

TALES OF TWO RECESSIONS IN CHILE: FINANCIAL FRICTIONS IN 1999 AND 2009

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During 2007-2009, the world underwent a deep economic crisis that has been termed the Great Recession, where total output is estimated to have decreased 0.6%. This event has had two salient characteristics: it was a financial shock that originated in advanced economies, and in the end, most of the economies of the world experienced negative rates of economic growth. The nature of the recession has renewed the interest of economists in studying the effects of financial shocks on aggregate economic activity. Understanding the precise mechanisms through which financial shocks spread to the rest of the economy has been at the center of the research agenda.

In this paper we aim to contribute to the studies that try to understand the propagation of financial shocks to the real economy. For this we use a unique database of non-financial Chilean firms that identify the banks that have extended loans to each of them. This firm-level database also indicates the amount of investment undertaken each year. We also have detailed balance-sheet information of the banks operating in Chile. Combining these two pieces of information, we are able to study the relationship between changes in the financial health of lenders, and the performance of the firms to which they have lent funds. In particular, we can analyze how banks financial characteristics—in particular their degree of

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leverage—affect their lending behavior and the investment decisions of firms to which they lend.

Another prominent feature of our paper is that we will conduct a comparative study of the recession experienced in Chile in 2009, with the previous economic contraction observed in the country. The last recession observed in Chile had occurred exactly ten years earlier in 1999. We adopt this comparative approach for several reasons. First, it is important to put an event in perspective that has been termed the *Great Recession*. How does the crisis of 2009 compare with other periods of economic distress? To what extent were developments observed in the banking sector in 2009 different from other recessions? Another important reason to make this comparison is to gauge the extent to which policy actions, during both events, might have had an impact on the observed performance during the crises. As we explain in section 1 between the two crises, there were important changes to the macroeconomic policy framework in Chile. Although it is no simple task to evaluate the contribution of each of these policy changes to observed changes in performance, the comparative study might shed some light on the benefits of adopting a “bundle” of reforms, which might be a valuable lesson for other developing economies.

Our empirical analysis is divided in two parts. First, we focus on the developments of the banking sector in Chile. We start by looking at the aggregate trends in bank loans in each episode, noticing that the recovery in lending was much faster after the 2009 recession. Another noticeable element that appears when one compares both episodes, is that the shift towards foreign assets (deposits abroad) was less intense in the more recent recession. Both of these differences in the reaction of banks in the two episodes could have been of importance for the real effects of the financial shocks. To shed more light on the reasons that could explain this different behavior, next we use the individual balance sheet data of banks operating in Chile in the period under study.

Our central aim when using the bank-level data is to examine the joint dynamics of leverage and asset growth, both in the buildup and the aftermath of each recession. As will be explained in more detail later, the extent to which leverage evolves over the business cycle is of central importance, both for the buildup of financial vulnerabilities and for the depth of the crises in the aftermath of a shock. Several important results emerge from the analysis of Chilean banks' leverage. First, and as documented by other economies, leverage appears to be strongly procyclical. Next, and related to this first

result, even though banks reduced their leverage in both episodes, the intensity of the process was weaker in 2009 and was more intense for the smaller banks. Lastly we document a strong positive correlation at the bank level between the *decrease* in lending during the crises, and its leverage at the onset of the crises.

Having documented this important correlation between the dynamics of lending and leverage, we turn to our non-financial firms database to examine the implications that the developments in the banking sector could have for the real economy. As explained earlier, for each firm we can identify all the creditor banks for which, in turn, we have data on their leverage prior to each financial crisis under analysis. We are able then to build, for each firm in the sample, a measure of the *average leverage* of its bank debt. We then regress the amount of investment on these measure of leverage of creditors and find a negative association between these variables. This is another important finding of the paper, in the sense that it provides evidence that illustrates the channels through which financial shocks spill over to the real economy.

The remainder of the paper is organized as follows. The next section provides a brief description of macroeconomic development in Chile during the 1999 and 2009 recessions. Next, in section 2, we look at the performance of commercial banks operating in Chile in both recessions, using both aggregate and balance sheet data. In section 3 we study the evolution of banks' leverage, its behavior around crises and its effects on banks' post-crises lending. After that we turn to the dynamics of the corporate sector in section 4. Section 5 concludes.

1. MACROECONOMIC DEVELOPMENTS IN CHILE DURING 1999 AND 2009

The Chilean economy has experienced two recessions in the last 10 years. The first of these took place in 1999, when the economy fell 0.8%; while during the second one in 2009, total output decreased by 1.7%. Both of these events were associated with disruptions of different intensity in international markets. In this section we will provide a brief overview of the macroeconomic development in each event and the associated policy response.¹

1. Along with the cited references, this section draws also from De Gregorio (2008, 2009).

The Asian Crisis that started unfolding in 1997 affected Chile's economy through several channels. As Caballero (2002) and Céspedes and others (2006) document, the reduction in foreign financing through lower capital inflows was a clear manifestation of the crisis. The decrease in the volume of capital flows to Chile was also accompanied by increases in both sovereign and corporate premiums. Taken together, this suggests that a negative shock to the supply of foreign funds was the main culprit for the decrease in capital inflows. Foreign income of the country also decreased as its terms of trade declined, led by the decrease in the price of copper, its main export.

On the domestic front the onset of the Asian Crisis found Chile at the peak of an expansionary cycle. Domestic demand had grown at a faster rate than GDP since 1995 and the Central Bank expected the current account deficit to reach 8% of GDP in 1998. The rapid increase in aggregate expenditure constituted a serious threat for the fulfillment of the inflationary target for 1998. The decrease in international financing, plus the anticipated real exchange rate adjustment needed to bring the current account to a more sustainable path, triggered expectations of nominal depreciation. Although the exchange rate band in place at the time would have accommodated a sizable nominal depreciation, the authorities were concerned that the depreciation of the currency would feed into domestic inflation. Faced with this policy dilemma and witnessing several speculative attacks on the Chilean peso during 1998, the Central Bank opted for non-sterilized interventions in the foreign exchange markets and several hikes of the monetary policy rate. The non-sterilized interventions proved to be particularly disruptive for the interbank market. As liquidity was drained, the interbank rate reached, on some days, levels of 60% in real terms (annual equivalent). This implied a complete halt of banking operations, as that rate was indeed higher than the maximum allowed by Chilean law in any credit operation.

