, \forall m, n.
\end{aligned}$$

Given the nature of the maximization problem faced by banks it is convenient to estimate this model using a system of simultaneous equations. The system includes:

- the cost function (10),
- banks's first order condition for profit maximization in each market (6) which, using equation (10), can be re–expressed as:

$$P_k\left[1 - \frac{1}{\eta_k}\left(\frac{Y_k^i}{Y_k} + \left(1 - \frac{Y_k^i}{Y_k}\right)\theta_{kk}\right)\right] - P_l\frac{1}{\eta_l}\frac{Y_l^i}{Y_k^i}\left(1 - \frac{Y_l^i}{Y_l}\right)\theta_{lk}$$

$$= \frac{C^i}{Y_k^i}(\alpha_k + \sum_{l=1}^{2} \delta_{kl} y_l^i + \sum_{m=1}^{M} \rho_{km} w_m^i) \quad k,l \in \{1,2\}\,, \;\; i = 1,..,I. \tag{11}$$

- $M-1$ share equations, which are the derivatives of the cost function with respect to input prices,

$$S_m = \beta_m + \sum_{n=1}^{M} \gamma_{mn} w_n^i + \sum_{k=1}^{2} \rho_{km} y_k^i \qquad m = 1,...,M-1\,, \quad i = 1,..,I. \tag{12}$$

  We estimate $M-1$ share equations to avoid linear dependency. More specifically, since we consider three inputs: labor, capital and deposits, we drop the share equation for capital.

To sum up, the system consists of five equations: two first order conditions, the cost function and two share equations.

The simultaneous estimation of the profit maximizing first order condition for banks together with the cost function provides information about both the production and the revenue side of the firm.

4.2 The Data

The system described above is estimated for a panel of annual data that covers the period 1997-1999 which, as discussed in Section 2 was a period of restructuring for the Argentine banking sector. The data set consists on a sample 70 financial institutions. It is restricted to those banks that operate in both markets, corporate and retail. For reasons of comparability we consider the same banks for the three years of analysis. Retail loans include financing to households and small enterprises: mortgages, personal loans and pledges. Corporate loans consist basically on financing to large enterprises: overdrafts, interbank loans and promissory notes. Output prices, i.e. interest rates on retail and corporate loans, are calculated as a weighted average of individual banks interest rates.

With regards to inputs, we assume that banks use three inputs to produce the two outputs: labor, capital and deposits. Labor prices are calculated as the ratio of labor expenses to total employees. The price of capital is the ratio of capital expenses to net worth and the price of funds is the implicit interest rate on deposits calculated as the ratio of interest payments on remunerated deposits. Given that the price of capital is only available since 1997, we restrict our analysis to the period 1997-1999.

Banks costs are composed by operative bank costs plus interest payments on deposits.

4.3 Estimation Methodology

The system of equations developed in Section 4.1 is a system of Seemingly Unrelated Regression Equations ($SURE$). It is estimated using the Full Information Maximum Likelihood Method ($FIML$). This estimation methodology seems to be adequate for the problem we are solving here for two main reasons. First, the error terms of the equation composing the system described above cannot be assumed to be non-correlated. While limited information methods, consisting in the estimation of one equation by time, neglect this problem, full information methods, that consist on the simultaneous estimation of all the equations in the structural model, allow for the error terms of the different equations in the system to be correlated, yielding more efficient estimators. Second, within the full information methods, maximum likelihood methods are invariant to different reparametrizations. The system we estimate here is subject to this problem, since one can obtain different parametrizations of the model depending on which particular share equation is dropped or the input price used as numeraire.

Given that our system is nonlinear, the most effective way to solve the maximization problem is to use an iterative algorithm. The most commonly used algorithms are gradient methods. We used here the Berndt, Hall, Hall and Hausman ($BHHH$) and the Newton algorithms. Although both methods worked, the Newton algorithm converged more rapidly.[9]

4.4 Results

4.4.1 Estimation of Demand Elasticities

Before we discuss the results of our main estimation exercise it should be noted that the market demand elasticities for the two products, retail and

[9] The use of numerical methods for maximizing a system of equations is subject to many practical problems such as multiple local maxima, discontinuities, large dimension and others. These kind of problems can affect the reliability of results.

corporate (6), are estimated separate from the equation system previously described.

