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Monetary Policy and the Banking Sector in Chile

Abstract: *This paper considers the existence of a bank lending channel in Chile. Toward that, we collect a data sample of nineteen banks that operated in Chile over January 1999–December 2002. In that period, banks primarily offered loans to firms in the manufacturing and the financial-services sectors (representing 13 and 26 percent of total loans, respectively), and to households through consumption and mortgage loans (at 9 and 10 percent of total loans, respectively). Our estimation results support the existence of a bank lending channel. We find that banks respond asymmetrically to monetary shocks depending upon their own characteristics, and that monetary shocks alter loan portfolio decisions in the aggregate.*

Key words: *bank lending channel, dynamic panel.*

There is no consensus among economists about how monetary policy operates. The traditional money channel (or interest rate channel) states that when a central bank reduces its reserves, commercial banks will be forced to reduce their demand for deposits due to the higher costs of funds. If prices are sticky, a decrease in real monetary holdings should lead to higher real interest rates in the short run. This provokes a contraction of the interest-sensitive components of aggregate spending (e.g., consumption and investment) and, therefore, lowers economic growth.

Empirically, however, the macroeconomic effect of monetary policy is larger than that implied by the interest rate elasticities of aggregate spending. Therefore, additional mechanisms of transmission other than the interest rate channel should be at work. A relatively new strand of the literature states that one such mechanism is the broad credit channel. According to this theory, the direct effect of monetary policy on interest rates is amplified by an increase in the external finance

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premium—that is, the spread between external funds (bonds, loans, and equity) and internal funds (retained earnings).

As risk increases over a recession, and as information asymmetries sharpen, the size of the external finance premium increases and amplifies the effect of tight monetary policy on aggregate spending and the real economy. Small firms, for instance, are probably in greater need of bank loans. And, if they do not rely on alternative funding sources, they might be forced to reduce their investment and, possibly, their production when facing higher interest rates. Bernanke and Gertler (1995) suggest the existence of two channels by which monetary policy affects the external finance premium: the balance-sheet channel, or net worth channel; and the narrow credit channel, or bank lending channel.

The balance-sheet channel states that changes in monetary policy affect borrowers' balance sheets and income statements, including their net worth, cash flows, and liquid assets. Due to asymmetric information, borrowers' reduced net worth will translate into an upward shift of the bank loan supply. Intuitively, a stronger financial position makes it possible to reduce conflicts of interest between borrowers and lenders by borrowers financing a share of their investment or by offering more collateral. Therefore, fluctuations in borrowers' net worth will affect their investment and spending decisions.

There is a rich body of literature about how procyclical fluctuations in firms' net worth might amplify and propagate economic cycles. This phenomenon is known as the financial accelerator. For instance, some studies link balance sheets and cash flows to investment on fixed capital and inventory among firms, and between net worth and durable goods and housing spending among consumers (e.g., Bernanke et al. 1996).

The bank lending channel, in turn, states that tight monetary policy may increase the external finance premium by shifting the supply of intermediated credit. Given that banks rely on demand deposits as an important source of funds, a contractionary money shock will reduce bank reserves and, therefore, the availability of bank loans. This channel is far more controversial than the balance-sheet channel. In the first place, it is not evident that monetary policy affects the loans supply. Bernanke and Blinder (1988) state that the U.S. Federal Reserve's open market operations reduce the reserves of the financial system and, consequently, bank deposits. This translates into an upward shift of the loan supply. However, a key assumption for this result is that banks cannot offset reduced deposits with other sources of funds, such as certificates of deposit and new stock issues.[1]

Romer and Romer (1990) conclude that the empirical evidence supports the classical approach of the money channel over the narrow credit channel. First, the authors state that reserve requirements on certificates of deposit are low. Banks can therefore obtain funds with little cost in terms of reserve holdings, and they can maintain their ability to lend. However, reserve requirements on transaction balances are much higher. Thus, the impact of tight monetary policy on interest rates is most likely to operate through bank liabilities.

A later work by Bernanke and Blinder (1992) finds that shocks in monetary policy affect bank portfolios systematically, which is not in accordance with the monetary channel.[2] Specifically, loans respond slowly to a restrictive monetary policy, but eventually, they fluctuate considerably as the unemployment rate rises. Even though tighter credit could be a response to a slowdown in economic activity, Bernanke and Blinder believe that this is primarily due to a loan supply reduction.

It is not a simple task to disentangle whether consumers and firms are more affected by a slowdown in economic activity and a subsequent reduction in credit demand or by a reduction in the loan supply as predicted by the narrow credit channel. In order to solve this identification problem, Kashyap et al. (1993) show that firms issue more commercial paper in response to a contractionary monetary shock. Firms thus resort to a substitute of bank credit because the loan supply falls, not because their loan demand is reduced by an economic slowdown.