Towards the end of June of 1998 the pressures on the currency intensified again, and the Central Bank responded with significant policy changes: the exchange rate band was considerably narrowed in an effort to contain the nominal depreciation, and the controls on capital inflows were loosened. Again the overnight interbank rate reached levels that were beyond the maximums allowed by law, dealing a significant blow to credit markets. This noticeable level of disarray in domestic financial markets that occurred in June of 1998, leads us to set the second quarter of 1998 as the initial date of the economic crises that would lead to the recession in 1999. The

tightening of monetary policy continued over the course of 1998: in September, the monetary policy rate was increased to 14% in real terms, capital controls were completely eliminated, and new adjustments to the exchange rate band were made.

In contrast to the events observed 10 years earlier, the financial crisis that began in 2007 was initiated in advanced markets. As before, the financial channel also proved to be one of the main transmission mechanisms of the foreign shock. This was seen in the steady increase of the borrowing costs for domestic banks (García, 2009) since September of 2007 that would peak with the collapse of Lehman Brothers a year later.

At the onset of this crisis, Chile's economy was weathering the impact of the significant increase in the commodity prices that the world had experienced in previous years. As financial tensions in advanced markets gained momentum, inflation in Chile rose steadily and this prompted the Central Bank to implement a series of hikes in its policy rate. As a result of these developments, at the collapse of Lehman Brothers, the monetary policy rate in Chile was at its all time high since it was set in nominal terms, and year to year inflation was more than three times higher than the Central Bank's target. Given this conjunction of events and the intensity of the disruption observed in international financial markets in the weeks following the bankruptcy of Lehman Brothers, prompts us to set the third quarter of 2008 as the starting point of the 2008-2009 crisis.

The initial response of the Central Bank was to put several actions in place, aimed at increasing short-term liquidity in dollars and pesos. The monetary policy rate was held constant through the last quarter of 2008. As the scenario of a rapid and deep deterioration of the world economic outlook become more plausible, private agents adjusted their expectations of inflation and growth downwards quickly. The Central Bank followed this revision of expectations with massive cuts of 600 basis points of its policy rate in January and February of 2009. The reaction of the monetary authority in 2009 presents a stark contrast with the one observed 10 years earlier.

The different response of the Central Bank to an adverse shock can be framed within significant changes to the policy environment that took place after 1999. First, a fully fledged inflation targeting regime was adopted. The inflation target became the economy's nominal anchor, and the exchange rate band that prevailed in 1999 was formally abandoned. Along with this, the Central Bank took several steps to increase its transparency and communication

with markets. Another important change was the removal of all the restrictions to transactions in the capital (financial) account which was accompanied by a significant increase in the depth of foreign exchange forward markets. A final important element that was significantly different in 2009, was the perceived coefficient of pass-through from nominal exchange rate depreciation, to domestic inflation. At the time of the Asian Crisis, this coefficient was estimated to be between 50% and 70%. This element was a key consideration in the decision to opt for interventions in the foreign exchange market and increases in the domestic interest rate (Céspedes and others, 2006). In contrast, the consensus at the onset of the *Great Recession*, was that the pass-through coefficient was significantly lower—in the neighborhood of 30% (De Gregorio and Tokman, 2004). Taken together, all these elements indicate that the Central Bank of Chile enjoyed a much higher degree of monetary independence in 2009, and could implement the aggressive monetary expansion observed from the beginning of that year.

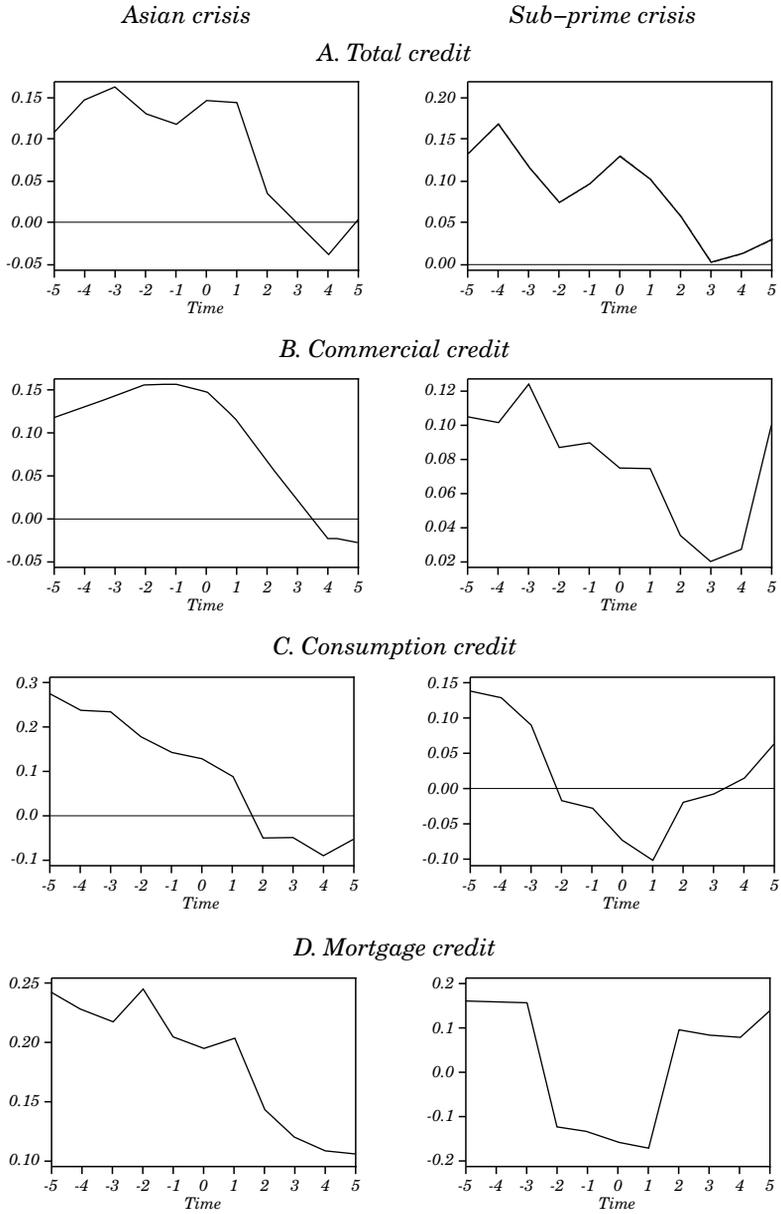
Isolating the effects of the monetary policy followed in both events, from the ones derived from the crises itself, is a difficult task that we do not pursue here. However, in the following sections we will relate some of our findings to the policy environment, but recognizing that we are not able to take definitive conclusions from our exercises in this respect.