We obtain the elasticities by estimating a supply and demand simultaneous system using time series of aggregate monthly data on interest rates charged on retail and corporate loans as well as quantities for the period 1996-1999.

Given that output prices are non stationary, we estimate a cointegrated system of equations that allows us to distinguish between the short and the long run price elasticities. Our interest in this case is in the long run price elasticity, since under the CV approach, decisions by firms about quantities can be interpreted as decisions about their capacity, what is essentially a long run phenomenon.

For each market we estimate the following system of demand and supply equations

$$\begin{aligned} \Delta y_t &= \sigma_1 \Delta r_t + \sigma_2 r_{t-1} + \beta_1 y_{t-1} + \beta_2 X_t^s + \varepsilon_t^s && \text{(Supply)} \\ \Delta y_t &= \eta_1 \Delta r_t + \eta_2 r_{t-1} + \alpha_1 y_{t-1} + \alpha_2 X_t^d + \varepsilon_t^d && \text{(Demand)} \end{aligned}$$

where the dependent variable, y is the (log of) seasonally adjusted market–wide production in each sector , r is the (log of) interest rate charged in each sector, σ_1, σ_2 are short and long run supply elasticities respectively, and $\eta_1$and η_2 are short and long run demand elasticities respectively; X^s and X^d are respectively, a vector of exogenous variables in the supply and demand equations and ε^s and ε^d are the corresponding error terms. We use a monthly sample dated from 1996:03 to 1999:12.

More specifically, in the retail market X^s includes a constant, the (log of) deposit rate, the (log of) amount of deposits in the banking system (used to control for credit constraints), the (log of) rate of return on the FRB as a substitute asset for banks, and two dummies to control for outliers. The vector X^d includes the same variables except for the (log of) amount of deposits in the banking system and the (log of) rate of return on the FRB. Given that we are estimating a dynamic model, the two equations include the dependent variable lagged one period. Since we estimate the system using three stage least squares, our instrumental variable is (in addition to the exogenous variables previously mentioned) the (log of) seasonally adjusted monthly estimator of industrial production lagged one period, tracked by the INDEC (EMI). For the corporate market we employ the same variables in the demand equations except for the dummies.

The results of the estimation for the demand equations are shown in Table 2.A. and 2.B., for the retail and corporate markets respectively. [10] Long run demand elasticities are 0.269 and 0.213 for the retail and the corporate market, respectively. This result is somewhat counterintuitive, since firms demanding funds in the corporate market, which are mainly the large ones, are expected to have more alternative financing sources than consumers or small firms. However, as we will show later, these elasticities are in line with the results we obtain when measuring market power for both markets.

4.4.2 Estimation of the System Equations

The results of the estimation of the system described in Section 4.1 are presented in Table 3. Although only first order terms are presented for the sake of brevity, second order terms were highly significant.

The cost function provides information about banks' technology. In particular, scale economies can be evaluated from the estimated parameters.[12] The empirical results presented in Table 4 indicate that there are economies of scale in the industry.[13] This result is consistent with previous work which estimates economies of scale using different output definitions and estimation methods.[14] As can be seen from Table 4, returns to scale are very stable along the three years.

The presence of joint production between the two outputs, could affect banks' strategic behavior, since in this case costs will be interrelated across markets.[15] Thus, shocks in one of the markets, changing profit maximizing quantities, could induce reallocation of resources from one market to the other as shown in (6), although jointness in production is not the only possible source of interaction between markets. Bulow, Geanakoplos and Klemperer

[10] We are interested in indentifying the demand equation. As the system is partially identified, we do not include the supply equation.

[12] In the case of multiproduct firms, scale economies measure the percentage increase in total cost due to a simultaneous and equal percentage increase in each output. For more details see Clark (1988).

[13] This outcome is somewhat problematic, since for the Cournot equilibrium to be unique, constant returns to scale as well as linearity for the demand function are needed. Tirole (1997)

[14] See (Streb and D'Amato (1995), Dick (1996), Burdisso (1997) and Burdisso et al. (1998).

[15] Jointness in production exists between two outputs when the marginal cost of producing one of them is decreasing in the other output.

