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BANK CONCENTRATION AND CREDIT VOLATILITY

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Resumen
Utilizando un panel de datos desbalanceado que cubre noventa y tres países durante el periodo 1990-2002, este estudio analiza la relación empírica entre la concentración bancaria y la volatilidad del crédito. El estudio encuentra una fuerte relación negativa entre la concentración del crédito y su sensibilidad a choques externos. Asimismo, muestra que estos resultados son robustos a cambios en la muestra de países, a la definición de concentración y a los modelos econométricos, y que esta relación negativa no se debe a periodos de crisis bancarias. Los resultados están en línea con la hipótesis de que los bancos con poder de mercado internalizan el efecto agregado de su contracción crediticia durante períodos recesivos.

Abstract
This paper uses an unbalanced panel covering ninety-three countries over the 1990-2002 period to study the empirical relationship between bank concentration and credit volatility. The paper finds that there is a strong negative relationship between loans concentration and credit sensitivity to external shocks. It also shows that this result is robust to different samples, measures of concentration and econometric techniques, and that this relationship is not driven by crisis episodes. These results are in line with the hypothesis that banks with a larger market share can internalize the countercyclical effects of expanding credit during recessions.

The opinion expressed in this paper do not necessarily reflect those of the Central Bank of Chile or the Inter-American Development Bank. We would like to thank John Boyd and conference participants for useful comments and suggestions and Dany Jaimovich for excellent research assistance and for useful comments and suggestions. The usual caveats apply.
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Introduction

This paper studies the relationship between bank concentration and credit volatility. This topic is closely linked to cross-border banking activity because there is a widespread concern that the globalization of the banking industry may, by increasing concentration, reduce bank competition, efficiency, and access to credit.

Although the paper is related to the literature on the relationship between bank concentration and interest margins (see Berger and Hannan, 1998, Corvoiser and Gropp, 2001, and Demirguç-Kunt et al., 2003, among others), the relationship between bank concentration and growth (Cetorelli and Gambera, 2002), and the relationship between bank concentration and financial fragility (see Allen and Gale, 2004, for a theoretical analysis and Beck et al., 2004, for an empirical analysis), we focus on an additional possible effect of bank concentration and test whether bank concentration is correlated with the way in which external shocks affect domestic credit. This is important because it is well known that external factors are important determinants of economic activity (this is especially the case in developing countries, see Calvo et al., 1993) and that there is a causal relationship going from credit availability to GDP growth. Hence, any mechanism that would amplify, through credit availability, the effect of an external shock would also play a role in amplifying the high degree of macroeconomic volatility that characterizes the majority of developing countries (Inter-American Development Bank, 1995).

There are several channels through which concentration may affect how bank credit reacts to external shocks and, interestingly, some of these channels predict opposite effects. On the one hand, there are at least three reasons why higher concentration may play a role in smoothing external shocks. First of all, a higher degree of concentration could be associated with larger and more diversified banks. This higher degree of diversification would allow banks to take more risk and, hence, continue lending during recessions. One caveat with this view is that it is not clear that concentration is associated with more diversification (Boyd and Runkle, 1993). Second, if a higher level of concentration is associated with higher profitability, banks with some monopoly power could be able to build a buffer that would allow them to take more risk (Boot and Greenbaum, 1993) and to reduce margins during economic downturns, especially if increasing lending during bad times allows them to extract more rents during periods of economic expansion (for a similar logic, see Petersen and Rajan, 1995). Finally, banks with a lager market share could internalize the positive counter-cyclical effects of expanding credit

during recessions or have incentives to reduce financial contagion (for a discussion on the latter point see Allen and Gale, 2004).

On the other hand, it is possible that bank concentration may lead to higher intermediation margins which, in turn, could increase macroeconomic instability. Smith (1998) studies this channel by building a general equilibrium model in which banks with market power can increase efficiency by improving the asset transformation mechanism but where market powers is also associated with higher cost of funds for all classes of borrowers, independently from their level of collateral. By calibrating his model, Smith (1998) shows that there is a wide range of parameters that yield the conclusion that a less competitive banking system is associated with lower economic activity and higher macroeconomic volatility.