2. CHILE'S BANKING SECTOR DURING THE 1999 AND 2009 RECESSION

In this section we describe the behavior of banks in reaction to the crises that hit the Chilean economy in 1998 and 2008. We focus the analysis on banks' lending evolution, their leverage, and on the interaction between these variables looking at event studies and regression analysis. In the event studies the "0" in the figures corresponds to the quarter when the crises were identified that correspond to the second quarter in 1998 and the third quarter in 2008. The axis measures the quarters from these. All the data we use in this section comes from publicly available information from all the commercial banks operating in Chile from 1989 to 2010.

As can be seen in figure 1, the yearly growth rate of total credit diminished in both crises; although, it did so more pronouncedly in the Asian crisis reaching negative growth rates. The graph also

Figure 1. Credit Growth
Yearly growth



Source: Authors' elaboration.

shows that the recovery began one quarter earlier after the crisis in 2008, than in 1998. The deceleration in credit growth began before the identification of the crisis in 2008, a phenomenon that looks less evident in the 1998 crisis. Looking at the decomposition of credit growth we can see that commercial loans, consumption and mortgages did not show the same patterns. In the Asian crisis, the reduction in commercial loans' growth began before consumption loans. In the Sub-prime crisis, the anticipation of commercial and consumption credit growths is more difficult to distinguish.

The quicker recovery in total credit in the 2008 crisis may have been the consequence of the more expansive policies adhered to in this opportunity.

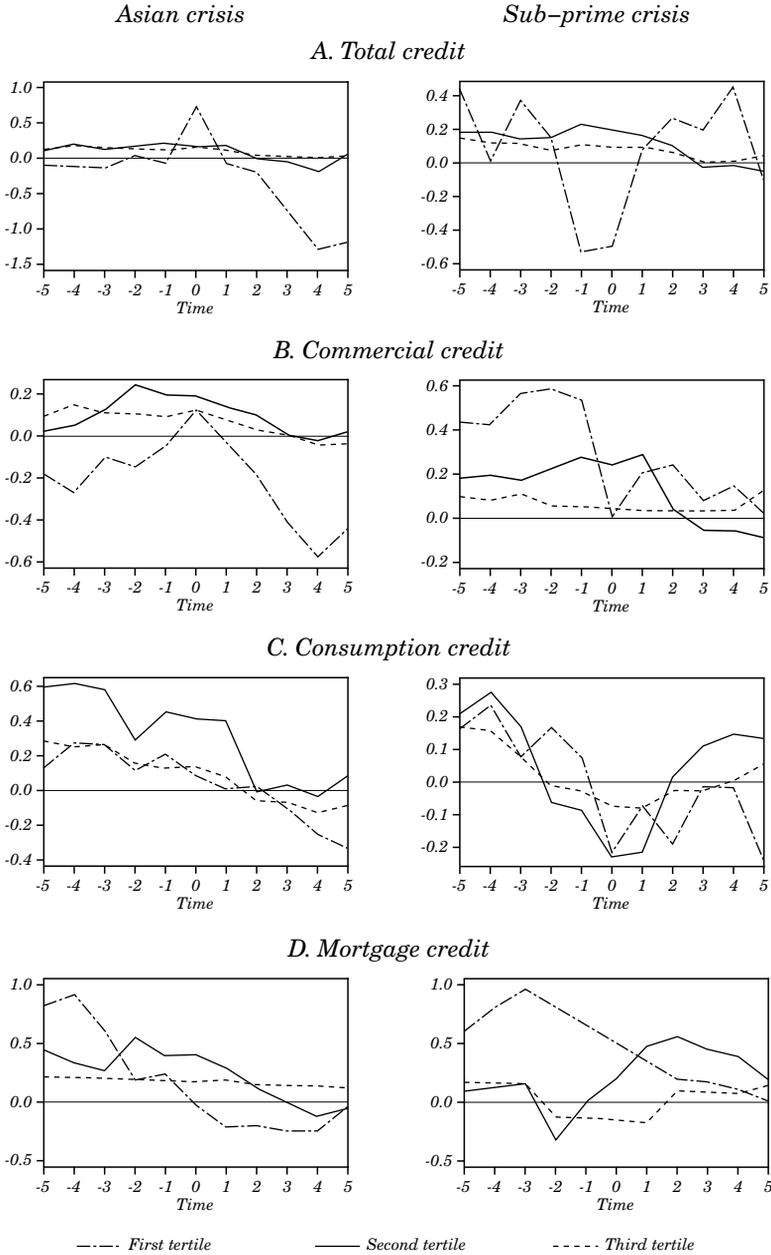
Next we turn to the evolution of the same variables as in the previous paragraph, but considering heterogeneity between banks.

Figure 2 presents the same information as previous graphs, but classifying banks by size. To do this, we divide banks into three sets according to the size of their total assets. In general, the graphs suggest that banks in the highest tier show less relative variation than banks in the other two groups. The comparison between the middle and lowest group is more ambiguous. It depends on the type of credit, and whether the crisis is the Asian, or the Sub-prime.

Credit behavior according to nationality is shown in figure 3. In general foreign-banks' credit growth rate has been below the one corresponding to Chilean banks. Comparing total credit growth, the behavior in both categories was more similar in the 2008 crisis than in the 1998, where the decline of the credit growth rate was higher for foreign banks.