Table 2.A.
Estimation of demand elasticity in the Retail Market

Dependent variable: First difference seasonally adjusted log retail output

Variable	Coefficient	P–Value
Constant	-0.115	0.092
First difference log retail market interest rate	-0.273	0.003
Log retail market interest rate$_{-1}$	-0.269	0.000
Seasonally adjusted log retail output$_{-1}$	-0.032	0.000

Adjusted R^2=0.558
Durbin_Watson = 2.240

Table 2.B.
Estimation of demand elasticity in the Corporate Market

Dependent variable: First difference seasonally adjusted log corporate output

Variable	Coefficient	P–Value
Constant	2.124	0.006
First difference log corporate market interest rate	-0.288	0.113
Log corporate market interest rate$_{-1}$	-0.213	0.045
Seasonally adjusted log corporate output$_{-1}$	-0.243	0.003

Adjusted R^2=0.224
Durbin_Watson = 2.168

Table 3.
Maximum Likelihood Parameter Estimates

Parameter	1997	1998	1999
Constant	7.788***	7.498***	6.878***
α_1 (retail output)	-0.053	-0.074*	-0.075**
α_2 (corporate output)	-0.349***	-0.155***	-0.153***
β_1 (cost of funds)	0.516***	0.695***	0.462***
β_2 (labor cost)	0.322***	0.260**	0.458***
θ_{11}(retail retail)	0.167***	0.0132	0.020
θ_{12} (retail corporate)	-0.017***	-0.002***	-0.005***
θ_{21} (corporate retail)	-0.013***	-0.012***	-0.017***
θ_{22} (corporate corporate)	0.001	0.028*	0.011

For the sake of brevity we omit second order terms. [11]
θ_{kl} is the percentage response in market k to a one percent increase in production in market l.
The superscripts *,** and *** denote rejection of significance at 10, 5 or 1% respectively.

Table 4
Properties of the Cost Function

Parameter	Year	Estimate	H_0	P-value
Scale Elasticity	1997	0.725	1	0.000
	1998	0.710	1	0.000
	1999	0.726	1	0.000
Jointness in Production	1997	0.126	0	0.000
	1998	0.108	0	0.000
	1999	0.130	0	0.000

Standard Errors in necessary for the calculation of P-values were calculated using the delta method.

(1985) show that interactions between markets can also appear if competitors regard products as strategic complements or substitutes.

Jointness in production can be evaluated from the cost function parameters. A test of jointness in production is a test of

$$JP = \frac{\partial^2 C^i}{\partial Y_k Y_l} = \frac{C^i}{Y_k Y_l} \left(\alpha_k \alpha_l + \delta_{kl} \right) < 0.$$

Since C^i, Y_k and Y_l are positive, the test consists on evaluating[16]

$$\alpha_k \alpha_l + \delta_{kl} \leq 0.\text{x}$$

The results, presented in Table 4 indicate no evidence of jointness in production. The value of the parameter for 1999 is 0.130 and we cannot reject the hypothesis that the parameter is positive.

4.4.3 Market Power

We use two strategies to evaluate market power. The first one is the one adopted by previous CV studies, which model banks as multi-output firms (Gelfand and Spiller (1987) and Berg and Kim (1998)). The null hypothesis are $\theta_{kk} = \theta_{kl} = 0$ for the Cournot solution, $\theta_{kk} = \frac{-1}{I-1}$ and $\theta_{kl} = 0$ for the competitive solution, and $\theta_{kk} = 1$ and $\theta_{kl} = 0$ for the monopoly solution. In this case we conducted Wald tests, which are presented in Table 5.A and 5.B.

We find that for both markets, retail and corporate, we are not able to determine market structure, since the three hypotheses are rejected.

These results give evidence that this strategy of evaluating market structure has some limitations. In the first place, the empirical CV literature explicitly tests for market power rather than market structure.[17] More importantly, in the case of uni–product firms, testing for market power and for market structure are equivalent, since there is a one to one correspondence between these two concepts. As explained in Section 3.4, however, in the case of multiple markets there are (infinitely) many market structure combinations (i.e. the θ's) which are consistent with, say, perfect competition (i.e. marginal cost pricing) in addition to $\{\theta_{kk}, \theta_{kl}\} = \left\{\frac{-1}{I-1}, 0\right\}$. Since it would be

[16] Since this restriction is non–linear in the parameters, we used the Delta Method which allows such non–linarities. For more details about the Delta Method, see Greene (1993).

[17] See Bresnahan (1989).