Finally, while Boyd and de Nicolò (2005) find that bank concentration increases fragility, Allen and Gale (2004) and Boyd et al. (2003) find that there is no clear theoretical relationship between bank concentration and financial stability. In particular, Boyd et al. (2003) build a general equilibrium model in which the relationship between the degree of bank competition and the probability of a banking crisis depends on the level of inflation. According to their model, monopolistic banking systems tend to be more crisis prone (with respect to a competitive banking system) in low inflation environments but this result reverses when inflation is above a certain threshold. Beck et al. (2004) empirically test the relationship between concentration and financial fragility and find that concentration is associated with a lower probability of observing a systemic banking crisis.

It is important to note that several of the theoretical models discussed above assume a one to one relationship between concentration and bank competition. Although this interpretation is consistent with the traditional "structure conduct performance" approach in which the causality goes from market structure to market performance (see Molyneux et al., 1994, for a survey applied to the banking system), recent advances in industrial organization made it clear that this direction of causality is not warranted and that it is perfectly possible for performance to affect market structure. Claessens and Laeven (2003) recognize this possibility and test whether there is a causal effect from concentration to (lower) competition and find no evidence for such a causal effect. In fact, the theory of contestable markets (Baumol et al. 1982) suggests that a high level of concentration is not inconsistent with the presence of a competitive market. According to this view, some banks may have large market shares simply because they are more efficient than

their competitors (Berger, 1995), and a situation where more efficient banks have a larger market share is clearly a desirable outcome and not one that reduces social welfare.

As theory cannot help us in identifying a clear direction in the relationship between bank concentration and macroeconomic volatility, in this paper we will take an agnostic stand and use an empirical approach to evaluate whether such a relationship exists and in which direction the relationship goes. Our main finding is that in countries with higher bank concentration domestic credit reacts less to external shocks, suggesting that bank concentration is associated with lower credit volatility. In our empirical analysis we also make an effort to separate the effect of concentration from that of competition (as proxied by entry barriers) and find some evidence indicating that it is concentration and not lack of competition that reduces volatility. In fact, our results provide some evidence (albeit not very robust) suggesting that entry barriers increase credit sensitivity to external shocks.

Data

Throughout the paper, we will study how concentration affects credit by focusing on real credit growth (CRGR). We measure real credit growth using data from the International Financial Statistics' (2003) entry for "Credit to the Private Sector (lines 22d.f plus 22zw for Europe) deflated by the CPI (line 64). Focusing on the 1990-2002 period, we were able to identify 54 countries with data on credit growth for the whole period (13 observations per country) and other 39 countries with at least 9 years of data, yielding a total of 93 countries and 1162 observations. In order to avoid possible problems due to extreme values, we then dropped the country-years in the top and bottom 2 percent of the distribution of our credit growth variable and obtained our final sample consisting of 1116 observations.

The second key variable in the empirical analysis is our measure of real external shocks (*SHOCK*). The real external shock is defined as the weighted average of GDP growth in country *i*'s export partners. Formally, we define the external shock as follows:

$$SHOCK_{i,t} = \frac{EXP_i}{GDP_i} \sum_j \phi_{ij,t-1} GDPGR_{j,t}$$

where $GDPGR_{j,t}$ measures real GDP growth in country j in period t, $\phi_{ij,t}$ is the fraction of export from country i going to country j, and EXP_i/GDP_i measures country i average exports expressed as a share of GDP. An advantage of our SHOCK measure is that it is highly correlated with GDP and credit growth (if we regress GDP growth over our SHOCK variable and control for country and year fixed effects, we find a coefficient of 1.5 and a t-statistics of 7.5) but it is exogenous with respect to these variables.