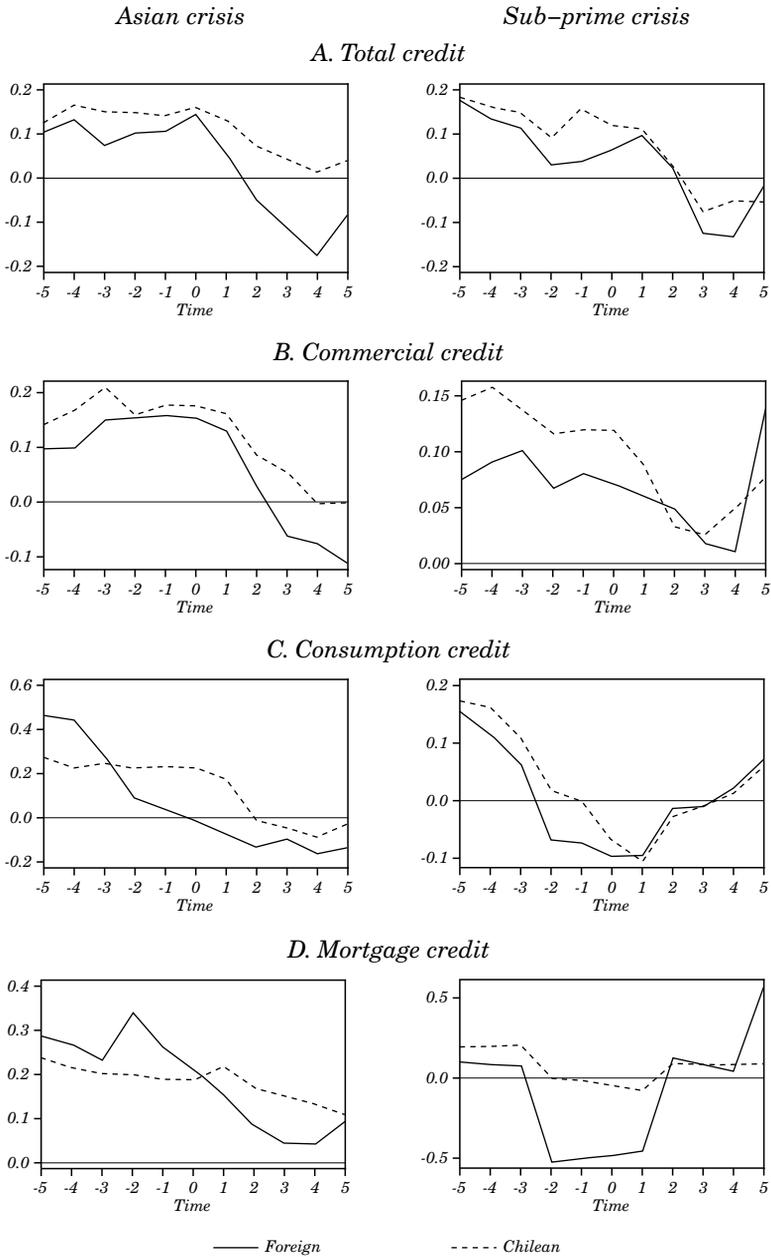
Looking at the short-term deposits that banks hold abroad (in figure 4) it can be seen that in 1998 there was a significant increase in these deposits, two quarters after the crisis was identified. In the 2008 crisis the effect exists especially for Chilean banks, but in a lower magnitude. Liquidity in a crisis becomes especially valuable. In monetary policy expansive phases, Central Banks provide liquidity to the system. A risk is that banks hold this liquidity instead of injecting it into the system. This may be particularly undesirable if banks translate liquidity abroad in middle of a crisis. As explained in section 1, monetary policy responses were different in both crises. While in 1998 the Central Bank raised interest rates before and after the crisis hit, that is a contractionary monetary policy (for example, Céspedes and others, 2006), in the Sub-prime crisis the Central Bank implemented an expansionary policy that included unconventional

Figure 2. Credit Growth by Size
Yearly growth



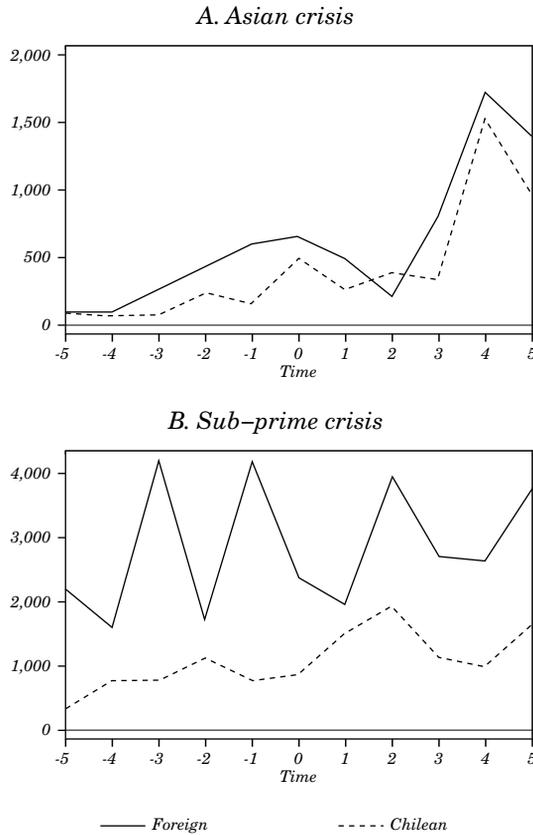
Source: Authors' elaboration.

Figure 3. Credit Growth by Nationality
Yearly growth



Source: Authors' elaboration.

Figure 4. Short-Term Deposits Abroad
Millions of US dollars



Source: Authors' elaboration.

liquidity provision. Thus, these graphs suggest that the increase in the deposits abroad in 1998 was not done with liquidity provided by the Central Bank. In 2008, however, the increase in deposits abroad may have been financed in part by the expansionary monetary policy. Along with this, given the significant distress in international financial markets that was observed in 2008, especially the perceived increase in counterparty risk after Lehman's collapse, it is possible that domestic banks felt reluctant to increase the share of foreign deposits in their portfolios.

