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Risk, Concentration and Market Power in the Banking Industry: Evidence from the Colombian System (1997-2006)^{*}

Jorge Tovar^a
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Abstract

This paper examines the relationship between risk, concentration and the exercise of market power by banking institutions. We use monthly balance-sheet and interest rate data for the Colombian banking system from 1997 to 2006. The evidence shows that, in the face of high risk, banks transfer a larger share of risk to customers through higher intermediation margins. The result suggests that systemic risk acts as a “collusion” device for banks: while high concentration is not enough to have collusion, the true effects of high market concentration on interest rates’ mark-ups emerge when the system is under stress.

November 2007

Keywords: Banking, market power, risk, concentration, intermediation margins.

JEL codes: G21, G34, G38, L11.

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Riesgo, concentración y poder de mercado en el sistema financiero.
El caso colombiano (1997 – 2006)

RESUMEN:

Este trabajo explora la relación entre riesgo, concentración y el ejercicio de poder de mercado en el sector financiero. Se utiliza información mensual de balances financieros de instituciones bancarias colombianas en el periodo 1997 a 2006. La evidencia muestra que en periodos de alto riesgo los bancos tienden a transferir a sus clientes una proporción mayor del riesgo a través de los márgenes de intermediación. Esto sugiere que el riesgo sistémico actúa como un mecanismo colusivo para los bancos. Una alta concentración de mercado no es suficiente para que haya colusión: es en situaciones de alto riesgo sistémico que la concentración se traduce en ejercicio de poder de mercado.

Palabras clave : Bancos, poder de mercado, riesgo, concentración, márgenes de intermediación.

Clasificación JEL : G21, G34, G38, L11.

I. Introduction

This paper examines the effect of increases in risk on the relationship between concentration and the exercise of market power by banking institutions. Our data covers the Colombian financial market for the period 1997-2006. In the late 1990s Colombia experienced a big macroeconomic crisis that caused large increases in the risk faced by banks, followed by a recovery during 2002-2006. In addition, the Colombian financial sector has seen an almost continuous increase in concentration since 1996, coupled with the existence of financial conglomerates that control a considerable number of banks.

We relate a market power proxy, the Lerner index, with measures of concentration and risk. Our results suggest that the correlation is positive with concentration and negative with risk. Our ultimate goal is to understand how risk and concentration influence the exercise of market power in the banking industry. We find that an increase in concentration allows for a stronger transmission of risk to the Lerner index (i.e to the customers): when risk is high firms transfer a larger share of risk to customers through higher risk premiums. This result suggests that systemic risk acts as a “collusion” device for banks. Thus, while high concentration is not enough to have collusion, the true effects of high market concentration on interest rates’ mark-ups emerge when the system is under stress.

The paper is divided in seven sections the first being this introduction. After a brief review of the evolution of the Colombian banking system, we discuss the relevant literature in section three. The model is presented in section four, while an overview of data is given in

section five. Finally section six discusses and analyses the results ending with the conclusions in section seven.

II. Background

The Colombian banking system changed from a strongly state-owned sector in the mid-1970s to a very open industry in the early 2000s. A major reform in the industry took place in the 1970s, when a type of bank was created with the specific aim of serving the housing market. Besides having a monopoly on this market, these institutions, called *corporaciones de ahorro y vivienda* (CAVs), enjoyed regulated interest rates designed to protect them against inflation spikes.^{1,2}

The 1980s brought the Latin American crisis and with it the bankruptcy of several banks and financial institutions across the region, including Colombia. The Colombian government was forced to take control of a number of institutions which would be privatized later in the 1980s and 1990s. However, except for the creation of an insurance deposit, no further reforms took place at the time. In the early 1990s a new reform allowed foreign investors to own 100% of a Colombian bank. Its aim was to promote a universal banking system and to encourage competition.

An asset price and loan bubble in the second half of the 1990s led to a second major crisis in the banking industry. Colombian GDP fell in 1999 for the first time since the great depression (a fall of 4.2%), while the unemployment rate rose to a peak of 20.5% in the

¹ A complete historical review of the evolution of the banking sector in Colombia during the 20th century is available in Caballero and Urrutia (2006).

² The literal translation of CAV would be *housing and savings corporation*.

third quarter of 2000. The associated risk to the banking system is reflected by the large decrease in the quality of loans depicted in Figure 1. As in the 1980s, the government had to step in, assisting both private and publicly owned financial institutions. In part as a consequence of the crisis, the regulation of the financial market changed to include new types of institutions and to allow banks to issue mortgage loans.³ The reforms continued to promote a more competitive and universally oriented banking system, and today most institutions are commercial and mortgage banks at the same time.⁴

Our data spans over the period 1997-2006, when the banking system has witnessed an unprecedented wave of mergers and acquisitions. In December of 1997 there were 34 banks and 7 CAVs, in December 2006 only 17 multipurpose banks. Consequently, concentration of the loan portfolio, as measured by the Herfindahl-Hirschman Index (HHI), has steadily increased over the period 1996 - 2006. The evolution of the HHI is depicted in Figure 2. However, much of the story of the Colombian banking system has to do with how financial conglomerates have evolved over the past decade. For example, by December of 2006, the *Sarmiento/AVAL* group controlled 27.8% of the consumption and 31.9% of the commercial loans portfolio through 4 of the 17 multipurpose banks in the system. As a consequence, Figure 3, which graphs the HHI grouping banks by financial conglomerates, shows a higher concentration index.⁵

³ The other institutions in the financial market are the financial cooperatives, which focus on investment banking, and commercial financial companies –essentially leasing and niche specialized institutions. This work focuses on banks and CAVs.

⁴ Commercial banks are referred to those whose main activity is receiving and allocating resources. Mortgage banks refers to those specialized in the housing market. These are essentially what we refer in the text to banks and CAVs respectively.

⁵ There are other relevant institutions in the financial market, namely financial cooperatives and commercial financial companies. The latter are essentially leasing and niche specialized institutions, while the former are

III. Literature Review

3.1 Recent performance of the Colombian banking system

Whether the regulatory reforms in Colombian banking sector succeeded is a matter of debate. Their stated aim was to promote more competition. Clavijo (2000) and Carrasquilla et al. (1997) for instance argue that they have failed: savings remain low and investments are still financed based on their collateral –not on expected return and risk.

In contrast, a review of several studies in Janna (2004) points out that while economies of scale in Colombia are exploited on a range that goes from 24% to 39%, depending on the type of account considered, bank investments are much more efficient: 82%. Table 1 summarizes the main results in Janna's work.

Janna (2003) and Estrada et al. (2003) have analogous results. When they compare bank costs using the most efficient bank in the market as a benchmark, their results suggest that costs could be reduced somewhere between 27% and 51%. When using absolute efficiency instead of relative efficiency, costs could be reduced somewhere between 57% and 72%. In fact, according to Janna (2003) the typical most inefficient bank for the period 1992 – 2002 would be a private domestic bank with a 78% potential for reducing its costs, while the most efficient one would be a foreign owned bank with a 54% potential for cost reduction. A summary of results is presented in Table 2.

more related with investment banking. We focus on CAVs and banks, which by December 2006, held 95.7% of the commercial loans portfolio and 92% of the consumption loans portfolio.

According to Janna (2004), the source of improvements in efficiency is different if the country is in a crisis. In normal years (prior to 1998), general market conditions explain the improvements; when the country was immersed in a major economic crisis, the variables determining efficiency were directly under the control of each bank. During the crisis, Janna argues, banks were forced to improve costs or suffer the consequences of inefficiency. This forced them to individually improve based on their control variables.