Our third key variable is bank concentration (*C3L*). Our main source of data is the Bankscope (BSC) database that includes information on bank balance sheets in 179 countries. In building an index of bank concentration, we faced three types of choices. The first had to do with the type of index to be used. The second had to do with the variable that should be used to measure concentration (assets or loans). The third had to do with the time dimension (purely cross-sectional or panel). With respect to the first choice, we decided to measure concentration using the C3 index (share of the three largest banks over total banking system). This choice was driven by the fact that C3 is the simplest measure of concentration and tends to work better in small countries with few banks. With respect to the second choice, we decided to compute concentration by using loans rather than assets (so, C3 is defined as share of loans of the three largest banks over total loans). We chose loans instead of assets because loans are closer to the concept of sales. It is worth nothing, however, that the two indexes of concentration yield identical results. With respect to the third choice, we followed Beck et al. (2004) and, rather than computing indexes of concentration year by year, we computed average concentration for the 1995-2002 period. One possible problem with this strategy is that our sample starts in 1990 and, as concentration is measured after some of the events we consider, this may lead to reverse causality. We think that this is not a very important problem because our estimation strategy focuses on the interaction between concentration and external shocks and it is hard to think that credit growth could have a large effect on this interaction. In their study of the relationship between bank concentration and fragility, Beck et al. (2004) investigate the possibility of reverse causality going from fragility to concentration and find no evidence in support to this hypothesis.

Our fourth key variable is financial development (*FINDEV*). We measure financial development by averaging the ratio between domestic credit and GDP (all data are from the World Development Indicators). In our sample, financial development averages 55 percent and ranges from 3.5 percent (Sudan) to 195 percent (Japan).

Empirical analysis

In this section, we run a set of fixed effects regressions aimed at estimating how concentration affects the relationship between external shocks and credit growth. Our basic specification takes the following form:

$$CRGR_{i,t} = \alpha_i + \tau_t + SHOCK_{i,t}\left(\beta + \gamma * C3L_i + \delta * FINDEV_i\right) + \lambda CR_{i,t-1} + u_{i,t}$$

where α_i is a country fixed effect and τ_i is a time fixed effect. β is a coefficient that captures how credit growth reacts to external shocks. γ is our parameter of interest and it measures how bank concentration mitigates (if the coefficient is negative) or amplify (if the coefficient is positive) the impact of external shocks on credit growth. δ measures how the size of the financial system affects the impact of external shocks on credit growth. We expect δ to be negative because countries with a larger financial system should be able to cope with external shocks better than countries with small financial systems. Finally, we control for mean reversion by including the lagged log value of real credit.

Table 1 reports our basic results. Column 1 shows that, as expected, real credit growth is positively and significantly correlated with the external shock and that the data exhibit mean reversion (λ=-0.12). We also find that the coefficient of the interaction between the external shock and financial development is negative and statistically significant, indicating that in countries with larger financial systems, credit growth tends to be less responsive to external shocks.

<TABLE 1 HERE>

What is more interesting for our purposes is the negative, large, and statistically significant coefficient of the interaction between the external shock and bank concentration. This coefficient suggests that countries with more concentrated banking systems tend to respond less to external shocks with respect to countries with less concentrated banking systems. This

finding seems to support the theoretical models that associate higher concentration with higher financial stability and is in line with the empirical findings of Beck et al. (2004) who suggest that the frequency of banking crisis tends to be negatively correlated with bank concentration. The coefficient also suggests that the impact of concentration is quantitatively important. Take for instance a country with an average level of financial development (0.54) and the lowest level of concentration (0.20). In this case, a one standard deviation change in the external shock (0.01) would affect credit growth by approximately one standard deviation (0.11). If we consider, instead, a country with the same level of financial development but the highest level of bank concentration (0.96), we find that a one standard deviation change in the external shock (0.01) has a minuscule effect (0.009, corresponding to less than one tenth of one standard deviation) on credit growth. If we repeat the same exercise but consider a change in the level of bank concentration from the 25^{th} to the 75^{th} percentile of the cross-country distribution, we find that a higher level of concentration reduces the effect of an external shock on credit growth by approximately 50 percent (from 8 to 4.6 percent).

One possible problem with the estimation of column 1 is that we used OLS to estimate a fixed effect model that includes a lagged dependent variable. To address this issue in column 2, we re-estimate the baseline model using the GMM estimator proposed by Arellano and Bond (1991). We find that the model performs well in terms of the various specification tests (OIR test and AR2 test) and that our results are basically unchanged.