3. EVOLUTION AND EFFECTS OF BANKS' LEVERAGE

In this section we study the evolution of banks' leverage, its behavior around crises and its effects on banks' post-crisis lending.

First, we start with an overview of the related literature.

Crisis in developing countries have usually been preceded with periods of capital inflows and credit expansion (Reinhart and Rogoff, 2008, 2009). Recently, some works have focused on risk-taking of financial intermediaries during periods of high liquidity, which may result in being the seed of the next crisis. Acharya and Naqvi (2011) showed that when financial intermediaries are awash of liquidity they are more prone to excessive risk-taking behavior derived from moral hazard issues, which end up in an asset bubble. Adrian and Shin (2010b) highlight a connection between liquidity and risk-taking actions derived from an active management of the balance sheet expansions, inherent to financial intermediation activities, and not from agency problems. In periods of low short-term interest rates (high liquidity) the term spread, which determines the profitability of the marginal loan added to the balance sheet, increases. This boosts the future value of capital of financial intermediaries. This, in turn, triggers new lending, given the higher risk-bearing from the banks. Adrian and Shin (2010b) analysis is motivated by the transmission channel of monetary policy, but the reasoning could be applied to periods of high liquidity in general.

Some recent works present evidence on the relationship between credit behavior, financial intermediaries' leverage, business cycles and crises. For example, in a recent contribution, Schularick and Taylor (2012) use historical data from 1870 to 2008 for fourteen developed countries. They note that banks' balance sheets have become bigger and riskier over time and that banks' leverage increased notably in the period after World War II. They find support to the view that the financial system itself creates instability through endogenous lending booms and an increase in banks' leverage. This is especially the case in post-war crises. Thus their evidence supports other works' hypotheses that crises are "credit booms that went wrong" (for example, Reinhart and Rogoff, 2008, 2009).

In a related work Jordà, Schularick, and Taylor (2011) find that the effects of leverage are particularly pronounced when the recession coincides with a financial crisis, but that there are similar effects in normal recessions. The aftermath of leveraged booms is associated with somewhat slower growth, investment spending, and credit

growth than usual. They also show that the economic costs of crises depend on the run-up in leverage during the preceding boom, and that the increase in leverage during the boom heightens the vulnerability of the economies to shocks. The preceding discussion suggests that leverage is important for macroeconomic *instability*. There seems to be a leverage build-up before crises and a deleveraging after them. Schularick and Taylor (2012) noted that this deleveraging is lower after the post-war crises. This deleveraging process is likely to be costly, and an amplifier of the original shock.

Given the connection between boom and bust cycles, liquidity and financial intermediates behavior, and given the important role that banks play in the intermediation of credit in economies like Chile: studying the strength of their balance sheets during boom and bust periods is an important issue.

The evidence for the Chilean economy indicates that banks' leverage is procyclical. Thus, leverage would act as an amplifier for the shocks that hit the economy (see, for example, Adrian and Shin, 2010a).² The initial reduction in the value of the assets caused by the shock would be amplified as banks reduce debt and sell securities in order to reduce their leverage. An active management of leverage would affect the transmission of shocks to the economy.

Figure 5 presents raw data showing the relationship between quarterly increases in banks' total assets and the quarterly increase in leverage, which is defined, from here on, as the ratio of total assets to net worth. As can be seen, there is a positive correlation between these two variables for the whole period 1990 to 2010, and for the years where the crises were present.

Figure 6 shows that there is a deleveraging process in the quarters following the crises. In the case of the Asian crisis, one quarter before the quarter identified as the crisis, the average leverage for the system was 13.6 percentage points while two quarters later, this magnitude decreased to approximately 12.5 percent.

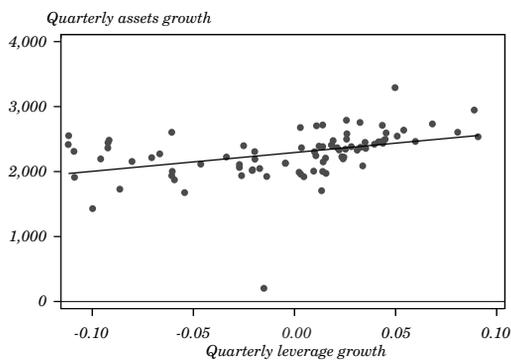
The middle panel in figure 6 presents the evolution of average leverage, dividing the sample by size, with the same criteria as before.³ In both cases, bigger banks show less proportional

2. Adrian and Shin (2010a) show evidence that leverage procyclicality is present in investment banks and security dealers in the US but not in US banks whose leverage is acyclical.

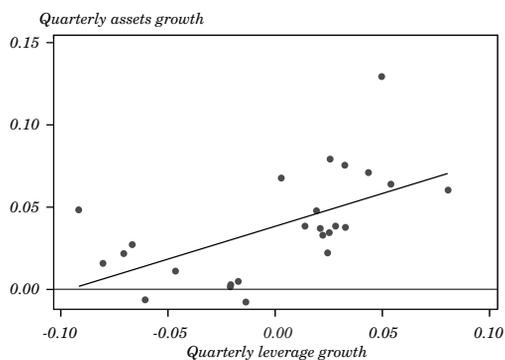
3. We normalize the value of leverage at 100, five quarters before the crisis for the three categories.

Figure 5. Leverage Procyclicality

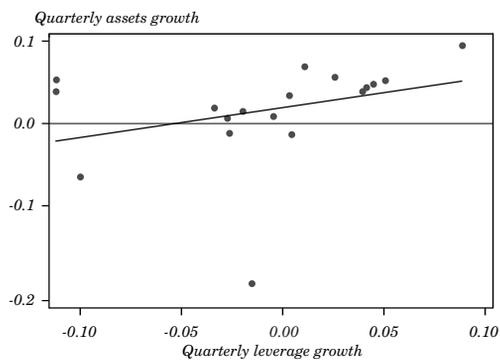
A. All sample



B. Asian crisis



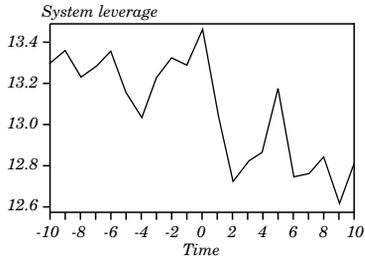
C. Sub-prime crisis



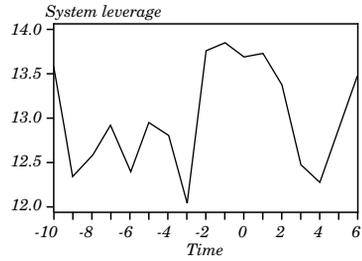
Source: Authors' elaboration.

