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Banking Sector Performance in Latin America: Market Power versus Efficiency

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Abstract

Since the mid-1990s the banking sector in the Latin American emerging markets has experienced profound changes due to financial liberalisation, a significant increase in foreign investments and greater mergers activities often occurring following financial crises. The wave of consolidation and the rapid increase in market concentration that took place in most countries has generated concerns about the rise in banks' market power and its potential effects on consumers. This paper advances the existing literature by testing the market power (Structure-Conduct-Performance and Relative Market Power) and efficient structure (X- and scale efficiency) hypotheses for a sample of over 2,500 bank observations in nine Latin American countries over 1997-2005. We use the Data Envelopment Analysis technique to obtain reliable efficiency measures. We produce evidence supporting the efficient structure hypotheses. The findings are particularly robust for the largest banking markets in the region, namely Brazil, Argentina and Chile. Finally, capital ratios and bank size seem to be among the most important factors in explaining higher than normal profits for Latin American banks.

Keywords: Structure-Conduct-Performance; Efficient Structure; Latin American banking; Data Envelopment Analysis (DEA).

JEL classification: G21; D24.

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1. Introduction

The banking sector in Latin America has undergone dramatic transformations over the last fifteen years or so as a result of the processes of financial liberalisation and international integration. One of the main responses to these changes has been an accelerated process of consolidation of their financial systems and, as a result, more concentrated banking sectors.[1]

Such developments have been set against the background of recent economic and financial crises[2] as well as a growth in foreign investment in the region. The presence of foreign banks has increased significantly since the mid-1990s with European and US banks being the main investors. Indeed Yeyati and Micco (2003) observe that unlike the US and the EU, the banking sector consolidation in Latin America has been largely driven by the acquisitions of local banks by foreign institutions. No doubt, foreign investments may help the undercapitalised financial systems in the region, and financial consolidation may create some benefits for consumers e.g. in terms of higher quality services (Berger and Mester, 2003). Serious policy concerns arise, however, regarding the potential collusive behaviour between the banks operating in highly concentrated markets and its effects on their conduct and profitability. Collusion activities, like other anti-competitive practices, can generate abnormal bank profits and ultimately burden consumers through, for example, higher than competitive loan rates, credit rationing and the downgrading of banking services.

Such considerations are typically formulated in the context of market-power explanations of bank performance. A popular market-power approach is the Structure-Conduct-Performance (SCP) paradigm, which implies that concentration lowers competition by fostering collusion among a handful of large banks in the market. A related market power theory is the Relative Market Power (RMP) hypothesis which suggests that firms with large market shares and well-differentiated products are more efficient and can earn supernormal profits. Another strand of literature, however, interprets the relationship between bank performance and concentration in terms of

[1] Over the period 1997 to 2005 most countries in the region experienced a profound decrease in the number of commercial banks: e.g. by 15% in Argentina and 26% in Brazil, and by approximately 10% in overall Latin America. The Latin American average is calculated using the following countries: Argentina, Brazil, Chile, Colombia, Costa Rica, Mexico, Paraguay, Peru, Uruguay and Venezuela.

[2] Countries that experienced financial crises in the mid-1990s include Mexico, Venezuela, Paraguay, and Argentina. Around the turn of the millennium further crises occurred in Brazil, Argentina, and Uruguay (for more details see Garcia-Herrero, 1997; Nazmi, 1999; and Rojas-Suarez, 2004).

enhanced efficiency. The efficient structure hypothesis formalizes the concept that more efficient firms have lower costs, which in turn lead to higher profits. Therefore, with respect to the RMP, the causality is reversed in the sense that the most efficient firms will be able to increase their market share, resulting in higher concentration. Recently Berger (1995) emphasises the need to include measures of estimated productive efficiency in the market power models of bank performance and distinguishes between X-efficiency[3] (ESX) and scale efficiency (ESS) hypotheses.

The market power and efficient structure hypotheses have contrasting implications for regulation, particularly in relation to mergers and antitrust policies. If the evidence favors the efficient structure hypothesis, then mergers (and market concentration in general) are motivated by efficiency considerations, which should increase consumer and producer's surplus. If on the other hand the evidence validates the market power hypotheses it would imply that the motivation behind mergers is monopolistic price setting. As a consequence, an argument for pursuing antitrust policies emerges. Moreover, given that the banking system affects economic development and growth (Beck et. al., 2000) as well as poverty alleviation (Levine, 2005) it is important to identify policies conducive to its efficient operation (e.g., see Barth et al. 2006).

We investigate the relationship between market structure, efficiency and bank performance/profitability in Latin America. We focus on a sample of approximately 2,500 bank observations in nine Latin American countries over the period 1997-2005. Relevant research testing these models has typically examined the developed countries' banking markets (mainly US and EU) while evidence for Latin America is scarce. Some recent country-specific studies exist focusing on Chile and Mexico (e.g. Berstain and Fuentes, 2005; Guerrero et al., 2005) but no comprehensive analysis of the above issues for the Latin America banking industry is available to our knowledge. Moreover, we employ the non-parametric Data Envelopment Analysis (DEA) technique to obtain reliable measures of bank efficiency. The evidence we produce is more consistent with the efficient structure hypotheses rather than the market-power theories.

The following section provides a review of the relevant literature. Section 3 discusses the model specifications, the methodology used for calculating efficiency,

[3] The concept was first introduced by Leibenstein (1966).

and the data. Section 4 presents and discusses the results and finally Section 5 concludes.