In columns 3 and 4 we split the sample between industrial and developing countries. We find that the results are qualitatively similar to those of column 1, but we also find that the mitigating effect of concentration is much stronger in developing countries. The difference in coefficients, however, is not statistically significant. In order to compare column 1 of Table 1 with columns 3 and 4, we simulated the effect of a one standard deviation change in the external shock for the two groups of countries (industrial and developing) and for the whole sample under different levels of bank concentration. In performing the simulation, we used group-specific average values of financial development and measured the impact of the shock as share of the group-specific standard deviation in credit growth. Our main finding is that, when we adjust for the fact that in industrial countries credit is less volatile than in developing countries, the impact of bank concentration in developing countries is similar to the impact of bank concentration in industrial countries.

In column 5 we check whether controlling for bank ownership affects our results. This important because Levy Yeyati et al. (2003) argue that state owned banks may have the explicit objective of stabilizing credit (in Micco and Panizza, 2004, we provide some evidence in this direction). If this were the case and if there were a correlation between state ownership of banks and bank concentration, then our results could just proxy for the effect of ownership. Foreign ownership may also be important. In particular, Caballero (2002) argues that foreign owned bank may have played a destabilizing role during the negative shock that affected Chile in 1998 and Galindo et al. (2004) discuss that, depending on the type of shock, foreign owned banks may either stabilize or destabilize credit. When we augment our baseline regression with the interaction between the external shock and the share of total loans that are issued by state owned banks and the interaction between the external shock and the share of total loans that are issued by foreign owned banks we find that the ownership variables do not affect our basic result.

Column 5 shows that the coefficient on foreign participation is negative although not statistically significant. Galindo et al. (2004) suggest that this should be the expected sign if foreign banks have an advantage at canalizing foreign liquidity and our shock variable is a better proxy of domestic liquidity than of domestic investment opportunities. The coefficient on public ownership is positive and marginally significant (at the 10 percent confidence level) suggesting that the presence of state owned banks is correlated with higher credit volatility. This result seems at odds with our previous study (Micco and Panizza, 2004) where we showed that individual public banks tend to be less procyclical than their private counterparts. These contrasting results have to do with the fact that the exercise of this paper focuses on cross-country variation in public ownership and the exercise in Micco and Panizza (2004) focuses on bank-level data. Taken together these results suggest that countries with more public banks are more sensitive to external shocks (perhaps because public participation is associated with country characteristics that may increase aggregate credit volatility e.g. lack of sound institutions) but individual public banks react less to external shocks than their private counterpart within each country.

Robustness Analysis

One possible problem with the specifications of Table 1 is that financial development is likely be endogenous with respect to credit volatility (countries with a more volatile credit market tend to develop a smaller financial sector). To address this issue, we substitute *FINDEV* with a dummy variable that takes value one for countries that have a common law legal system and zero otherwise (common law is clearly exogenous and strongly correlated with financial development La Porta et al., 1998). We find that substituting financial development does not affect our basic results.[1] We also investigate whether using asset concentration makes a difference. We find that when we repeat our baseline regression but replaces loan concentration with asset concentration we find that the results are unchanged.

To test whether our result is purely due to banking crises or whether concentration also affects credit volatility in normal times, we augment our baseline specifications with a dummy that takes value one during banking crises (we use data from Caprio and Klingebiel, 2003) and with the interaction between this dummy and our measure of bank concentration. We find two noteworthy results. As expected, the crisis dummy is negative and statistically significant; indicating that credit growth tends to be low during episodes of systemic banking crises. However, we also find that the interaction between the crisis dummy and bank concentration is positive and statistically significant, indicating that credit contractions due to banking crises tend to be smaller in countries with more concentrated banking systems. The effect is economically important. The point estimates indicate that a one standard deviation increase in bank concentration would reduce the negative impact of a banking crisis by approximately 25 percent. This is another indication that bank concentration stabilizes credit. Furthermore, we still find that the interaction between the external shock and bank concentration is negative, large, and significant.