Figure 6. System Leverage, Leverage by Size and Leverage by Nationality

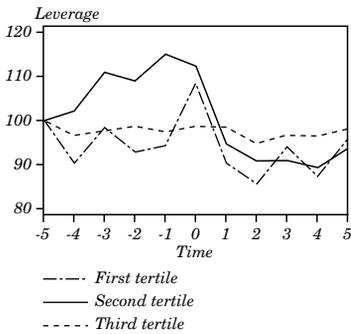
A. Asian crisis



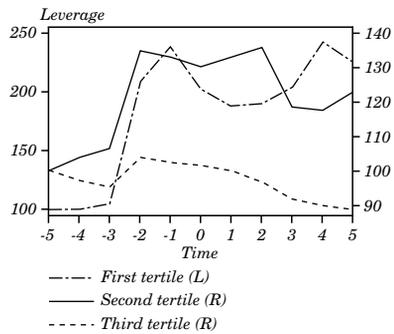
B. Sub-prime crisis



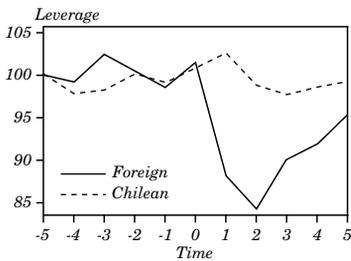
C. Asian crisis (1997.I=100)



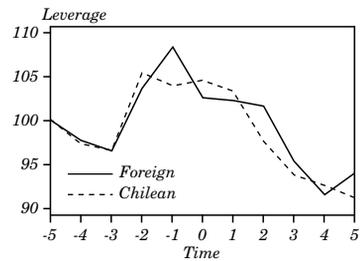
C. Sub-prime crisis (2007.II=100)



D. Asian crisis (1997.I=100)



E. Sub-prime crisis (2007.II=100)



Source: Authors' elaboration.

Table 1. Procyclicality of Leverage, Regression 1

Dependent variable: Quarterly leverage growth

	<i>All sample</i>	<i>1997.I- 1999.III</i>	<i>2007.II- 2009.IV</i>
Quarterly assets growth	0.277*** (0.010)	0.904*** (0.030)	0.107*** (0.021)
Fusion dummy	-0.041* (0.021)	-0.117*** (0.034)	-0.029 (0.173)
Constant	0.003 (0.003)	-0.016*** (0.006)	0.035** (0.018)
No. of observations	2,566	337	280
R ²	0.229	0.744	0.094
No. of banks	45	31	27

Source: Authors' elaboration.
Standard errors in parentheses.
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

variation than the other two groups. In Chile, bigger banks present higher levels of leverage. The average level of leverage is 14.5 percentage points for the highest tier, 10.3 for the middle one, and 5 for the smallest one. Thus, these differences in the magnitude of proportional variation would be due to differences in levels to begin with. Bigger banks have higher levels of leverage and lower percentage variation.

Looking at the evolution of leverage around crisis, in the last row of figure 6, we can see that in 1998 most variation came from foreign banks, while in 2008 the evolution of foreign and Chilean banks was much more similar than in the previous case.

We next turn to the panel-regression analysis to see procyclicality of leverage and the effects of leverage on bank lending. Our database consists of balance sheet information at an individual bank level for the period from 1989 to 2010. The number of banks varies in the sample as, although some have disappeared, new ones are created and there are some acquisitions. The average number of banks is 31; the highest number is 39, in 1989; and the lowest is 25, in 2010.

In table 1 we present the regression using the increase in leverage as the left-hand side variable and the increase in total assets in the right-hand side; this is following Adrian and Shin

(2010a).⁴ In the first column we report the results for the whole sample, while in the second and third columns we report the results for the Asian and Sub-prime crises. As suggested by the graphs discussed above: leverage is procyclical. An increase of one percentage point in total assets translates into an increase of twenty seven percentage points in leverage. The magnitude is economically significant; an increase of one standard deviation in total assets, which is thirty six percentage points, translates into an increase of leverage of ten percentage points. A relevant effect given that the mean of the increase in leverage is one percentage point, and the standard deviation, eighteen percent.

Although the sign is the same for both crises, the magnitude is different. A shock of one standard deviation in both sub-samples translates into an increase of sixteen percentage points in the Asian crisis, and ten percentage points in the Sub-prime crisis. These magnitudes are close to the standard deviations in both cases.

The findings in the previous paragraph indicates that, in the last crisis, the process of leverage reduction, after it, was slower than after the previous one. This also could have been a consequence of the expansive monetary policy that was followed. By having access to cheaper funds, banks have less incentives to reduce their leverage, using same reasoning as Adrian and Shin (2010b), mentioned above.

Table 2 presents results discriminating by size, using the same classification as above. We estimate the regression using an interaction term between the increase in total assets, and the variable indicating the tier to which a bank belongs. This variable can take the value of *one*, if the bank belongs to the smallest group; a value of *two*, if it is in the middle group; or *three*, if it is in the group with highest assets.

The results suggest that size matters. However, the effects obtained for both crises differ. For the whole sample, and in the case of the Sub-prime crisis, the results indicate that the bigger a bank is—in terms of total assets—the higher is its procyclicality. However the opposite is true in the case of the Asian crisis. For the Sub-prime crisis, the effective coefficient indicates that an increase

4. Throughout the regressions we use a dummy variable indicating whether a bank was involved in a merge or acquisition since in these periods there would be a discrete jump in assets.