Estrada (2005) reports similar results, but he also finds a significant loss in efficiency in the period 2003-2004. He does not however offer an explanation. Table 3 shows that regulation, concentration, the economic cycle, the number of branches, the quality of the product and public ownership decrease efficiency. Size, solvency and the importance of the commercial portfolio increase it.

In another related study, Estrada (2005) reviews the impact of mergers on competition and efficiency. He finds no strong evidence of collusion on the deposits side but says nothing about the lending side.

Brock et al. (2000) examine the bank intermediation margin for seven Latin American countries, including Colombia, in the 1990s –when their financial systems were deregulated. They find that Colombia’s margins are the highest and explained mostly by macroeconomic variables. They also find evidence that higher operational costs imply higher margins and that there is a positive correlation between high margins and non-performing loans.

Barajas, Steiner and Salazar (1999a) show that intermediation margin levels in Colombia remained relatively stable over time but its composition changed over the past three decades. They decompose the margin into four parts: operative costs, financial taxes, market power and portfolio quality. They find little competition in the Colombian banking system during the 1970s and 1980s, with an average mark-up of 29%. The 1990s show an improvement, when private banks had market power. They also find a positive correlation between portfolio quality and lower margins, particularly in the 1990s. Despite the smaller than expected effects in competition, privatizations and foreign investment seem to have brought efficiency improvements.

Barajas, Steiner y Salazar (1999b) additionally find that the entry of foreign-owned banks reduced the intermediation margins and financial costs, and improved the portfolio quality. However, they note that despite better productivity and portfolio indicators, these foreign-owned banks chose to operate at the incumbents' margins and to avoid competition when possible. Nevertheless, they argue that the 1990s liberalization process reduced market power in the banking industry.

Finally, Castro and Steiner (2002) report an increase in competition during the 1990s. The intermediation margin fell during this decade, though the observed level remained higher than that observed in developed economies. For these authors, the margin depends on non financial costs, reserve requirements, risk and market structure. They also find a positive correlation between privatizations and foreign investment and the efficiency in the banking sector.

3.2 Strategy for analysis

Two strands in the literature are relevant for our purposes. One connects economies of scale with size, risk and costs, and with the advantages of universal banking. The other focuses on the link between concentration and market power; it relates market structure with prices and the degree of competition in the system. The latter is closely related to our approach in this paper.

De Nicoló (2000) gives a detailed review of the literature on economies of scale in the banking sector. He examines empirically the relationship between size and operational diversification of banks, their risk levels and their market value. Controlling for regulation and market structure, he finds that in developed financial systems risk and bank size are positively correlated, while risk and market value are negatively correlated.

De Nicolo, whose sample includes banks from Japan, USA and Europe, is very careful in noting that the results may depend strongly on how developed the financial system is. Thus, they may not be applicable to the Colombian case. Another interesting aspect of De Nicolo (2000) is the measure of risk he uses. Textbooks discuss at least three type of risk inherent to banks: market risks, loan risks and liquidity risk. Freixas and Rochet (1998) add out-of-balance-sheet risks and operational risks. Instead of a direct measure of one or several of these types of risk, De Nicolo uses the z index –a measure of global insolvency based on the assumption that bank profits are distributed normally⁶.

⁶ The global insolvency risk is the probability that losses exceed profits. The z index is the number of standard deviations that a particular realization of banks profits should fall in order for the assets to be exhausted.

The second relevant strand of literature focuses on the relationship between concentration and market power. This paper applies methodologies used in Bikker and Haaf (2002) and Prager and Hannan (1998). Bikker and Haaf (2002) use the H -statistic, proposed by Panzar and Rosse (1987), to examine the competitiveness of the banking sector in a variety of countries, mostly European. Based on how the firms' revenue changes when factor prices change, this model assesses whether the firms behave like a cartel, monopolistic competitors or competitively. Its main limitation is that it does not account for strategic interaction among firms or barriers to entry. Moreover, the tests for monopolistic competition and perfect competition are valid only in long-run equilibrium.

First, using balance-sheet data, Bikker and Haaf examine the exercise of market power by banks, controlling for size and country. With all banks in the sample, they reject the market power hypothesis. This result stands in sub samples by country and size.

Next, they examine the econometric relationship between the Herfindahl-Hirschman (HHI) index and the H -Statistic. Their results suggest that the number of banks is negatively correlated with the degree of competition. Further analysis suggests that in markets with a few large banks, the small banks have little effect on the degree of competition. The authors conclude that there is a relation between market structure and competition driven by the presence of large banks.

Nathan and Neave (1989) look at a different aspect of market power. They argue that concentration may generate conditions for market power, but it does not necessarily imply the exercise of such power. Specifically, they study the possibility that market power is not

exercised when entry is relatively easy and sunk costs are not significant. Using a dataset of Canadian banks for the period 1982-1984, they use the *H*-statistic as a measure of competition, controlling for wages, input costs and interest payments. The paper rejects the hypotheses of monopolistic or oligopolistic behavior in every market considered. Contrary to Bikker and Haaf (2002), they do not find that bank size matters.

Prager and Hannan (1998) examine the effects of mergers over market prices and find evidence of the exercise of market power in the U.S. financial system for the period 1991-1994.⁷ To identify the effect of prices, they consider markets where horizontal mergers took place and use markets without mergers as control groups. They take deposit interest rates to be the relevant prices, define the markets geographically and take into account product differentiation.⁸ Their findings suggest exercise of market power, as deposit rates offered by participants in horizontal mergers declined by a greater percentage than did deposit rates offered by banks not operating in markets in which such mergers took place. Moreover, in markets where mergers occurred, they find that merged and non-merged banks behave in a similar way. They interpret this as evidence against the argument that quality improvements of merged banks are responsible for the observed price changes.

Summarizing, the evidence suggests that there is possibly a link between market structure and market power –albeit higher concentration does not always imply the exercise of such

⁷ They use data from the Federal Reserve's Monthly Survey of Selected Deposits. Data covers between 500 and 550 banks for a period of 25 months.

⁸ Product differentiation is accounted for by using three different types of deposit products, NOW accounts, personal money market deposit accounts and small three month certificates of deposit. NOW accounts are defined as interest-bearing accounts that allow unlimited checking. Money market account are interest bearing accounts that restrict the account holder to six withdrawals per month by automatic transfers or checks, only three of which may be checks.

power—; and, in developed financial systems, a further link between market structure and the efficiency in dealing with risk. Specifically for Colombia, there seems to be a link between higher efficiency, foreign-owned banks and mergers. However, whether this higher efficiency translated into more competition is controversial. There is also some evidence that the determinants of bank efficiency may be different when the system is in crisis.

IV. The Model

Our objective is twofold. First we want to establish comparable market power indicators for the period 1996 – 2006. Second, we want to calculate the effects that changes in concentration had (if any) over the exercise of market power, taking into account the effect of risk in this relationship.

We assume, as in Prager and Hannan (1998) that the relevant prices for the financial sector are the interest rates. We use this approach to construct a Lerner Index, which we use to link econometrically market power with concentration, as measured by the HHI.

4.1 Concentration and Market Power Measurement

The measure for concentration we use is the *HHI*. Some banks are controlled by the same conglomerate. Thus in order to examine the difference between a market where all banks act independently and one where they have cooperation incentives, we construct the *HHI* by bank and by financial conglomerate. For the latter, we aggregate the data of the banks controlled by each conglomerate.