2. Literature Review

2.1 Industrial Organisation Considerations in the Banking Sector

The traditional SCP hypothesis that a firm's profits and conduct are determined by the structural features of the market where it operates (Bain, 1951) has been challenged by further developments in the theory of industrial organization. The RMP hypothesis (Shepherd, 1982, 1986) considers firms' market share as a proxy variable for assessing market power. Essentially, market share is assumed to capture both firm's efficiency and other factors like market power and product differentiation. In this context, Hicks' *quiet life* hypothesis (1935) is often considered as a special case of RMP because it establishes that concentrated markets reduce competitive pressure as managers put less effort to maximize the firm's efficiency. Demsetz (1973) proposes as an alternative the efficient structure hypothesis, which postulates that the correlation between market concentration and bank profitability is the result of the underlying relationship between profit and the efficiency of the firms. In this case, the positive relationship between profits and concentration is spurious because efficiency is the variable that actually explains profitability and that motivate larger market share.

The SCP and RPM models have been tested extensively in the banking industry, with most of the research focusing on the US and, more recently, the EU. The results, however, appear mixed and there is no conclusive evidence to indicate the superiority of one model over the other (e.g., Gilbert, 1984; Goddard et al., 2001). Berger (1995) argues that existing market power models may be mispecified due to omitted variables and that models of bank profitability should include direct measures of X- (ESX) and scale (ESS) efficiencies. The ESX hypothesis implies that firms experience lower costs and thus higher profits because of superior management or production technologies. The ESS hypothesis emphasizes that firms producing at more efficient scales achieve lower unit costs and higher unit profits. Berger (1995) tests the four competing hypotheses (SCP, RMP, ESX and ESS) in the US and finds that only the market share and X-efficiency variables are positively and significantly related to bank profits. The explanatory power of the models tested, however, is lower than expected. Similarly, some EU studies (e.g. Goddard et al., 2001) corroborate

such concerns about the capability of these models to explain variations in bank performance.

Subsequent research has evolved in several directions. Some studies emphasize the role of different factors in explaining competitive conditions in banking markets, such as bank risks, regulation, the quality of banking services, and the ownership and size of banks (Berger et al., 2004). Other studies have applied advanced method for measuring competition using e.g. the Panzar and Rosse H-statistics (Casu and Girardone, 2006) and the Lerner Index of monopoly power (Fernandez de Guevara et al., 2005). These models, originally developed in the context of the "New Empirical Industrial Organisation" literature, have the advantage of employing direct measures of (static and dynamic) competition.

The majority of studies, however, still rely on tests of market power and/or efficiency as analytical models of bank competition both in the US (see e.g. the reviews by Gilbert and Zaretzky, 2003; Northcott, 2004) and the EU (e.g. Punt and Van Rooij, 2001; Vander Vennet, 2002; Hahn, 2005; and Yu and Neus 2005, to name a few). Usually the results of these studies are mixed; however if the models incorporate explicit measures of efficiency they generally tend to find some support for the efficient structure hypotheses.

2.2 Evidence from Developing Countries and Emerging Markets

Recent research testing the market power and the efficient structure hypotheses have expanded to various regions in the world including developing nations. Only a handful of recent studies test market power versus efficiency hypotheses in the Latin American banking sector and most of them are country-specific. Moreover, only a limited number of those studies uses sophisticated techniques to measure X- and scale efficiencies[4] (e.g., Carvallo and Kasman, 2004; Wong, 2004). Berstain and Fuentes (2005) study the relationship between banking concentration and price rigidity in Chile for the period of 1995 to 2002. They find that greater concentration in the banking sector in Chile has generated more rigidity in the deposit rates. Their findings are interpreted as being broadly in line with the SCP argument. Guerrero et al. (2005) study the Mexican banking industry focusing on 19 banks for the period 1997 to 2003 and find evidence in support of the RMP hypothesis, thus rejecting the SCP and

[4] Please see Section 3.2 for a discussion of alternative methodologies.

efficient structure models. The authors use a balanced panel of banks which does not take into consideration merger and acquisition effects. They also estimate stochastic frontiers to obtain bank efficiency measures and they do not find evidence of a positive relationship between profitability and X- or scale efficiency. Similarly, Park and Weber (2006) study the market power and efficient structure models for a sample of Korean banks for the period 1992 to 2002. They find that bank efficiency rather than concentration has a significant effect on bank profitability thereby giving support to the efficient structure model.

Some other studies consider a large number of countries. For example, Beck et al. (2003) analyze the relationship between market structure and bank performance for 364 banks operating in 8 Central and Eastern European Countries for the period 1998 to 2001. They reject the SCP hypothesis and accept the RMP, although they also observe that costs, risks and reserve ratios are important determinants of bank performance. Gonzalez (2005) analyses efficiency and market power of the banking sectors in 69 countries, including Latin America, using 2,592 observations over 1996-2002. His results are consistent with the efficient structure hypothesis. He also acknowledges other relevant variables as significant determinants of profitability such as bank regulation, supervision, financial structure and financial development. Claessens et al. (2001) study 80 countries, including Latin America, from 1988 to 1995 and investigate how profits, net interest margins, overhead, and taxes differ between domestic and foreign banks. They find that in developing nations foreign investment is associated with higher profitability and high interest rates.