Testing for Alternative Market Structure

Table 5.A.

Retail Market

Market Structure	Year	Hypothesis	χ^2	$P-value$
Perfect Competition	1997	$\theta_{11}=\frac{-1}{I-1}$ and $\theta_{21}=0$	64.35	0.000
Cournot		$\theta_{11}=0$ and $\theta_{21}=0$	57.57	0.000
Perfect Collusion		$\theta_{11}=1$ and $\theta_{21}=0$	959.39	0.000
Perfect Competition	1998	$\theta_{11}=\frac{-1}{I-1}$ and $\theta_{21}=0$	43.28	0.000
Cournot		$\theta_{11}=0$ and $\theta_{21}=0$	42.89	0.000
Perfect Collusion		$\theta_{11}=1$ and $\theta_{21}=0$	841.06	0.000
Perfect Competition	1999	$\theta_{11}=\frac{-1}{I-1}$ and $\theta_{21}=0$	80.53	0.000
Cournot		$\theta_{11}=0$ and $\theta_{21}=0$	82.25	0.000
Perfect Collusion		$\theta_{11}=1$ and $\theta_{21}=0$	1143.83	0.000

Table 5.B.

Corporate Market

Market Structure		Hypothesis	χ^2	$P-value$
Perfect Competition	1997	$\theta_{22}=\frac{-1}{I-1}$ and $\theta_{12}=0$	70.98	0.000
Cournot		$\theta_{22}=0$ and $\theta_{12}=0$	78.12	0.000
Perfect Collusion		$\theta_{22}=1$ and $\theta_{12}=0$	3194.58	0.000
Perfect Competition	1998	$\theta_{22}=\frac{-1}{I-1}$ and $\theta_{12}=0$	13.96	0.001
Cournot		$\theta_{22}=0$ and $\theta_{12}=0$	11.56	0.003
Perfect Collusion		$\theta_{22}=1$ and $\theta_{12}=0$	2810.82	0.000
Perfect Competition	1999	$\theta_{22}=\frac{-1}{I-1}$ and $\theta_{12}=0$	34.71	0.000
Cournot		$\theta_{22}=0$ and $\theta_{12}=0$	34.16	0.000
Perfect Collusion		$\theta_{22}=1$ and $\theta_{12}=0$	3373.74	0.000

The standard errors necessary for calculation of χ^2statistic were calculated using the Delta Method.

Table 6.A.
Market Power Indices

Retail Market

Structure	$\widehat{m}_r$	m_0	z–ratio	Null Hypothesis (p-values) $\widehat{m}_r \leq m_0$	$\widehat{m}_r \geq m_0$	$\widehat{m}_r \neq m_0$
1997						
Perfect Competition	0.155	0	5.652	0.000	1.000	0.000
Cournot		1/I=0.014	5.129	0.000	1.000	0.000
Perfect Collusion		1	-30.931	1.000	0.000	0.000
1998						
Perfect Competition	0.002	0	0.059	0.477	0.523	0.953
Cournot		1/I=0.014	-0.349	0.636	0.364	0.727
Perfect Collusion		1	-28.450	1.000	0.000	0.000
1999						
Perfect Competition	0.006	0	0.177	0.430	0.570	0.860
Cournot		1/I=0.014	-0.244	0.596	0.404	0.807
Perfect Collusion		1	-29.278	1.000	0.000	0.000

The standard errors necessary for calculation of the z-statistic were calculated using the Delta Method.

impossible to test for all such market structures, the second strategy is to employ the market power index developed in section 3.4. We feel our market power index is the proper multi–product generalization of the CV approach.

The results from this strategy are shown in Tables 6.A. and 6.B.. The market power indices ($\widehat{m}_r$ for the retail market, and $\widehat{m}_c$ for the corporate market) are calculated following (9), where the marginal revenue for each market is a weighted average of individual banks marginal revenues.