To link concentration with market power, we carry out an exercise in the spirit of the structure-conduct-performance paradigm discussed in detail in Salinger (1989). Following Prager and Hannan (1998) we use the lending and deposit interest rates as prices, taking the latter as the equivalent of marginal costs.⁹

Our measure of market power is the Lerner index. In principle, this measure should account for the risk premium as part of the marginal costs. It would be $\frac{i_{jk}^* (1 - \gamma_k) - i_k^c}{i_{jk}^*}$ with a risk premium $f_k = \gamma_k i_{jk}^*$. However, it is difficult to calculate the risk premium directly. Instead, we account for it separately in the regression, using a proxy on the right-hand side: the ratio of nonperforming loans to total loans in every period of time, γ_k . Our Lerner index, is then:¹⁰

$$L_{jk} \equiv \frac{i_{jk}^* - i^c}{i_{jk}^*}$$

where i_j^* refers to the lending interest rate for type j credit in bank k and i^c is the weighted average by amount of the fixed term deposit interest rates.

4.2 Estimation

Once we have the Lerner index, we estimate the following equation:

⁹ The indicator would be a perfect measure of market power if in fact the bank's only business lending is deposits. In reality it is not (though it is an important component) and so we take that into account when constructing the right hand variables.

¹⁰ Strictly speaking, in the construction of the Lerner index we ignore the fact that banks products typically are differentiated. Data on products by banks are unavailable at the time in Colombia. We thus, work under the implicit assumption that banks do offer different products, but they decide jointly about them.

$$(1) \quad \ln L = a + b * \ln HHI + c * \ln \gamma + e * Others + Fe$$

where $\ln L$ is the natural logarithm of the Lerner index, $\ln HHI$ is the natural logarithm for the concentration index and $\ln \gamma$ is the natural logarithm for the risk measure. *Others* are control variables: the natural logarithm for an industrial production index, quarterly dummies intended to capture economic activity and a monthly trend intended to measure technological changes. *Fe* represents fixed effects by bank or conglomerate depending on the aggregation we are considering.

γ_k is a measure of *ex post* risk. Contrary to an ideal *ex ante* risk measure, it captures only risk issues related to the chances of default. Suppose that the coefficient γ_k reflects exclusively the relationship between non-performing loans and the risk premium of each financial institution. In that case, one would expect that in equation (1) $c=1$ as long as markets value correctly *ex ante* risk and banks are risk neutral. Similarly, c values greater than one would be indicative of risk aversion among banks. In such a case, one should ask why these banks remain in the market: in a competitive market, such risk aversion implies higher marginal costs; such banks should not be able to survive competition.

However, in our case the estimate of c also reflects that γ_k is an imperfect measure of risk. If γ_k systematically overestimates (underestimates) risk, the value of the coefficient will be biased towards zero (away from zero). Also, if γ_k is simply a noisy proxy for risk, the estimate of c will have attenuation bias. Hence, if in fact c contains information about market power, it may not be possible to separate it from those effects.

Since we cannot use the coefficient on γ_k to identify the exercise of market power, we focus on a subtler form of it. We expect that the ability of a bank to exercise its market power differ depending on the level of risk that the system faces. Our measure of potential market power is the market's concentration, but even in the face of high concentration banks may be unable to sustain high mark-ups. However, it may be that systemic crises act as a coordination (or collusion) device: banks may compete less aggressively when in danger. Thus, one would find that an increase in systemic risk implies a higher rise in the Lerner index when the market is concentrated: the increase in rates would include both a higher risk premium and higher, collusive prices. In other words, in more concentrated markets banks would transfer to their customers a higher share of the risk. To capture this effect, we include an interaction between risk and *HHI* on the right-hand side of the regression:

$$(2) \quad \ln L = a + b * \ln HHI + c * \ln \gamma + d * (\ln HHI * \ln \gamma) + e * Others + fe$$

A positive coefficient on the interaction term is then indicative of an increase in the exercise of market power when systemic risk is high.

V. Data

The estimations in this paper use monthly data starting May 1997 until December 2006. This information was provided by the *Superintendencia Financiera de Colombia* (*Superfinanciera*), the Colombian agency in charge of banking supervision and regulation.

Concentration and quality of portfolio were built based on the monthly balance sheet and income and expenses information reported by the banks to the *Superfinanciera*. This data includes information for the entire banking system, i.e. banks, saving corporations, financial corporations and commercial financial companies.

Our analysis focuses on commercial and consumption loans, and only those administered by banks and CAVs.¹¹ There are other relevant institutions in the financial market, namely financial cooperatives –essentially leasing and niche specialized institutions– and commercial financial companies –devoted mainly to investment banking. We exclude them because their interest rate data is not available for the whole sample, but in any case their share of the market is small when compared with banks and CAVS. For example, banks held 95.7% of the commercial loans portfolio and 92% of the consumption loans portfolio in December 2006.

Superfinanciera also provided us with lending and deposit interest rates by bank and type of credit. The amount that each bank lent or received at any given interest rate on a particular month is also available, so we are able to calculate a weighted average of the rates when necessary. Our deposit interest rate is then a weighted average of fixed term certificates of deposit. The reported interest rate by financial conglomerate is a weighted average of the interest rates of the banks in the conglomerate.

¹¹ We follow the classification by type of portfolio that appears in the balance sheet: commercial, consumption and mortgage. By regulation, banks report microcredits separately starting 2002.

We include the industrial production index as a proxy of the level of economic activity. It is constructed every month from a sample of manufacturing companies in Colombia by the *Departamento Administrativo Nacional de Estadística (DANE)*, the national statistics department.

Finally, the history of mergers, acquisitions and bankruptcies was built using data from *Superfinanciera*, the banks' websites and the magazine *Dinero*.

5.1 Interest Rate Evolution

Figure 4 shows the evolution of both deposit and lending interest rates. Colombia has passed from a period of very high interest rates to lower, less volatile rates since 2001. Figure 5 and Figure 6 show the evolution of the consumption and commercial interest rates for the three main financial conglomerates and the public banks. The level and evolution are, of course, similar to those shown in Figure 4. Overall, dispersion does not seem particularly large, with the exception of specific periods. The higher rates charged and paid by public banks during the crisis are not necessarily explained by particularities in their pricing behavior. An alternative explanation rests in selection: the government intervenes banks on a non-random basis. For example, a bank with liquidity problems is more likely to be intervened and also to charge and pay higher interest rates.

VI. Results and Analysis

We report our results first by bank and then by financial group. Figure 7 shows the share of each type of credit in total loans. Two things stand out: commercial loans are the most important type of credit in the Colombian banking system; and the effect of the late 1990s

recession shows strongly in mortgage loans –as one might expect from the change in their regulation and the rapid increase in their risk.

The evolution of the Lerner index calculated using real interest rates is presented in Figure 8. Its level increased until 2003 and fell afterwards. Values above one in 2003 are due to negative real deposit rates in some months. For the aggregate system, this only happens in April 2003.

It is important to calculate a real Lerner index –the Lerner index based on real rather than nominal rates. Colombia experienced a substantial reduction of the inflation rate throughout the sample. The correlation of this reduction with market power can be seen by comparing Figure 8 with Figure 9 where nominal instead of real interest rates were used. Market power increases when inflation is low through a reduction in the real deposit rate, which is the denominator in the Lerner index. Since the intermediation margin is a difference in rates, the increase is apparent only if market power is measured with the real Lerner index.