Overall, it seems that only a few studies focus on the determinants of bank performance and profitability in Latin America. Moreover, the existing US and EU evidence does not suggest the development of a consensus in the literature. This paper contributes to the existing literature by testing the SCP, RMP and efficient structure hypotheses using X-efficiency and scale efficiency measures. We obtain these measures using the non-parametric DEA technique. As far as we know this is the first study to carry out a systematic analysis for a large sample of banks operating in a large group of different Latin American countries. It is also the first to test the efficient structure hypotheses using DEA efficiency estimates.

3. Methodology and data

3.1 Model Specification and Methodology

To empirically test the SCP (Structure-Conduct-Performance), RMP (Relative-Market-Power) models and the two efficient structure (ESX and ESS) hypotheses we use the following equation (Berger, 1995):

$$ROA_{it} = \alpha_i + \beta_1 HHI_t + \beta_2 MS_{it} + \beta_3 ESX_{it} + \beta_4 ESS_{it} + \sum_{j=1}^{3} \eta_j X_{j,it} + \sum_{n=1}^{4} \delta_n Z_{n,t} + \varepsilon_{it} \quad (1)$$

where ROA is a profitability ratio calculated as net income over total assets; the Herfindahl-Hirschman Index (HHI) is a measure of market structure calculated as the sum of squared market shares in the assets market as follows: $HHI_t = \sum_{i=1}^{n} (MS_{it}^{assets})^2$. The HHI is chosen over other measures of concentration since it accounts for all banks operating in the chosen market. MS represents bank i's share of assets at time t. Based on the SCP argument, a positive impact of concentration on profitability would be indicative of collusion. A positive sign on market share would support the relative market power hypothesis, thus banks with a relatively high market share would be able to set prices as they think fit without facing the usual market constraints. The relative market hypothesis predicts a positive relationship between MS and return on assets (ROA) and no role for HHI. ESX is a measure of managerial cost efficiency where firms with superior management have lower costs and therefore higher profits. ESS is a measure of scale efficiency and refers to firms that have equally good management and technologies, but produce at more efficient scale than others. Following Berger (1995), if the efficient structure theory holds, then either or both the ESX and ESS are expected to be positive and significant. On the other hand HHI and MS will lose their explanatory power and be insignificantly related to profitability.

The vector of the control variables, X includes a number of firm- and/or market- specific characteristics while Z is a vector of country-specific macroeconomic variables. Finally, the ε is the error term. More specifically the X can be written as follows:

$$\sum_{j=1}^{3} \eta_j X_{j,it} = \eta_1 CAP_{it} + \eta_2 LTA_{it} + \eta_3 ASSETS_{it} \quad (2)$$

where CAP is the degree of capitalisation measured as equity over assets, LTA is a measure of liquidity risk measured as loans over assets, and ASSETS is the natural logarithm of total assets which is included as a proxy for bank size.

The relationship between the degree of capitalisation (CAP) and profitability is typically expected to be negative since greater capital induces banks to take less risk and thus earn less profit. Higher capital ratios, however, may also reflect lower expected bankruptcy (and hence lower funding costs) and/or higher incentives from the part of the shareholders to monitor management. In these cases, the hypothesis is that higher capital ratios are associated with more profitable institutions. The variable LTA reflects the risk that banks have in terms of liquidity, therefore the higher the ratio, the more aggressive a bank should be towards increasing profitability. According to Claeys and Vander Vennet (2003) high values of LTA should increase ROA since they capture the banks' highest yielding type of assets. Therefore, a positive relationship between LTA and ROA is expected. Finally, the natural logarithm of total assets (ASSETS) is included as a proxy for size and is expected to be an important determinant of profitability if the banks are operating at increasing returns of scale.

In addition, we specify the vector of the macroeconomics variables as

$$\sum_{n=1}^{4} \delta_n Z_{n,t} = \delta_1 XRATE_t + \delta_2 CPI_t + \delta_3 GDP_t + \delta_4 INT_t \quad (3)$$

where XRATE is the average annual exchange rate; CPI is the average percentage change of the consumer price index; GDP is the average annual change in GDP; and INT is the market interest rate. There is no *a priori* expected relationships between profitability and the exchange rate (XRATE) since the sign of its correlation with ROA may vary. The relationship between the inflation rate (CPI) and profitability is spurious and no particular sign is expected. One would expect that a positive relationship between GDP growth and ROA since banking profitability is pro-cyclical. Finally, the average annual market interest rate and its relationship with ROA may vary because on one hand higher market interest rates restrict economic

activity but on the other hand they push commercial interest rates on the same direction, potentially creating a more profitable business environment for banks.

We estimate the model described in equation (1) using an unbalanced panel of data. This choice was dictated by two main reasons: first, to account for the consolidation process that has taken place in Latin America over the period considered and second, to observe heterogeneity between observations and time effects.[5]

3.2 Estimating Bank Efficiency: The Data Envelopment Analysis (DEA) Methodology

The different methodologies for measuring efficiency can be divided into parametric and non-parametric. The dominant non-parametric approach is DEA which obtains efficiency estimates for the production units considered and creates an efficient frontier through the observed input-output ratios using mathematical programming techniques. In contrast to parametric methods[6], which define the efficient frontier through a functional form and require statistical distributions for the shocks and efficiency scores, DEA does not allow shocks to production or costs. Thus, DEA does not allow random shocks to affect the frontier and interprets any deviation from the frontier as a manifestation of inefficiency. A consensus on which methodology efficiency-measuring frontier is preferable has not yet been achieved (Berger and Humphrey, 1997; Goddard et al. 2001). Some of the most important advantages of the DEA methodology, however, include the lack of restrictions on the functional form, the different variables and values (e.g., ratios) which may be used, the possibility of measuring those variables in different units, and the fact that any deviations from the efficiency frontier are noticeable (e.g., see, Thanassoulis, 2001).