Can We Say Anything About the Channels?

After having shown that there is a robust negative correlation between concentration and sensitivity to external shocks, we now explore some of the possible channels discussed in the introduction. In particular, we check whether this relationship is due to the fact that higher

[1] In order to save space, we do not report the results of our robustness analysis. All the results are available upon request.

concentration is due to the presence of larger (and possibly more diversified) banks or whether this relationship is due to regulations that restrict the competitiveness of the banking system and generate monopoly rents.

To test the first hypothesis, we augment our baseline specification with the interaction between the external shock and a variable measuring absolute bank size (SIZE is defined as the time-invariant average of the log of the sum of loans issued by the 3 largest banks). If the relationship between concentration and credit volatility were due to the fact that more concentrated banking system tend to have larger (and possibly more diversified) banks, we should find that SHOCK*SIZE has a negative coefficient and that controlling for this interaction reduces the explanatory power of SHOCK*C3. Columns 1 and 2 of Table 2 show that SHOCK*SIZE has the expected negative coefficient but that the coefficient is not statistically significant. Moreover, the regression results show that controlling for SHOCK*SIZE has no effect on the coefficient of SHOCK*C3. This seems to indicate that the smoothing effect of concentration is not due to bank size. This result is consistent with the previous finding that large banks do not seem to be more diversified than smaller banks (Boyd and Runkle, 1993).[2]

<TABLE 2 HERE>

The last four columns of Table 2 look at the effect of regulations that restrict competition. Again, if the effect of concentration on credit growth were to go through lower competition, we should expect that controlling for these factors should reduce the coefficients and the explanatory power of SHOCK*C3. We start by augmenting our baseline specification with the interaction between the external shock and a variable that measures barrier to entry in the banking system. In particular, we use a variable assembled by Barth et al. (2001) that measures the number of denied entry application as a share of total entry application received from both foreign and domestic institutions (DENY). While this variable is far from being problem-free and its use greatly reduces the size of our sample, it can give us some idea on the

[2] In principle, economies of scale do not affect our Shock*C3 coefficient unless these are increasing or decreasing. Increasing (decreasing) economies of scale would induce a positive (negative) coefficient.

mechanism that drives the relationship between concentration and credit growth.[3] If entry restrictions have a positive impact on profit without greatly reducing efficiency, we should find a negative coefficient for the SHOCK*DENY interaction and also find that controlling for this variable reduces the explanatory power of SHOCK*C3. If, instead, entry restrictions only increase the inefficiency of the banking system, we should find that SHOCK*DENY increases credit volatility and that including this variable in the regression does not affect the coefficient and explanatory power of SHOCK*C3. Column 3 of Table 2 shows that this is the case. In particular, we find that the coefficient of SHOCK*DENY is positive (although not statistically significant) and that the coefficient of SHOCK*C3 remains negative and highly significant. Column 4 shows that using Common Law instead of financial development does not affect the results described above.

As a last experiment, we use Barth et al.'s (1999) index of regulatory restrictions on bank activity (REST). The effects of these restrictions are ambiguous. On the one hand, they could make banks safer and (by restricting competition) more profitable and hence more able to perform countercyclical lending. On the other hand, they could limit diversification, reduce efficiency and explicitly limit lending activity (through margin requirements) during recessions. Column 5 shows that SHOCK*REST has a positive (although not statistically significant) coefficient and that including this variable in the regression does not affect our basic results. Again, the results are unchanged if we substitute FINDEV with Common Law (column 6).

Conclusions

Economic theory yields ambiguous predictions on the relationship between bank concentration and credit volatility. In this paper, we analyze the empirical relationship between bank concentration and credit volatility using an unbalanced panel of 93 countries during the period 1990-2002. To identify this relationship, we study credit reaction to external shocks in countries with different level of loan concentration. We find that there is a strong and negative relationship

[3] There are two types of problems with this variable. The first one has to do with the fact that the variable is only available for the late 1990s. Barth et al (2005) show that this is not a very serious problem because banking regulations tend to be stable over time. The second, and more serious problem, has to do with the fact that a low number of denied application may not signal free

between loans concentration and credit sensitivity to external shocks and that this result is robust to different samples (industrial and developing countries), measures of concentration, econometric techniques, and that it is not driven by crisis episodes. We also find that the result does not vanish when we control for financial development, bank ownership, bank size and lack of competition (measured by entry barriers).