The results of the estimations following equation (1) and equation (2) by institution are reported in Table 4. Columns (1) and (3) omit the interaction term between concentration and risk; all other columns include it. Beyond the main variables of our model, all regressions include bank fixed effects, a trend, the logarithm of the industrial production index (IPI) and quarterly dummies that control for fluctuations in economic activity. The analysis in columns (1) and (2) is based on variable constructed using total assets. In (3) and (4) it is based on total loans excluding mortgages; in (5) on consumption loans; and in (6) on commercial loans.

The results without the interaction term are counterintuitive. Risk has no statistically significant effect on mark-ups. This result is surprising: since our Lerner index is not risk adjusted, risk premiums should increase it, even if banks are competitive, unless (i) either the loan demand elasticity or the savings offer elasticity were very large, or (ii) banks ration credit when systemic risk is high, so that only very safe loans are assigned for which the risk premiums are actually lower. The first explanation would imply that risk is always irrelevant for our Lerner index. The second would imply that risk may have a positive or a negative effect on the Lerner index, depending on the extent of credit rationing.

When the interaction term is included, the results regarding risk vanish; risk becomes relevant with a negative sign. This result suggests extensive credit rationing. But something else happens as well: the increases in concentration imply now increases in market power, regardless of the way risk is measured. This is in line with the theoretical predictions. While the coefficients of both concentration and the interaction term are positive in the last four columns, the coefficient of the interaction is statistically significant only in the aggregate market and in the consumption market. What about the market for commercial loans? Its results are perhaps not altogether surprising: companies have better access to external credit than consumers.

Next we repeat the exercise, but this time we aggregate the balance-sheet data by financial conglomerates –that is, we treat all banks in a conglomerate as a single institution able to make joint or closely coordinated decisions. The evolution of the corresponding Lerner

index, shown in Figure 10, is similar to that in Figure 8. The trend is similar, although the levels of mark-ups of the financial conglomerates are slightly higher than those of the aggregate market.

Table 5 reports the results of the model estimations by financial conglomerates. The table is organized in the same way as Table 4. This time, however, we include fixed effects only for conglomerates; banks that do not belong to a conglomerate have no associated dummy. Even without taking into account the interaction between risk and concentration, the effect of the latter on market power is non-negative. If the interaction is included, the coefficient on the concentration measure is always positive and statistically significant. The coefficient on risk stills suggests strong credit rationing when risk is higher. Finally, the coefficient on the interaction term is always positive and significant regardless of the market.

To summarize, we identify three effects. First, there is a direct positive effect of concentration on the Lerner index as shown by the *HHI* coefficient. This may be a sign that higher concentration leads to the exercise of market power, or that mergers occur when for external reasons risk premiums are high. However, we are explicitly controlling for risk in the regression, so either those mergers are undertaken to achieve medium-term cost reductions (i.e. their benefits are to come later), or they are undertaken to be able to raise mark-ups quickly (that is, their benefit comes from the extra market power), or both. The second effect is that the Lerner index falls when risk increases, which is consistent with strong credit rationing in the market. Finally, an increase in concentration allows for a stronger transmission of risk to the Lerner index. This last result suggests that our hypothesis that systemic risk acts as a collusion device for banks is correct.

The results do change depending on whether one considers banks individually or aggregated by conglomerate. For total loans (columns 3 and 4 in both tables), all three effects on mark-ups are much smaller in magnitude, albeit still very strong. This result is driven by consumption loans, which show a similar pattern. The results for commercial loans, on the other hand do differ. Our results suggest that the three channels increase their magnitude and become statistically significant when one considers financial conglomerates. This suggests that firms do shop more for good credit conditions, so that any exercise of market power in commercial loans requires more control of the market.

For the subsequent analyses in this section we use the results of column (4) in Table 5.¹² Our results state that the elasticity of the Lerner Index with respect to concentration depends on the level of risk. Figure 11 shows iso-Lerner curves, that is, different combinations of concentration and risk consistent with constant levels of market power. This is a phase space graph: each point corresponds to a possible state of the financial system. The measure of concentration (HHI, on the y-axis) is based on total loans. The risk measure, on the x-axis, is the percentage of non-performing loans. The small squares at the right of the graph show the exercise of market power in the corresponding level curve. For instance, $L=35\%$ indicates the curve where the Lerner index is 0.35. Finally, the boxes with years mark the observed concentration – risk combination in the banking system in each December¹³.

¹² We choose to focus on total loans, not on assets because the former seem a better indicator on the firms' activity.

¹³ Curves are calculated based on the estimates of equation (2). Given that only risk and concentration vary, the rest of variables included are evaluated at their simple average, and are therefore constant.

To read the graph, consider the effects on mark-ups of a given increase in risk –a horizontal movement to the right, like the onset of an economic downturn. At low levels of concentration, this movement will cause the system to cross few iso-Lerner curves: the exercise of market power does not increase much. At high levels of concentration, in contrast, the increase in mark-ups is larger. Alternatively, consider a vertical move upwards –an increase in market concentration at a given level of risk, like a merger. If current systemic risk is low, the merger won't affect mark-ups by much. However, if risk is high, it will lead to larger increases in the Lerner index.

In summary, Figure 11 suggests that in periods with high risk (as observed in late 1990s and early 2000s in Colombia), a merger would have stronger effects on the Lerner index. On the contrary, in boom periods, with low financial risk, a merger would have lower effects on market power.

VII. Conclusions

This paper relates market power with concentration and risk in the financial sector. Using Colombian data we identify three effects. First, a direct positive effect of concentration on the Lerner index, which may be a sign that higher concentration leads to the exercise of market power, or that mergers occur when for external reasons risk premiums are high. Since we are explicitly controlling for risk in the regression, either those mergers are undertaken to achieve medium-term cost reductions that we cannot account for with our

empirical specification, or they are undertaken to achieve extra market power, or maybe both.

The second effect is that the Lerner index falls when risk increases, which is consistent with credit rationing in the market. The third effect is that an increase in concentration allows for a stronger transmission of risk to the Lerner index (i.e. to the customers). This last result suggests that systemic risk is an important element to include when examining the link between concentration and market power in the financial system: it seems to act as a “collusion” device for banks in recent Colombian history. When risk is high firms do transfer a larger share of risk to customers through higher risk premiums. Thus, while high concentration is not enough to have collusion, the true effects of high market concentration on interest rates’ mark-ups emerge when the system is under stress.

Why would the banks be more able to transfer risk to customers when risk levels are high? A possible interpretation is that, in good times with strong business, banks compete for borrowers and collusion is hard to maintain. In a recession or a crisis, the increased vulnerability of the system leads banks to fear a run on them started by a bank going bankrupt. Therefore, a recession reduces the incentives to compete in the sector and acts instead as a coordinating signal for cooperation.

When considering banks individually, all three estimated effects are very large –except for commercial loans, where they don’t seem important. If the banks that belong to a financial conglomerate are treated as a single institution, all three effects on mark-ups become smaller in magnitude but are still very strong. Moreover, a similar pattern of results appear

for commercial loans. This suggests that any exercise of market power in commercial loans requires more control of the market.

The discussion here is not really about the level of market power in itself, but about the circumstances under which banks do exercise their market power. The theory suggests that the ability to exercise market power increases with concentration. Whether firms do it or not remains an empirical issue. Our results suggest that in the past, under bad macroeconomic conditions, the Colombian banks have exercised such market power.

Our results have at least two important implications for bank regulation. First, suppose a merger is proposed in the sector that needs the approval of a regulatory institution. Suppose moreover that systemic risk is low. An ex ante assessment of the effect of the merger is then likely to understate its effects on consumers if it does not consider the hypothetical scenario of an increase in systemic risk. A merger that looks convenient in boom times might be, from a social point of view, counterproductive in periods of crisis. This makes the requirements for approval more stringent.