The DEA was first used by Charnes et. al. (1978) and ever since has been widely used to estimate efficiency in banking. The DEA frontier is formed by "best-practice observations" yielding a convex production possibility set. The most commonly used DEA approach for measuring technical efficiency in banking is the

[5] The fixed effects panel data methods were assumed to be appropriate for estimating equation 1. We carry out the Hausman specification tests, however, to choose random versus fixed effects models. All computations are carried out with STATA.

input-oriented Variable Returns to Scale (VRS) model. That is, for a given output level the use of the minimum input bundle that is found based on observed practice can still produce the required output level. The actually used input bundle is radially reduced. We adopt this approach since banks usually tend to minimize costs, where output is normally constrained by the market demand, and therefore it cannot be controlled for. The VRS model yields what is known as pure (technical) efficiency scores. Scale efficiency is defined by the ratio of Constant Returns to Scale (CRS) to VRS, i.e., ESS = CRS/VRS and the value for scale efficiency is bounded by 0 and 1. More specifically, the VRS linear programming model we use is defined as follows:

$$\begin{aligned} &\min_{\theta,\lambda} \theta, \\ &st \\ &y_i + Y\lambda \geq 0 \\ &\theta x_i - X\lambda \geq 0 \\ &N1\lambda = 1 \\ &\lambda \geq 0 \end{aligned} \tag{4}$$

where θ is a scalar, λ is a N times 1 vector of constants, y_i is the output vector for the *i-th* DMU, Y is the matrix of outputs of the other DMUs and the number of DMUs ranges from i=1…n; x_i is a vector of input of the *i-th* DMU and X is the matrix of input of the other DMUs. The value of θ will be the efficiency score for the *i-th* *D*MU where $0 \leq \theta \leq 1$, if θ is equal to 1, then the DMU lies on the efficient frontier and thus the observation is fully (i.e. 100%) efficient. When the convexity constraint $N1\lambda = 1$ is omitted from (4) we obtain the CRS based efficiency scores. The estimated DEA efficiency scores are then used as regressors in a second-stage model in order to observe the relationship between efficiency and profitability (see Section 3.1).[7]

[6] Examples of parametric techniques are the SFA (Stochastic Frontier Approach), DFA (Distribution Free Approach) and TFA (Thick Frontier Approach). See Aigner, Lovell and Schmidt (1977), Berger (1993) and Berger and Humphrey (1992, 1997).

[7] Many papers have used DEA estimates of efficiency in 'second stage' regressions, however there are limitations to this type of analyses. Simar and Wilson (2007) have pointed out that bootstrapping can help improve statistical efficiency in second stage regressions when non-parametric methods are used to calculate productive efficiency. In the parametric approach, these problems can be reduced by employing a single-step estimation of the frontier and inefficiency equations (see e.g. Koutsomanoli-Filippaki et al., 2009).

3.3 *Data and Input/Output definition*

The data for this study was obtained from the BankScope database maintained by Fitch/IBCA/Bureau Van Dijk. The sample includes commercial banks operating in Argentina, Brazil, Chile, Colombia, Costa Rica, Paraguay, Peru, Uruguay and Venezuela. The data are annual and cover the period 1997 to 2005. The macroeconomic variables XRATE, GDP, CPI and INT are extracted from the IFS database of the International Monetary Fund.

The approach to output definition used in this study is a variation of the *intermediation approach*, which was originally developed by Sealey and Lindley (1977) and posits that total loans and securities are outputs, whereas deposits along with labour and physical capital are inputs. Specifically we use the sum of personnel expenses, interest expenses, non-interest expenses and other operating expenses as inputs; whereas the output variables capture both the traditional lending activity of banks (total loans) and the growing non-lending activities (other earning assets) (see e.g. Beccalli et al., 2006). . The descriptive statistics of the inputs and outputs used for the empirical analysis are reported in Table A1 in the appendix.

Table 1 reports the bank observations used for each country. It is clear that the largest banking markets are in Brazil (around 100 banks on average per year) and Argentina (46 banks on average). In contrast, the country that presents the lowest number of observations per year is Peru (13 banks on average). The peculiarities of the banking markets in Latin America can be inferred by looking at the average size of banks in terms of total assets. For example, the average bank in Brazil is roughly 2.5 larger that of Argentina and 30 times larger the one of Paraguay. In terms of trend over time, while the total number of banks seems to increase initially over the period 1997-2001 (as probably has the quality of data available) the consolidation wave appears to have affected the early 2000s as the number of banks plummeted by about 33% over 2001-2005.