Table 2. Procyclicality of Leverage, Regression 2
Dependent variable: Quarterly leverage growth

	<i>All sample</i>	<i>1997.I-1999.III</i>	<i>2007.II-2009.IV</i>
Quarterly assets growth	-0.368*** (0.025)	1.321*** (0.085)	-0.817*** (0.045)
Fusion dummy	-0.077*** (0.019)	-0.098*** (0.033)	-0.083 (0.103)
Bank size	-0.019** (0.008)	0.052* (0.028)	0.058 (0.081)
Bank size change	0.526*** (0.019)	-0.259*** (0.049)	0.836*** (0.039)
Constant	0.028* (0.016)	-0.117** (0.057)	-0.143 (0.181)
No. of observations	2.566	337	280
R ²	0.407	0.767	0.683
No. of banks	45	31	27

Source: Authors' elaboration.
Standard errors in parentheses.
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

Table 3. Procyclicality of Leverage, Regression 3
Dependent variable: Quarterly leverage growth

	<i>All sample</i>	<i>1997.I-1999.III</i>	<i>2007.II-2009.IV</i>
Quarterly assets growth	0.229*** (0.009)	0.894*** (0.029)	0.075*** (0.018)
Fusion	-0.040* (0.021)	-0.120*** (0.029)	-0.065 (0.130)
Nationality dummy	0.007 (0.008)	-0.012 (0.012)	-0.020 (0.035)
Bank size	-0.002 (0.005)	-0.005 (0.007)	-0.004 (0.022)
Constant	0.006 (0.009)	0.000 (0.014)	0.060 (0.054)
No. of observations	2,566	337	280
R ²	0.407	0.767	0.683
No. of banks	45	31	27

Source: Authors' elaboration.
Standard errors in parentheses.
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

of one standard deviation, in total assets, increases leverage by almost 5% if the bank is in the smallest group, by 82% if it is in the middle group, and 160% in the highest. In the Asian crisis these magnitudes are 190%, 140% and 97% respectively.

Table 3 includes, in the regression, a dummy variable that takes the value of *one* if the bank is Chilean and *zero* otherwise. This dummy does not yield any significant effect in procyclicality. Thus, we are not able to find a relationship between increases in assets and leverage, although, we have seen graphically that the level of leverage varies differently, according to nationality, around crises.

We turn next to the effects that leverage has on bank lending. This is important because the relevance of studying leverage relies on the effect that this variable has on the economy, and bank lending is at the heart of the effects that banks may have in real variables.

In the following regressions, we use the annual growth of credit as the dependent variable and the leverage level, in the quarter before a crisis hit the economy.

In column 1 of table 4, we estimate the regression for the whole sample; in column 2 and column 3, for the quarters immediately before and after the Asian crisis; and in column 4 and 5, we run the same exercise but for the Sub-prime crisis. We can see that for the whole sample there is no significant effect of leverage on lending. However, around crises, conclusions change. For both crises we find that the higher the level of leverage that a bank brings to a crisis, the larger the reduction on its lending; this can be inferred from columns 2 and 4. The effect disappears in the regressions following the crisis (columns 3 and 5).

Above we have seen that, on average, banks reduce their leverage after a crisis. The results of this regression complement that finding; banks would be reducing their lending, in order to strengthen the *liability side* of the balance sheet, by reducing their leverage.

Also, as shown above, banks' leverage reduction was lower in the Sub-prime crisis, but the negative effect of leverage on credit growth was lower in this crisis. Both results together imply that, for some reason, leverage was less harmful in the last episode and, thus, banks needed a lower reduction in leverage.

Table 4. Procyclicality of Leverage, Regression 4
 Dependent variable: Total credit growth (yearly)

	<i>All sample</i>	<i>1998.I-1998.II</i>	<i>1998.III-1998.IV</i>	<i>2008.I-2008.II</i>	<i>2008.III-2008.IV</i>
Leverage _{<i>t</i>-1}	-0.012 (0.034)	-1.014* (0.584)	0.004 (0.319)	-0.423*** (0.144)	0.003 (0.537)
Fusion dummy	0.135** (0.060)	-0.027 (0.407)			
Bank size	-0.005 (0.027)	1.189*** (0.306)	-0.072 (0.311)		0.081 (0.341)
Constant	0.112 (0.087)	-0.252 (1.544)	0.083 (1.123)	0.933*** (0.300)	-0.119 (1.306)
No. of observations	2,383	62	61	46	46
R ²	0.002	0.478	0.003	0.282	0.003
No. of banks	43	31	31	23	23

Source: Authors' elaboration.
 Standard errors in parentheses.
 *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

4. FINANCIAL FRICTIONS AND FIRM PERFORMANCE

In this section we examine the extent to which financial frictions might have had an impact on the performance of Chilean firms in the aftermath of the financial shocks, which ultimately led to the recessions of 1999 and 2009. To do this we will use firm level data for a sample of Chilean firms. This database contains detailed information on the firms' financial statements. With that information we are able to test specific mechanisms through which financial conditions may affect the performance of the economy during a recession. Our evidence suggests that after a period of financial distress, maturity mismatches constitute a drag on investment. We also find evidence that relates the financial health of the banks that lend to each corporation, with the intensity of the effect of maturity mismatches on firms' investment.

The source of our data is the *Ficha Estadística Codificada Uniforme* (FECU) that a subsample of Chilean corporations must submit to the *Superintendencia de Valores y Seguros* (SVS), the government agency in charge of overseeing the domestic financial market. Only firms in Chile, issuing stocks and debt instruments in open markets, are required to submit FECU. In practice this means that the firms in our sample are, in all likelihood, the ones with more ample financial access. This is a desirable characteristic for our research purposes since we aim to study the behavior of firms after a financial shock, focusing on the potential changes to its access to external financing. Nevertheless, our sample does not include the smallest firms in the economy, which should be considered when interpreting our results.

We begin our analysis of the effects of financial disruption on firms performance, looking at the impact of maturity mismatches on investment. This has been one channel previously explored in the literature to try explaining the fall in real outcomes after financial shocks. The mechanism to be explored states that firms with a greater gap, between their short-term liabilities and assets, will experience a larger contraction of investment in the aftermath of a decrease in the aggregate supply of financing. In a scenario where payments due, in the short term, exceed the amount of liquid assets of the firm, and new financing is not available, firms will be forced to scale back their purchases of fixed capital.