A second implication is more favorable to mergers: if banks argue convincingly that systemic risk will fall with a merger, even a significant increase in concentration might lead to negligible increases in market power.

We use for our analysis non-performing loans –a standard risk measure. However, the exact risk measure adequate for a specific analysis may vary. The analysis may call for instance for an industry or country-level measure instead of a firm-level one. This paper proposes a

type of analysis rather than a specific way to carry it out, and shows how this analysis was relevant for the Colombian banking sector in recent years. Further research should explore the role of risk as a collusion signal in other contexts and using different risk –and concentration– measures.

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Tables

Table 1 Economies of scale in commercial banks

Paper	Time Period	Output	EE	EEA
Bernal y Herrera, 1983	1981		.93	
Suescún, 1987	1983 y 1986	Credit and debit accounts	.71	.83
Ferrufino, 1991	1986 – 1988	No. credit accounts	.61	.82
		Credit and debit accounts	.67	
Suescún y Misas, 1996	1989 – 1995	Credit portfolio	.78	1.06
Castro, 2001	1994 – 1999	Credit portfolio	.76	
		Investments	.18	

Source: Janna, 2004. **EE** stands for Economies of Scale, defined as the percentage increase in costs associated with a 1% increase in the output measure. **EEA** stands for Extended Economies of Scale, which takes into account new branches.

Table 2 Economic Efficiency in Colombia Banks

Paper	Time Period	Methodology^a	Average Efficiency
Suescún y Misas, 1996	1989 – 1995	Gross frontier	73%
Castro, 2001	1994 – 1999	Distribution free approach	49%
Badel, 2002 ^b	1998 – 2000	Distribution free approach	73%
Janna, 2003	1992 – 2002	Stochastic frontier	34%
	Sep. 2002		43%
Estrada y Osorio, 2004	1989 – 2003	Stochastic frontier	28%
Estrada, 2005	1994 – 2004	Stochastic frontier	71%

Source: Janna (2004) y Estrada (2005).

^a For a full description of the methodology, see Janna (2003). ^b The estimated cost frontier includes banks from Costa Rica, Colombia y México. The figure reported is the average of Colombian banks.

Table 3 Economic efficiency determinants in the Colombian banking system

Variables		PAPER		
		Castro, 2001	Badel, 2002	Janna, 2003
Ownership	Foreign	Not Significant		Positive
	Public	Negative		Not Significant
Bank Characteristics	Size and ROE		Positive	
	Branches	Negative		
	ROA	Positive	Negative	Positiva
	Solvency	Positive		
Type of producto	Portfolio deterioration	Negative	Negative	
	Portfolio quality			Negative
	% commercial portfolio	Positive		Positive
Market conditions	Regulation			Negative
	Economic cycle			Negative
	Concentration			Negative

Source: Janna, 2004.

Table 4

**Lerner Index Determinants
(By institution)**

	(1)	(2)	(3)	(4)	(5)	(6)
DEP. VAR: Lerner Index	Total loans ⁺	Total loans ⁺	Total loans ⁺	Total loans ⁺	Consumption loans	Commercial loans
HHI by:	Total assets	Total assets	Total loans ⁺	Total loans ⁺	Consumption loans	Commercial loans
Risk in:	Total loans ⁺	Total loans ⁺	Total loans ⁺	Total loans ⁺	Consumption loans	Commercial loans
ln(HHI)	-0.75 [0.094]***	0.75 [0.424]*	-0.222 [0.090]**	1.701 [0.425]***	1.705 [0.489]***	0.065 [0.343]
ln(Risk)	0.007 [0.022]	-2.574 [0.719]***	-0.013 [0.024]	-3.928 [0.811]***	-3.769 [1.194]***	-0.847 [0.531]
ln(HHI)*ln(Risk)		0.407 [0.113]***		0.6 [0.124]***	0.571 [0.183]***	0.127 [0.081]
ln(IPI)	0.171 [0.097]*	0.299 [0.093]***	0.151 [0.103]	0.267 [0.091]***	0.125 [0.077]	0.146 [0.139]
Trend	0.007 [0.001]***	0.006 [0.001]***	0.004 [0.001]***	0.004 [0.001]***	0.002 [0.000]***	0.005 [0.001]***
Q2	0.031 [0.010]***	0.026 [0.010]**	0.029 [0.010]***	0.026 [0.010]**	-0.008 [0.005]	0.043 [0.014]***
Q3	0.001 [0.012]	-0.008 [0.012]	-0.003 [0.013]	-0.009 [0.013]	-0.025 [0.008]***	0.014 [0.015]
Q4	-0.044 [0.018]**	-0.055 [0.017]***	-0.049 [0.019]**	-0.056 [0.018]***	-0.039 [0.009]***	-0.033 [0.021]
Constant	1.977 [0.602]***	-8.103 [2.785]***	-1.09 [0.711]	-14.245 [2.840]***	-12.202 [3.130]***	-2.219 [2.379]
R2	0.517	0.527	0.501	0.524	0.561	0.421
Number of observations	2837	2837	2837	2837	2674	2789

Standard errors in brackets

* Significant at the 10% level, ** at the 5% level, *** at the 1% level

⁺Only includes commercial and consumption loans

Source: Superfinanciera. Own calculations

Table 5
Lerner Index Determinants
(By financial conglomerate)

	(1)	(2)	(3)	(4)	(5)	(6)
DEP. VAR: Lerner Index	Total loans [†]	Total loans [†]	Total loans [†]	Total loans [†]	Consumption loans	Commercial loans
HHI by:	Total assets	Total assets	Total loans [†]	Total loans [†]	Consumption loans	Commercial loans
Risk in:	Total loans [†]	Total loans [†]	Total loans [†]	Total loans [†]	Consumption loans	Commercial loans
ln(HHI)	0.343 [0.139]**	1.105 [0.280]***	-0.09 [0.154]	0.913 [0.312]***	0.98 [0.256]***	0.356 [0.263]
ln(Risk)	0.106 [0.031]***	-1.955 [0.594]***	0.113 [0.031]***	-2.481 [0.641]***	-2.502 [0.740]***	-1.225 [0.373]***
ln(HHI)*ln(Risk)		0.289 [0.081]***		0.365 [0.088]***	0.358 [0.106]***	0.178 [0.053]***
ln(IPI)	0.59 [0.160]***	0.531 [0.160]***	0.295 [0.157]*	0.281 [0.145]*	0.025 [0.077]	0.116 [0.200]
Trend	0.003 [0.001]**	0.004 [0.001]**	0.006 [0.001]**	0.007 [0.001]**	0.003 [0.000]**	0.006 [0.001]**
Q2	0.004 [0.014]	0.011 [0.014]	0.018 [0.014]	0.024 [0.014]	-0.009 [0.006]	0.047 [0.019]**
Q3	-0.054 [0.016]***	-0.044 [0.016]**	-0.026 [0.017]	-0.019 [0.017]	-0.02 [0.008]**	0.001 [0.021]
Q4	-0.109 [0.027]***	-0.101 [0.027]***	-0.077 [0.026]***	-0.071 [0.025]***	-0.037 [0.011]***	-0.051 [0.029]*
Constant	-5.557 [1.071]***	-10.772 [1.884]***	-1.271 [1.223]	-8.391 [2.176]***	-7.438 [1.755]***	-3.909 [2.098]*
R2	0.305	0.323	0.301	0.325	0.423	0.199
Number of observations	2203	2203	2203	2203	2041	2184