With regards to the retail market, perfect collusion can be rejected for the three years. Given the large number of banks in the industry this is a quite strong result in favor of competition, since the Cournot solution is very close to competition. As can be seen in Table 6.A., for 1998 and 1999 we are not able to reject perfect competition neither Cournot, although the index is

Table 6.B.
Market Power Indices

Corporate Market						
				Null Hypothesis (p-values)		
Structure	$\widehat{m}_c$	m_0	z–ratio	$\widehat{m}_c \leq m_0$	$\widehat{m}_c \geq m_0$	$\widehat{m}_c \neq m_0$
1997						
Perfect Competition	-0.014	0	-0.609	0.729	0.271	0.542
Cournot		1/I=0.014	-1.224	0.890	0.110	0.221
Perfect Collusion		1	-43.662	1.000	0.000	0.000
1998						
Perfect Competition	0.026	0	1.412	0.079	0.921	0.158
Cournot		1/I=0.014	0.642	0.260	0.740	0.521
Perfect Collusion		1	-52.435	1.000	0.000	0.000
1999						
Perfect Competition	0.005	0	0.295	0.384	0.616	0.768
Cournot		1/I=0.014	-0.527	0.701	0.299	0.598
Perfect Collusion		1	-57.279	1.000	0.000	0.000

The standard errors necessary for calculation of the z-statistic were calculated using the Delta Method.

TABLE 7
MARKET CONCENTRATION RATIOS

Market	Year	Herfindahl-Hirschman Index
Retail	1997	702
	1998	682
	1999	704
Corporate	1997	656
	1998	592
	1999	628

closer to the competitive solution.

The results for the corporate market are quite similar, as can be seen from Table 6.B.. Perfect collusion can be rejected for all years, and similarly to the retail market, the competitive and the Cournot solution cannot be distinguished. Thus, summing up, both markets, retail and corporate seem to be very close to the competitive solution.

We can also compare the obtained results with those of the SCP approach. Table 7 shows the HHI for the retail and corporate markets. For both markets the indices are very low and also very stable along the period, giving evidence of non-concentrated markets. Thus the conclusions that can be drawn from the CV approach are not different to those drawn from the HHI.

5 Conclusion

We evaluated the competitiveness of the banking industry in Argentina in a multi–output setting, modelling banks as firms which operate in two markets, retail and corporate. These firms choose output in each market as to maximize total profits, subject to their expectations about other firms' responses. Contrary to the standard practice in the literature, we estimated the firms' first order conditions along with their cost structures.

In order to measure market power we employed two kind of tests. The first one was to test for specific forms of market structure: competition, Cournot and perfect collusion. This avenue did not yield conclusive results because it is a test of a particular market structure rather than a measure of market power, and has an ambiguous interpretation in a multi–output setting. For this reason, we developed an index of market power which ranges continuously from a value of 0 (perfect competition) to 1 (perfect collusion), allowing us to measure the degree of market power in each market.

We found evidence that both markets, retail and corporate are close to the competitive solution (in the sense that marginal revenue equals marginal cost) along the period of analysis. These results are consistent with the predictions drawn from concentration measures, used in the SCP literature.

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A Appendix: Descriptive statistics

Table A
Descriptive Statistics

Variable	Year	Mean	Std. Dev	Minimum	Maximum	Cases
Total Cost[1]	1997	56452	100056	516	481292	70
Retail output[1]		149880	298660	29	1463048	
Corporate output[1]		165622	316247	93	1747003	
Price of labor[1]		36.07	13.29	12.14	69.17	
Price of funds		0.071	0.024	0.016	0.160	
Price of Capital		0.099	0.065	0.005	0.331	
Retail price[2]		0.212	-	-	-	
Corporate price[2]		0.156	-	-	-	
Total Cost[1]	1998	73476	135903	657	603226	70
Retail output[1]		226167	442344	57	2142985	
Corporate output[1]		196805	351736	717	1878195	
Price of labor[1]		35.75	11.53	13.23	72.26	
Price of funds		0.067	0.019	0.019	0.119	
Price of Capital		0.101	0.068	0.015	0.320	
Retail price[2]		0.200	-	-	-	
Corporate price[2]		0.178	-	-	-	
Total Cost[1]	1999	84702	157429	611	716375	70
Retail output[1]		251184	501444	57	2327479	
Corporate output[1]		196948	365565	838	2200561	
Price of labor[1]		36.42	13.13	13.94	72.97	
Price of funds		0.072	0.018	0.031	0.114	
Price of Capital		0.119	0.104	0.015	0.701	
Retail price[2]		0.209	-	-	-	
Corporate price[2]		0.185	-	-	-	

[1]In thousands

[2]Market wide interest rates calculated as a weigthed average of individual banks rates.