<Insert Table 1 here>

Table 2 reports some key financial variables, including loans, deposits, assets, equity, NIM (net interest margin), ROA (return on assets) and ROE (return on equity). It shows that there are also marked differences across countries in terms of performance and balance sheet composition. We can observe that Brazil, Argentina

and Chile dominate the region when analysing the amount of bank deposits, loans, assets and equity. The average net interest margin is significantly high for Brazil (12.6%) followed by Peru (10.8%) and Venezuela (9.5%). The region reports an average net interest margin of 7.52%, that is considerably high if compared to industrial countries (e.g. around 4.17 % for US on average and 2.79% for UK, see Singh et al. 2005).[8] On the other hand, Uruguay and Chile report the lowest net interest margin ratios at 1% and 5.1% respectively. In terms of cost over income, the region has an average of 69.25% having Chile and Paraguay the largest ratios of 105.21% and 84.31%. The most efficient countries in terms of cost /income ratios are Costa Rica and Peru.

<Insert Table 2 around here>

The profitability ratios (ROA and ROE) show an average in the region of 1.89% and 16.44% respectively. Concerning ROA, the countries exhibiting the lowest values are Uruguay and Chile with 0.51 and 0.99, respectively; this latter country also reports a relatively low level of ROE at 10.19%. In contrast, the best performing countries are Colombia and Venezuela. This is possibly due to the current banking expansion in these countries as well as the economic growth experienced recently.

4. Results

Tables 3 and 4 present the X- and scale efficiency scores calculated using the non-parametric DEA methodology explained in section 3.2. It is important to note that these scores are not directly comparable across countries since each of them is computed using its own set of country-specific banks. However it is interesting to examine the general trends for the Latin American region as a whole and over time.

<Insert Tables 3-4 here>

Average X-inefficiency scores are around 32% and they are slightly lower (25%) for scale inefficiencies. The results are generally higher than existing US and

[8] We obtain data for the net interest margin for the US and UK from the Financial Structure Database

EU literature (Berger and Humphrey, 1997; Goddard et al. 2001) however no doubt they reflect the substantial distress experienced by banks during the many financial crises that have occurred in the region over the period under study.

Figure 1 (a) shows the average trends in X- and scale efficiency over the period 1997 to 2005. Panel (c) in the same figure clearly shows that the average efficiency scores experienced a significant slump until 2002 (particularly in terms of X-efficiencies), most probably fuelled by the banking crisis experienced by Argentina and Brazil in 1999 and 2001 respectively. However, it is also apparent that the scores started to recover and grow in the following years (panel d).

<Insert Figure 1 here>

For completeness we also present the ROA trend over the same period (panel b) and it seems clear that it follows a trend similar to the estimated efficiency scores. Indeed the Pearson correlation coefficient confirms that there is a high and positive relationship between these variables (0.76 for X-efficiencies and 0.63 for scale efficiencies).

The next step is to run equation (1) as described in section 3.1 to empirically test the market power (SCP and RMP) and efficient structure (ESX and ESS) hypotheses. The final estimations are presented in Table 5. We apply a fixed effects panel data method that assumes heterogeneity between observations and considers the time effects. We carry out a number of tests in order to correct for autocorrelation and heteroscedasticity, particularly the Wooldridge and Wald (group wise) tests respectively. We then choose between fixed and random effects models in accordance with the Hausman test results.

<Insert Table 5 here>

Table 5 shows that we do not find evidence to support the two market power hypotheses SCP and RMP: the value of HHI when significant is always negative (see results for Argentina, Costa Rica and Paraguay). This suggests an inverse relationship between concentration and profitability. Moreover, the MS coefficient is negative and

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of Beck et. al. (2000).

significant in the majority of cases, thus indicating that greater market share is also reducing banking profitability. According to Goddard et al. (2001), a negative value in the market share variable could signal an average of smaller banks being more profitable than larger ones. The only country for which we find support for the RMP hypothesis is Costa Rica where the MS coefficient is found positively and significantly related to profitability and the efficient structure hypothesis does not hold. This result can be explained by the fact that the largest three banks in Costa Rica hold more than 50% of the market share and this trend has increased over the period under study.[9]

Looking at the sign and significance of the coefficients for ESX and ESS, our results give considerable support to the efficient structure hypotheses. The ESX and ESS coefficients are relatively high and our results appear robust for the largest banking markets in the region, namely Brazil, Argentina and Chile. However, ESX is found positive and significant only for Argentina and Brazil, while ESS seems to have a much more important role. ESS is found positively related to ROA in Chile, Paraguay, and Peru. Thus in these countries there is evidence of greater scale efficiency producing greater profitability.

From the bank specific factors, two of them seem to be particularly important in explaining Latin American banks' performance: the degree of capitalisation, calculated as equity/assets and banks' assets size. The coefficient for capital is generally positive and significant for most countries under study thereby implying that greater capital available increases profitability. As observed by e.g. Claeys and Vander Vennet (2003) larger proportions of "free" capital can encourage banks to increase their portfolio of risky assets in the form of loans or securities. Moreover, higher capital ratios can give higher incentives to shareholders to monitor managers' operations and strategies thereby indirectly encouraging profitability. Another variable that is found significant and positive in the majority of cases is the logarithm of total assets. This variable is included in the model to account for the effect of bank size on bank profitability. Our findings could be interpreted as evidence that if banks are operating in the increasing returns portion of their average cost curve then bank profits are also positively affected (Dermiguc-Kunt et al., 2004). It also indicates that larger banks are more likely to operate at the most efficient scale. On the other hand,

[9] The average market share for the 3 largest banks in Costa Rica for the period of 1997-2005 is 57.40%.

larger banks can typically pursue riskier investments which yield higher returns. Finally the evidence for the last bank-specific variable LTA (a measure of liquidity risk) is weak and cannot be generalised for all Latin American countries. In particular the coefficient is found negative and significant only for Paraguay, remaining insignificant to the rest of the countries under study.