It is worth noting that although our paper is purely positive, we did implicitly assign a normative connotation to our findings and assumed that the shadow value of an extra dollar of lending is higher during recessions than during economic expansions and, hence, credit stabilization (or countercyclical lending) is socially optimal. This equivalent to believing that over-lending during periods of economic expansion plants the seeds for the successive crisis and that, during crises, there are valuable projects that are not executed or abandoned for lack of financing. Alternatively, one may believe that technology plays a key role in determining the business cycle and, as a consequence, investment projects will have low returns during economic crises and high returns during economic expansion. In this set-up, procyclical lending would be socially optimal and our finding that bank concentration reduces procyclicality should be seen as evidence in favor of policies aimed at reducing bank concentration.

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entry but could signal that nobody bothers to apply because but it could signal that nobody bothers to apply because the probability of approval is extremely low.

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Table 1: Concentration and Real Credit Growth

	(1)	(2)	(3)	(4)	(5)
Log real credit t-1	-0.117	-0.199	-0.132	-0.021	-0.118
	(0.013)***	(0.006)***	(0.016)***	(0.017)	(0.013)***
Shock	16.551	15.184	16.712	16.254	13.301
	(3.739)***	(1.733)***	(4.867)***	(4.765)***	(4.364)***
Shock*C3-Loan	-13.713	-12.840	-14.451	-8.970	-12.121
	(4.674)***	(2.403)***	(6.264)**	(4.292)**	(4.768)**
Shock*FINDEV	-4.612	-5.367	-4.651	-7.629	
	(1.663)***	(0.668)***	(1.955)**	(3.919)*	
Shock*Pub.Own.					10.499
					(6.351)*
Shock*For.Own.					-0.535
					(3.243)
Observations	1116	1002	830	286	1116
R-squared	0.2688		0.2671	0.4717	0.2709
Test OIR		0.152			
Test AR 1		0.0005			
Test AR 2		0.470			
Period	1990s	1990s	1990s	1990s	1990s
Sample	All	All	Developing	Industrial	All
Estimation Method	OLS FE	GMM AB	OLS FE	OLS FE	OLS FE

Robust Standard errors in parentheses significant at 10%; ** significant at 5%; *** significant at 1%
OIR: Sargan test of overidentification restrictions.

Table 2: Real Credit Growth and Regulation

	(1)	(2)	(3)	(4)	(5)	(6)
Log real cr. t-1	-0.118	-0.117	-0.135	-0.133	-0.147	-0.147
	(0.013)***	(0.013)***	(0.016)***	(0.016)***	(0.016)***	(0.016)***
Shock	20.993	21.532	14.605	15.015	12.087	8.312
	(6.062)***	(5.601)***	(4.394)***	(4.202)***	(5.610)**	(4.922)*
Shock*C3-Loan	-14.236	-13.477	-17.504	-16.901	-12.153	-11.282
	(4.708)***	(4.743)***	(5.559)***	(5.527)***	(4.445)***	(4.440)**
Shock*FINDEV	-2.655		-0.438		-3.608	
	(2.681)		(2.709)		(1.942)*	
Shock*SIZE	-0.596	-0.774				
	(0.641)	(0.448)*				
Shock*CL		-2.564		-4.518		-1.978
		(1.660)		(2.194)**		(1.513)
Shock*DENY			5.922	9.349		
			(3.588)*	(3.912)**		
Shock*REST					0.613	1.219
					(1.660)	(1.602)
Observations	1116	1116	712	712	873	873
R-squared	0.2695	0.2705	0.3229	0.3274	0.2937	0.2921
Period			1990-2003			
Sample			All Countries			

Robust Standard errors in parentheses * significant at 10%; ** significant at 5%; *** significant at 1%

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