To test this mechanism we ran the following cross section regressions for each year's recession, 1999 and 2009:

$$Investment_i = \beta \times \left(\frac{Short-term Liabilities - Short-term Assets}{Total Assets} \right)_i + \varepsilon_i \quad (1)$$

The dependent variable is the amount of investment reported by firm i in a recession year. It is calculated as the annual change in the stock of fixed capital normalized by initial total assets of the firm. The right-hand side variable is the measure of maturity mismatch commonly used in the literature, and it is measured in the year before the crisis. To save on notation, the short-term mismatch that appears in parenthesis in the right hand side of (1), will be denoted by ST . ε_i is a random error.

We acknowledge that investment has many other determinants that do not appear in equation (1). Yet, in this study we are interested in testing whether financial characteristics of firms affect investment in periods of economic distress. To correctly identify this effect it needs to be the case that the other determinants of investment are uncorrelated with our measure of maturity mismatch. This assumption of no correlation is likely to hold in practice, since in traditional models of investment, financial variables play no role at all. Moreover, it is important to remember that in equation (1) the variable ST is measured the year *before* the recession, so problems of reverse causality are unlikely to bias the estimation of β .⁵

The results of the estimation of (1), for years 1999 and 2009, are presented in table 5. As can be seen in columns (a) and (c) the coefficient associated with the maturity mismatch variable enters with a negative, and significant, sign. This suggests that financial frictions in the balance sheet of firms contributed to the decrease in investment observed in each of the recessions. To provide further support to our identification strategy, we estimate regression (1) the years before and after each recession, which is in the spirit of a falsification strategy: if the mechanism we are trying to identify is relevant only in recessions, then the estimated β in non crisis years should be not statistically significant. The results show that this is precisely the case, which lends additional support to the importance of maturity mismatches. Our findings contradict the results of Bleakley and Cowan (2010) that support the view that maturity mismatches are irrelevant for investment during episodes

5. This identification strategy for β is essentially the same argument given by Bleakley and Cowan (2010) to estimate.

Table 5. Maturity Mismatches and Firm Level Investment
Dependent variable: Investment

	1999		2009	
Maturity mismatch (ST)	-0.164*	0.371	-0.137*	0.36
	(0.10)	(0.24)	(0.08)	(0.31)
Bank leverage		-0.0397**		-0.026*
		(0.0171)		(0.016)
ST × Bank leverage		0.159		0.086
		0.111		0.122
Constant	0.0283*	0.0931**	0.0224*	0.086**
	(0.016)	(0.036)	(0.012)	(0.040)
No. of observations	155	104	187	187
R ²	0.017	0.053	0.015	0.035

Source: Authors' elaboration.

Standard errors in parentheses.

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

of contractions in the foreign supply of credit. One possible way to reconcile both results, is to consider that our sample is broader than the one in Bleakley and Cowan (2010).⁶

Our next exercise takes advantage of the great level of detail of the information in the FECU database for exploring the link between the financial conditions of banks and the performance of its debtors. Specifically, firms are required to inform the amount of debt and currency that they owe to each bank. We use this information to build a measure of the average leverage of the banks that have extended loans to each firm. For this, first we compute α_j which corresponds to the share of bank's j in firm's i total short-term debt with all banking institutions. Next, from the banks balance sheet (the same data that we described earlier) we compute the leverage measure L_j . With these two pieces of information we can therefore build l_{ij} which is a weighted average of the firm's creditors' leverage:

$$l_{ij} = \sum_j \alpha_j \cdot L_j, \quad (2)$$

6. Our sample consists of 155 and 187 for 1999 and 2009 respectively. Bleakley and Cowan (2010) include approximately 100 firms and all of them are listed in the stock market so they are probably the ones with best access to alternative (that is, other than banks) sources of funding.

which we use to extend our regression (1) in the following way:

$$Investment_i = \beta \cdot ST_i + \phi ST_i \cdot l_{ij} + \gamma \cdot l_{ij} + \varepsilon_i. \quad (3)$$

We estimate equation 3, for each of the recession years. Our results reported in table 5 tend to support the view that the financial health of banks does affect the performance of the firms they have lent money to, in a way that tends to amplify the financial shocks in the banking sector. For both episodes we observe that the average leverage of the banks that have provided short-term funding, has a negative impact on firms' investment; and the magnitude of these effects is similar in both events. As was described in section 2, banks with higher leverage are the ones that exhibit the larger drops in lending activity during periods of economic distress. Therefore one would expect that firms that have contracted debt with more leveraged institutions, will exhibit larger declines in investment, which is precisely what we find. Following this same reasoning, one would expect that the interaction term would also show up with a negative coefficient in the regressions. This result is only obtained for the 1999 episode, although the statistical significance is not high (p -value is 0.15).

To summarize, there appears to be evidence that links characteristics of financial institutions to its creditors during times of economic turbulence. This suggests that the identity of creditor institutions, and their leverage levels, should be of interest to policy makers since it may shed light on the expected behavior of the corporate sector when banks undergo difficulties.

5. CONCLUSIONS

In this paper we present micro-evidence on Chilean banks' and firms' behavior around the Asian and Sub-prime crises. We find that, in Chile, banks' leverage is procyclical which may be a shock amplifier. The evidence shows that banks that had a higher leverage level at crises time, were the ones that reduced their credits more, after the crises. Banks' leverage procyclicality was lower in the Sub-prime crisis than in the Asian crisis, as was the sensibility of credits. Consequently, the evidence suggests that in the last crisis, banks reduced their leverage less, but this behavior did not reduce credits in the same magnitude, as would have been the case if the

credit elasticity to changes in leverage were as high as the one in the Asian crisis.

Using information in firms' financial statements, we were able to know which banks lend to them. The evidence shows that firms that borrow from more leveraged banks are the ones that reduce their investment more after a crisis. This is in accordance with the discussion about the relationship between banks' leverage, and credit activity in crisis, presented in the paper. The higher a bank's leverage the higher the reduction in its credits. Thus, firms having relationships with banks having high leverage would find their supply of credit reduced, and this is likely to affect their investment.

We also find that firms' maturity mismatch affects their investment, and the magnitude of this effect was very similar in both crises.

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