Standard errors in brackets

* Significant at the 10% level, ** at the 5% level, *** at the 1% level

[†]Only includes commercial and consumption loans

Source: Superfinanciera. Own calculations

Figure 1

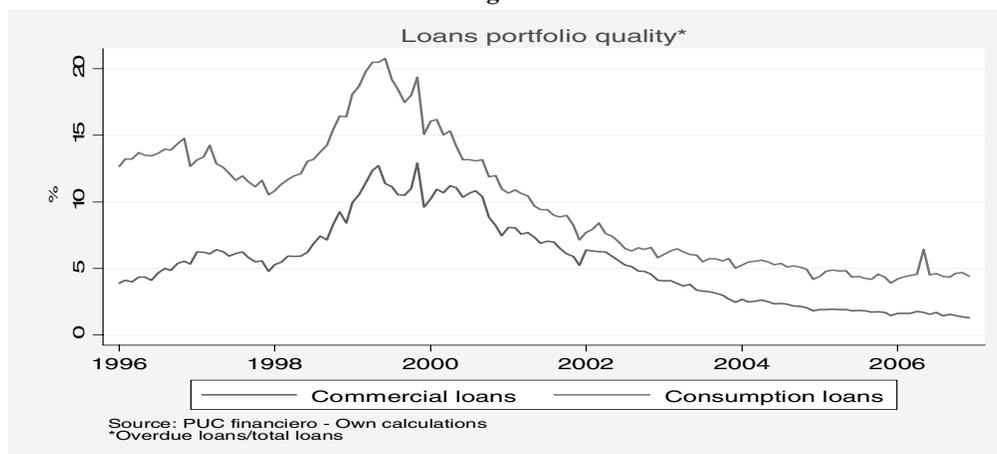


Figure 2

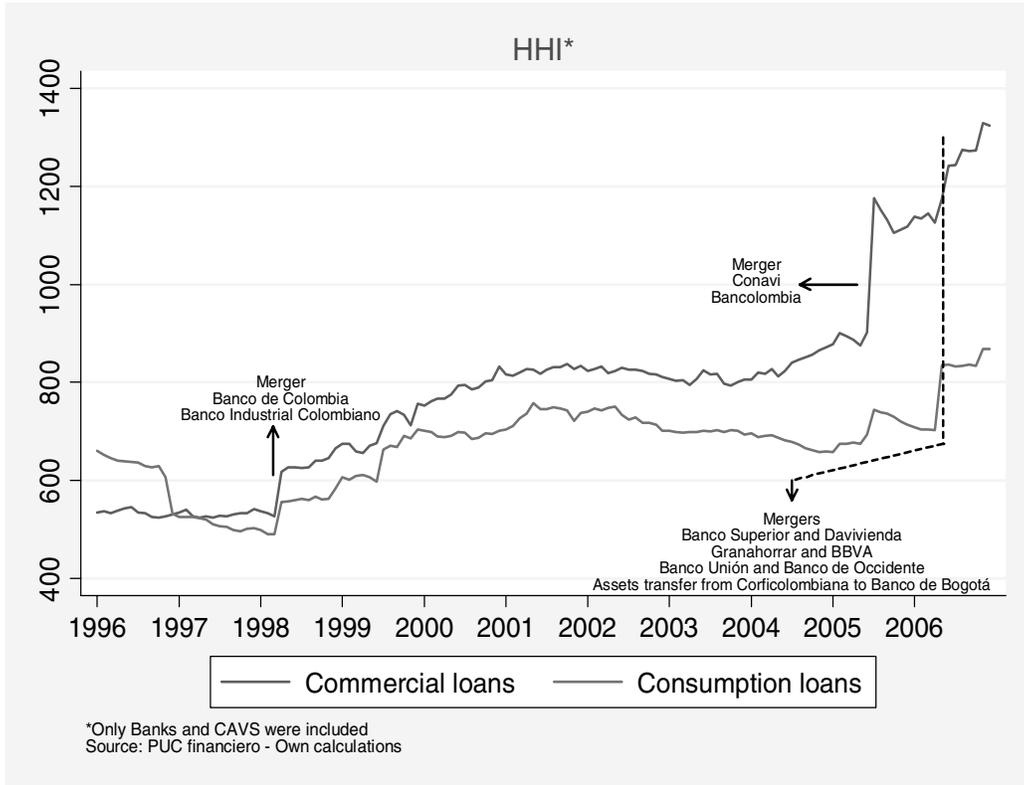


Figure 3

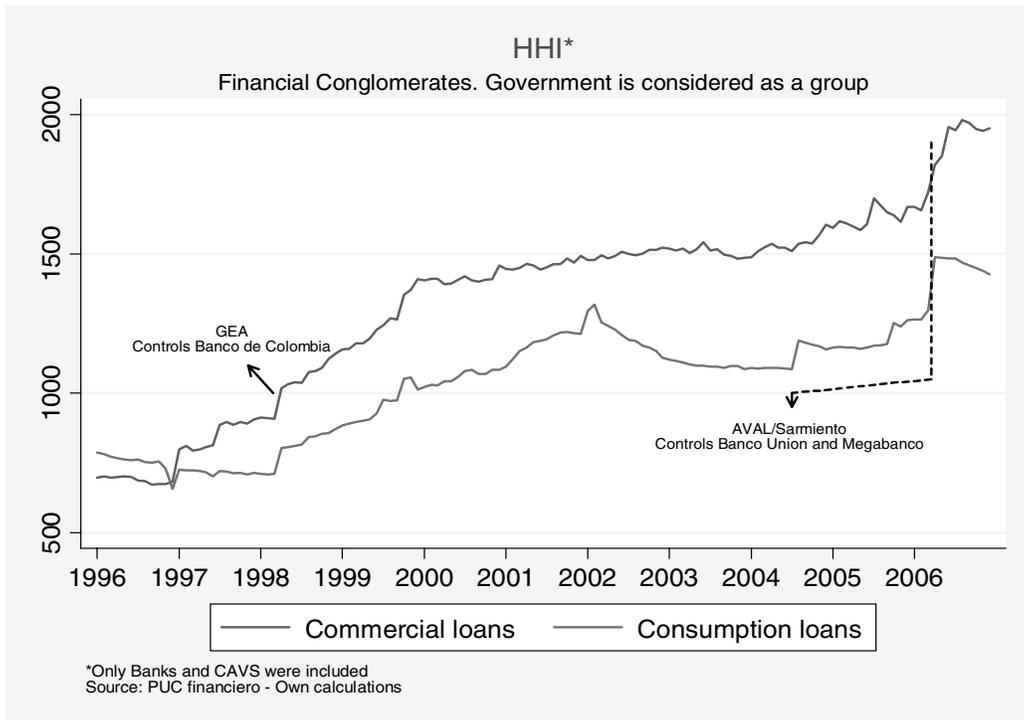


Figure 4

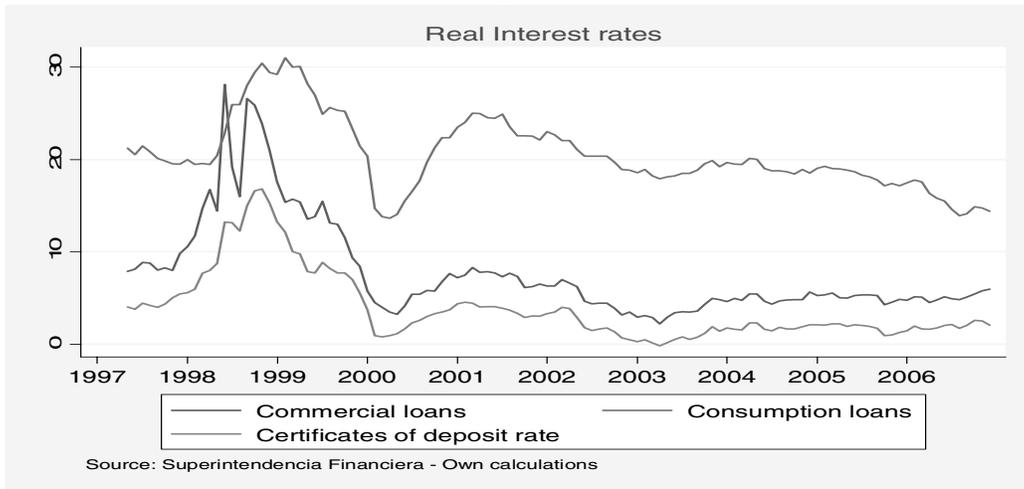