The macroeconomic control variables show mixed results and the significance of the coefficients is less strong than expected. For example, the exchange rate displays a positive and significant relationship with the profitability ratio (ROA) in Brazil but a negative relationship in Chile and Peru. For the remaining countries the relationship with profits is insignificant. The exchange rate is included to account for macroeconomic risk and we did not have any specific sign expectations for this variable. Similarly the CPI and GDP growth seem to affect Latin American countries in different ways. For example, in Chile the relationship between these variables and profitability is negative and significant; while in Argentina the GDP growth affects ROA positively and in Venezuela inflation seems to increase banks' profits. Finally, the market interest rate, INT, is positive and significant in Brazil, Paraguay and Venezuela while is negatively related to ROA in Costa Rica. A possible explanation is that Brazil, Paraguay and Venezuela have had large reductions in their market interest rate during the period of study and this change has generated more favourable economic conditions for the banking sector.[10] On the other hand, the negative relationship with INT and ROA in Costa Rica can be explained by the fact that Costa Rica's banking sector is dominated by few market players, and any adjustment in the market interest rate is automatically transferred to their consumers, reducing the amount of credits and other financial services.

Overall the results above show that the arguments supporting the market power hypotheses are rejected for the Latin American countries under study, while efficiency gains, particularly in terms of scale efficiencies, appear to have a direct and significant impact on banking profitability. The results seem to contradict our expectations of increased market power that could have possibly derived from the gradual decline in the number of commercial banks in the majority of countries in the region, a parallel increase in the level of concentration, and a sharp increase in takeovers from foreign commercial banks.

5. Conclusions

Over the last fifteen years or so the Latin American banking sector has experienced profound changes due to deregulation and liberalisation that encouraged foreign investments and merger and takeover activities. In addition, the largest countries in the region have experienced significant financial crises that have affected their economies and banking sectors as a whole. The wave of consolidation and the rapid increase in market concentration that took place in the banking systems of most of these countries has generated concerns about the potential rise in banks' market power, and implied detrimental effects on consumers.

In this paper we test empirically the Structure-Conduct-Performance and Relative Market Power hypotheses versus two efficient-structure models (the X- and scale efficiency) to investigate whether banks earn supernormal profits because they are exercising market power or as a result of achieving higher efficiency levels. We estimate managerial and scale efficiency by employing the non-parametric DEA technique. To our knowledge this is the first paper to provide such an investigation for a large sample of Latin American banks over 1997-2005.

Our results uncover evidence supporting the efficient structure hypotheses in Latin American countries. The findings are particularly robust for the largest banking markets in the region, namely Brazil, Argentina and Chile. In addition, capital ratios and bank size seem to be among the most important factors in explaining higher than normal profits for Latin American banks.

Our findings have important policy implications because they broadly suggest that despite the significant rise in takeovers from foreign banks and the increase in market concentration, banks' profits do not seem to be explained by greater market power. In contrast, efficiency (particularly scale efficiency) seems to be the main driving force of increased profitability for most Latin American countries. The key implications of the present study are that policies aimed at removing the remaining barriers to competition should be expected to benefit the banking system without being detrimental to consumers. On the contrary, intervention aimed at achieving "deconcentration" should be viewed with scepticism. Implementing pertinent

[10] The change on market interest rates for Brazil, Paraguay and Venezuela was -27%, -92% and -65% respectively, during 1997-2005.

competition policies contributes to the efficient operation of the banking sector and as an extension (Beck et. al., 2000) to economic development and growth.

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Table 1

Number of Banks Used in Each Latin American Country by Year

	Argentina	*Brazil*	*Chile*	*Colombia*	*Costa Rica*	*Paraguay**	*Peru*	*Uruguay*	*Venezuela**	*TOTAL*
1997	10	82	13	22	10	n.a.	12	14	n.a.	163
1998	42	92	20	22	16	17	19	15	10	253
1999	67	94	22	20	17	21	16	13	36	306
2000	64	101	23	22	18	21	16	24	40	329
2001	69	115	24	22	20	19	13	37	36	355
2002	62	114	24	23	20	17	12	34	33	339
2003	50	101	24	24	18	13	11	27	32	300
2004	30	98	24	23	16	13	11	27	33	275
2005	23	92	24	18	17	13	9	17	25	238
Total	417	889	198	196	152	138	119	208	248	2,565
Average number of banks	46	99	22	22	17	17	13	23	31	246
Average asset size of banks (Millions of USD)	1,426	4,073	3,118	1,171	322	140	1,185	667	727	

Source: Bankscope.

*Data from Venezuela and Paraguay was not available (n.a.) in 1997.