Figure 5

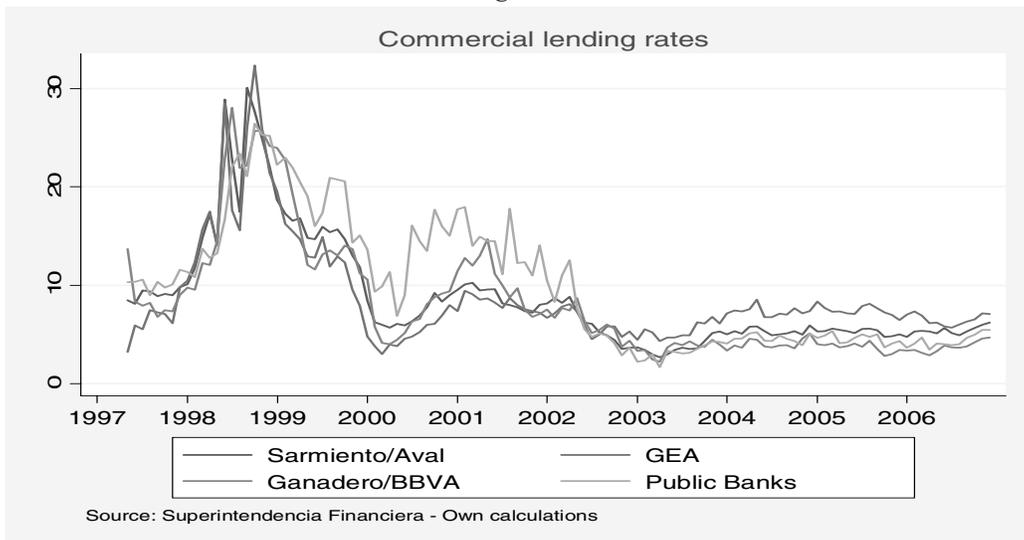


Figure 6

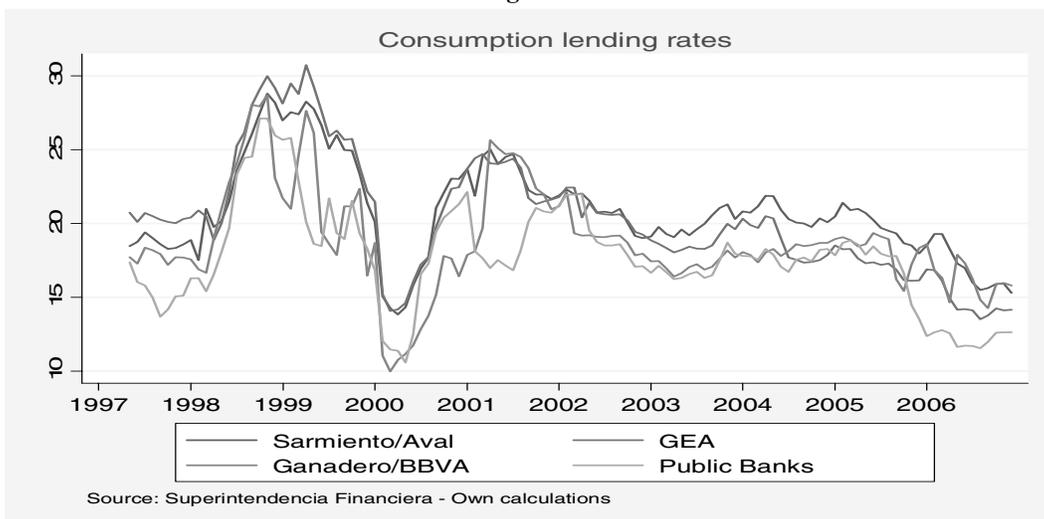


Figure 7

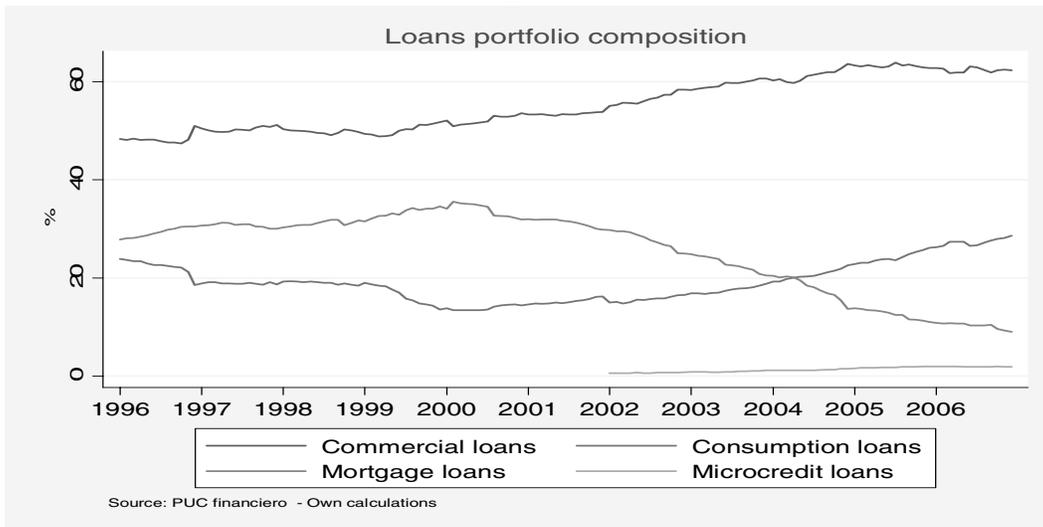


Figure 8

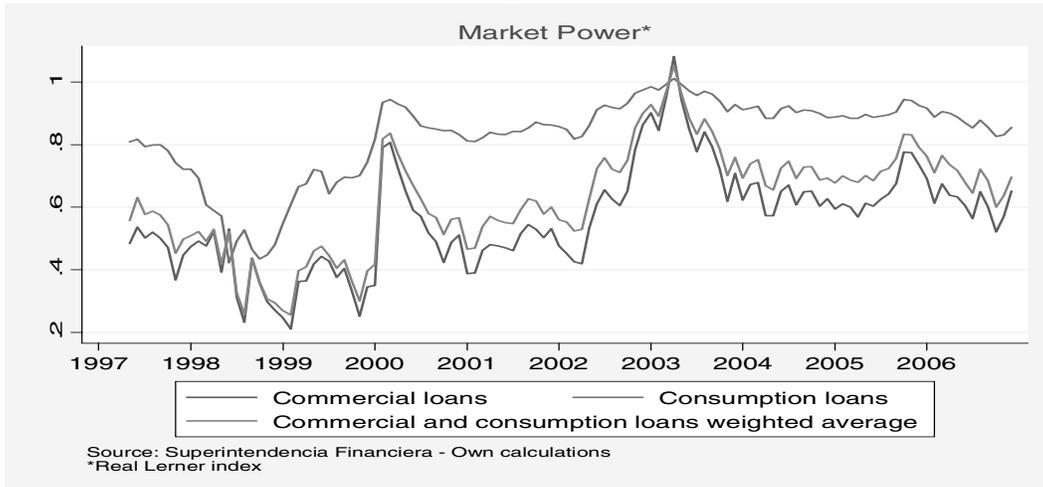


Figure 9

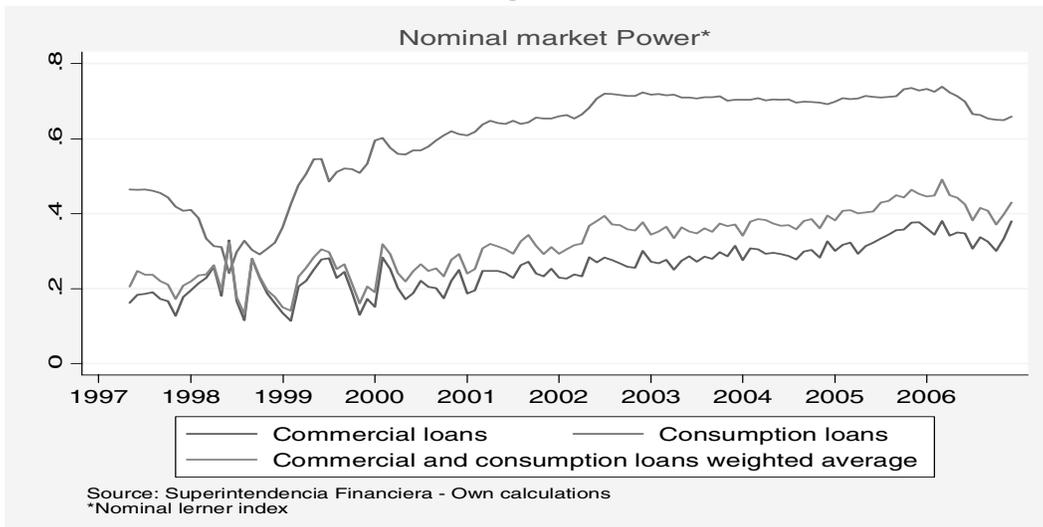


Figure 10

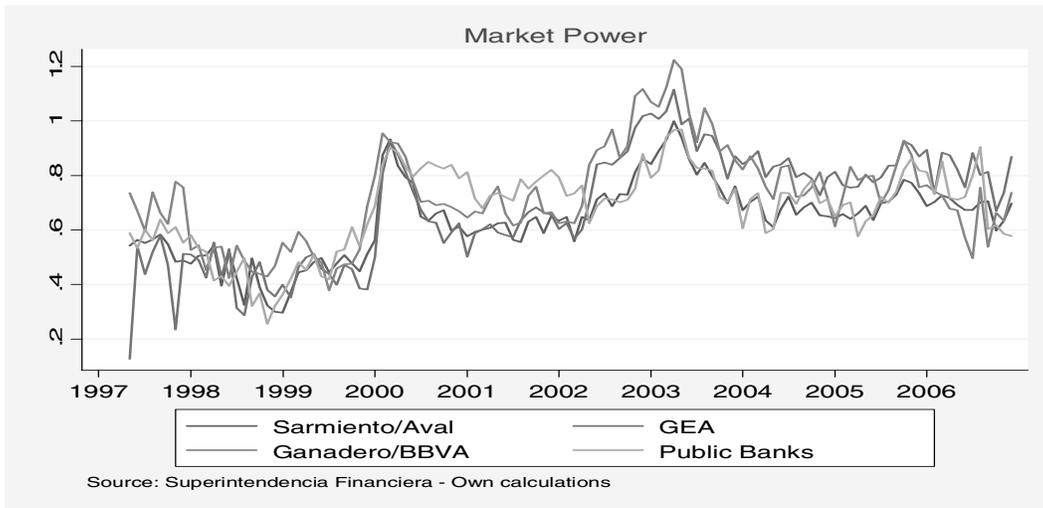
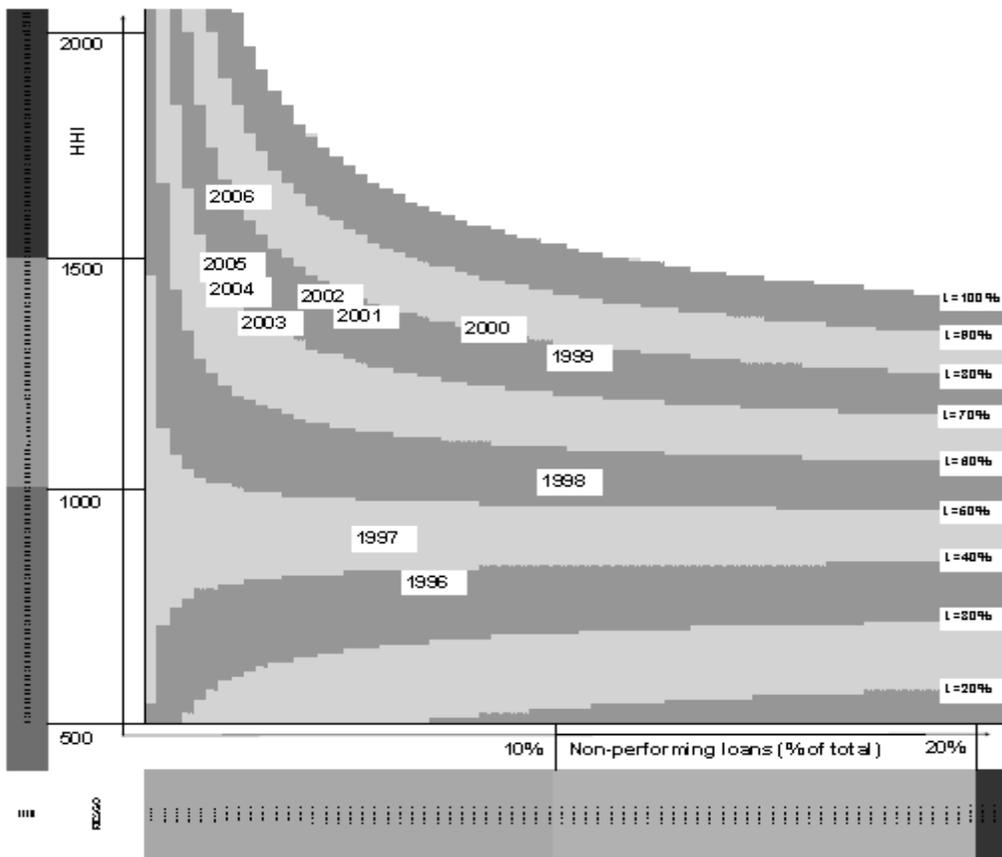


Figure 11
Iso-Lerner curves in risk-concentration space



Each change of shade marks an iso-Lerner level curve. The value of the Lerner index on each level curve appears on the right of the graph. The boxes with year values indicate the position of the Colombian financial system each December from 1996 through 2006. There are two clear stages: the crisis (1996-1999) and recovery (2000-2006).