Table 2

Selected Balance Sheet Items and Performance Indicators (2005)

	Deposits	Loans	Assets	Equity	Net Interest Rate Margin %	Cost over Income %	Return on Assets %	Return on Equity %
Argentina	60,098	24,838	70,931	7,290	6.18	79.15	0.63	6.53
Brazil	390,435	208,422	605,670	60,454	12.6	77.13	2.4	15.93
Chile	81,731	71,860	106,425	9,173	5.1	105.21	0.99	10.19
Colombia	37,394	25,797	47,511	5,531	5.9	65.91	2.51	23.43
Costa Rica	8,426	5,441	10,333	1021	7.59	63.53	2.22	17.5
Paraguay[a]	2009	991	2378	272	9.05	84.31	1.7	16.96
Peru	19,932	12,326	23,377	2103	10.75	64.58	2.36	17.94
Uruguay	9,910	5,866	11,046	850	1	84.42	0.51	13.17
Venezuela[a]	30,126	17,170	39,479	8149	9.50	78.03	3.66	26.32
Total	640,061	372,711	917,150	94,843	7.52	69.25	1.89	16.441

Source: Bankscope.

[a] The variables of deposits, loans, assets and equity are the sums (in million USD) of all the commercial banks of each of the countries in our sample in 2005. The variables of net interest margin, cost over income, return on assets and return on equity are the averages of the commercial banks for each of the countries in study.

Table 3

X-efficiency scores (ESX) 1997-2005 (%)

	1997	1998	1999	2000	2001	2002	2003	2004	2005	% change 1997-2002	% change 2002-2005	% change 1997-2005
Argentina	67.22	49.66	33.03	51.54	47.50	47.80	57.51	64.03	74.86	-20	+56	+25
Brazil	54.55	58.59	49.54	49.86	41.07	26.09	34.44	47.81	57.93	-51	+118	+7
Chile	88.54	84.65	87.00	87.91	86.50	85.25	79.58	70.83	85.21	-4	-0.05	-4
Colombia	73.64	73.50	76.40	67.77	80.73	84.04	65.13	66.83	63.67	+14	-24	-14
Costa Rica	92.50	65.19	79.00	87.17	81.65	77.90	72.22	77.81	79.71	-16	+2	-14
Paraguay[a]	N.A.	68.47	72.86	61.05	72.16	62.29	67.23	71.62	76.08	-9	+22	+11
Peru	52.33	69.32	82.56	86.25	91.38	90.50	90.36	90.27	90.78	+73	+0.31	+73
Uruguay	58.36	64.00	61.23	67.00	44.70	35.38	58.74	40.93	63.24	-39	+79	+8
Venezuela[a]	N.A.	88.30	48.56	46.60	66.44	50.48	59.69	67.94	84.20	-43	+67	-5

[a] Results for Paraguay and Venezuela for 1997 were not calculated due to data availability.

Table 4

Scale efficiency (ESS) scores, 1997-2005 (%)

	1997	1998	1999	2000	2001	2002	2003	2004	2005	% change 1997-2002	% change 2002-2005	% change 1997-2005
Argentina	47.00	76.93	71.62	83.41	81.43	65.28	60.92	88.79	85.23	+34	+29	+73
Brazil	69.23	57.57	35.04	44.36	51.46	39.74	72.23	73.46	82.24	-43	+107	+18
Chile	80.15	89.40	88.55	64.00	84.92	87.71	93.17	49.17	92.29	+9	+5	+15
Colombia	93.05	84.55	67.50	90.14	89.23	92.57	84.83	80.48	79.94	-1	-14	-14
Costa Rica	87.20	75.94	85.53	87.33	72.70	77.20	83.17	90.44	86.76	-11	+12	-1
Paraguay[a]	N.A.	50.71	90.48	87.90	93.95	78.71	79.15	90.46	87.85	+55	+12	+73
Peru	61.25	82.58	84.44	95.00	89.62	89.67	93.82	65.55	91.00	+46	+1	+49
Uruguay	72.00	82.00	81.00	61.58	54.76	55.12	35.44	45.19	53.29	-23	-3	-26
Venezuela[a]	N.A.	93.50	67.22	60.28	67.11	61.39	85.00	68.36	69.80	-34	+14	-25

[a] Results for Paraguay and Venezuela for 1997 were not obtained due to data availability.

Table 5

Market power versus efficient structure hypotheses for Latin American Banks

Variables	Argentina	Brazil[a]	Chile[a]	Colombia	Costa Rica[b]	Paraguay	Peru	Uruguay	Venezuela
HHI	-.043**	-.021	-.002	-.002	-.001*	-.03***	.001	.003	-.008
MS	-.865	-.018	-.085*	.077	.096*	-.507**	-.136*	-1.328**	-1.054
CAP	.06	.108***	.019	.57***	.098***	.207***	-.05	.5***	.244*
LOATA	-.028	.014	-.009	.182	-.006	-.165**	-.028	.009	.14
logASSETS	3.874*	.147	.81***	.728	.237	7.287***	3.508***	9.075***	7.968*
ESX	6.366*	1.581*	-1.313	-1.997	.191	.732	-.345	2.839	-4.433
ESS	2.968	1.244	2.445*	3.044	-.511	3.484**	1.767*	-5.134	3.181
XRATE	.961	2.713***	-.022*	.001	.004	.001	-4.223**	.031	-.002
CPI	-.164	-.29*	-.982*	-.297	-.033	-.001	.045	.146	.491**
GDP	.408**	.349	-.983**	.466	-.049	-.19	-.011	-.34	.02
INT	-.04	.669**	-.063	.082	-.05*	.18*	-.029	-.152	.19**
Constant term	-21.794	-6.193	12.883	-28.141	-.804	-55.8***	-31.9***	-118***	-104.5
R-square	0.28	0.09	0.23	0.37	0.37	0.48	0.54	0.42	0.30
Observations	417	889	143	196	120	134	119	208	245
F-stat	4.41			6.81	4.39	8.31	5.94	9.15	4.09
(p-value)	(0.00)			(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Wald (Chi-square)		91.13	25.55						
(p-value)		(0.00)	(0.01)						

*, **, *** indicates significance at the 10%, 5% and 1% levels.

Where HHI is the Herfindahl-Hirschman Index in terms of assets, MS is the market share in terms of assets, CAP is the degree of capitalisation measured as equity over assets, LTA is the measure of liquidity risk measured as loans over assets, the logarithm of Assets is a measure of size, ESX is the managerial efficiency, ESS is the scale efficiency, the XRATE is the exchange rate, CPI is the inflation rate, GDP is the real growth of GDP and INT is the market interest rate.

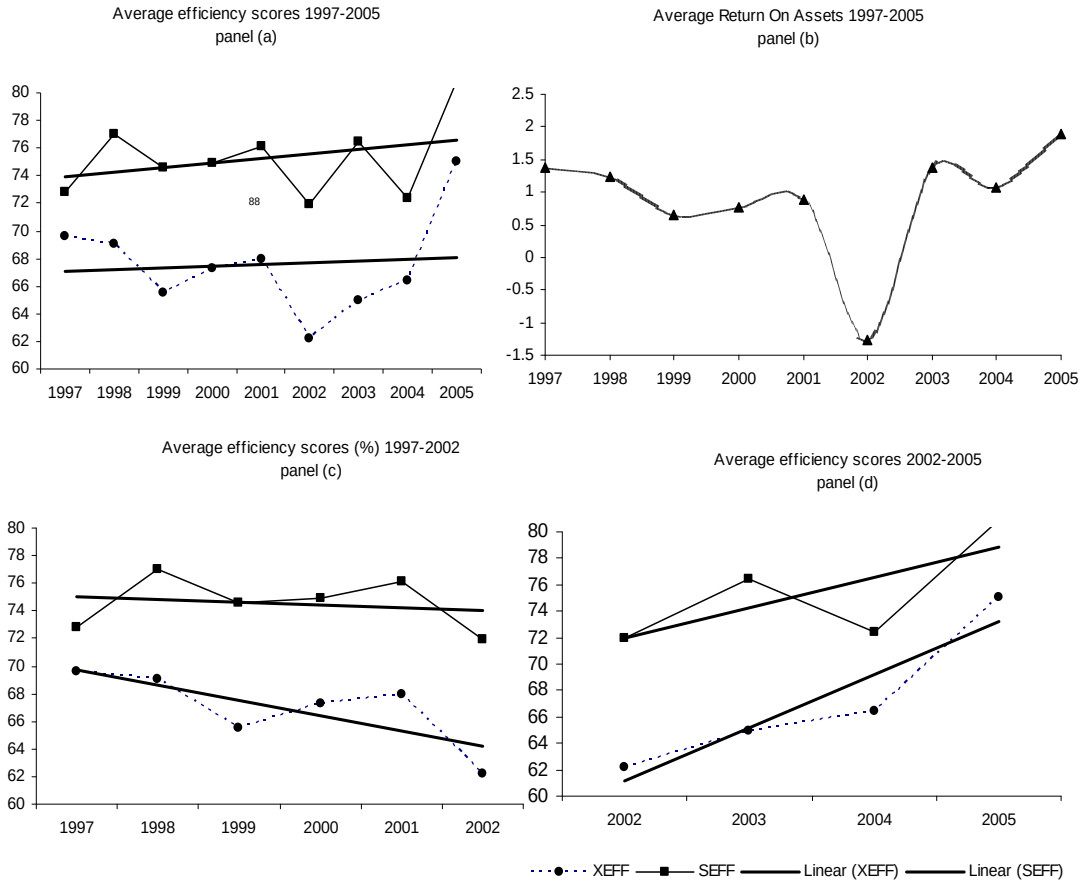
[a] Fixed effects model was rejected. [b] A fixed effects model with AR(1) was run in Costa Rica to correct for autocorrelation.

Table 6

Autocorrelation and Heteroskedasticity Tests

Wald Heteroskedacity test (p-value)	5.9e+29 (0.00)	8.8e+30 (0.00)	6800.08 (0.00)	51297.58 (0.00)	2313.92 (0.00)	83596 (0.00)	4222.76 (0.00)	2.6e+06 (0.00)	12665 (0.00)
Wooldridge test for Autocorrelation (p-value)	1.369 (0.25)	0.788 (0.38)	3.003 (0.097)	0.679 (0.42)	24.630 (0.00)	3.327 (0.08)	0.010 (0.92)	0.012 (0.91)	2.944 (0.09)

Figure 1
X- and Scale efficiency trends vs ROA
(Averages of each year for all Latin American countries)



Appendix

Table A1

Descriptive Statistics of Inputs and Outputs (millions of USD, 1997-2005)

	Mean	Std. Dev.	Min.	Max.
Inputs				
Personnel Expenses	65.178	262.450	0.041	5,644
Interest Rate Expenses	207.854	703.879	0.001	11,700
Other-Operating Expenses	27.539	68.220	0.001	944.248
Outputs				
Loans	879.598	2,511.446	0.020	38,400
Other Earning Assets	976.203	3,622.869	0.004	51,300

Source: Elaborated from Bankscope.