Unfortunately, small firms do not issue commercial paper. Nilsen (2002) uses trade credit (TC) as an alternative measure of a bank credit substitute, which is also available to smaller firms. TC is a short-term loan a supplier provides to a customer in conjunction with sales. The history of the supplier's relationship with the customer is critical to this decision. The customer thus extended credit either repays or delays when repayment is due. The first decision involves the transactions motive of TC; that is, the supplier provides a credit to the customer, thus reducing the use of cash. The second decision involves the finance motive; that is, firms that rely on fewer alternatives sources of funding are more likely to postpone repayment when they lack funds. In this case, TC turns from a substitute for cash into a substitute for loans.

Nilsen points out that, in general, firms should not resort to the finance motive as a substitute for bank loans. However, if bank loans fall in response to tight monetary policy, those firms that depend heavily upon them might be forced to use TC as a funding source. Given that the terms of TC are relatively constant over time, TC should become more inexpensive than loans, particularly following a contractionary monetary shock.[3] In other words, if firms increase their ratio of accounts payable to sales in response to an upward move in the loan supply, the narrow credit channel would find support. Nilsen's estimation for the United States over the period 1959–92 shows that not only are small firms affected by an increase in interest rates, but also larger firms that lack bond ratings are affected. Those affected firms tend to rely more heavily on TC under these circumstances.

In a previous study, Petersen and Rajan (1995) examine TC in the context of banks–firms relationships. The authors conclude that, after controlling for firm age, profits, incorporation status, and relationship characteristics, the value of total assets has a positive and significant impact on the share of TC that a customer takes. This implies that small firms are less able to exploit more advantageous conditions of TC due to fewer alternative credit sources available to them.

An alternative method to test the existence of a narrow credit channel is through bank balance sheets. Kashyap and Stein (2000) study the transmission of monetary

policy with a data set that includes every insured U.S. commercial bank from 1976 to 1993. They conclude that the impact of monetary policy on lending is stronger for banks with less liquid assets. This pattern is largely attributable to those banks in the bottom 5 percentile of the size distribution. Overall, Kashyap and Stein find support for the existence of a bank lending channel in the United States, but they are unable to quantify its importance for aggregate economic activity.

Hernando and Martinez Pages (2001) conduct a similar study for Spain for 1991–98.[4] Their estimation results show little evidence in favor of a bank lending channel due to the importance of small banks. These attract a substantial amount of savings and, therefore, they count on sizeable resources to lend even following a tight monetary policy. Along the same lines, Worms (2003) studies the existence of a bank lending channel from the individual balance sheets of German banks for 1992–98. He finds that the average bank reduces its lending more sharply in reaction to tight monetary policy the lower its ratio of short-term interbank deposits to total assets. Overall, this evidence supports the existence of a bank lending channel, but the results indicate that it is weakened by the network structure existing in the German economy.

Other mechanisms of monetary policy transmission are the wealth channel and the exchange rate channel (see Kuttner and Mosser 2002). The wealth channel is based on the life-cycle model developed by Ando and Modigliani (1963), and it establishes that tight monetary policy reduces the value of long-lived assets (e.g., stocks, bonds, and real estate) and, therefore, households' resources. As a consequence, consumption drops. The exchange rate channel, in turn, claims that changes in interest rates affect the exchange rate via the uncovered interest parity. In particular, an increase in domestic interest rates vis-à-vis foreign interest rates will lead to an appreciation of the domestic currency and, consequently, to a reduction both in net exports and in aggregate demand.

Although there is an extensive literature on testing the existence of a credit channel in both its broad and narrow version for the United States and Europe, such testing for emerging economies is almost nonexistent. In general, because emerging markets are subject to greater volatility and regime changes, reliable data are harder to obtain, and credit channel theory pertains mostly to industrialized nations (see, for example, Kamin 2000).

The contribution of this study is to determine whether the results found in the literature on the existence of a (narrow) credit channel are applicable to an emerging market country such as Chile. We investigate the effect of monetary policy on different loan categories using bank balance sheets for the years 1999–2002. In addition, we analyze whether monetary policy affects bank portfolios in the aggregate.

The Chilean Banking Sector in Figures

The banking sector in Chile was both healthy and profitable over the sample period of January 1999 to December 2002. Panel (a) of Table 1 shows that past-due

Table 1

Indicators of the Chilean Financial Sector: January 1999–December 2002

(a) Performance indicators of commercial banks ($n = 48$)

	Income-generating assets[1]	Global efficiency[2] (percent)	Operating efficiency[3] (percent)	Personnel costs[4] (percent)	Past-due loans/ loans (percent)	Provisions/ loans (percent)	ROE[5] (percent)	Loans rate[6] (percent)	Personnel[7]
Mean	42,858	0.10	0.50	0.28	1.83	2.26	1.11	0.70	39,896
Median	42,773	0.09	0.49	0.27	1.87	2.27	1.12	0.70	40,484
Std. dev.	1,876	0.05	0.11	0.04	0.12	0.17	0.59	0.12	1,546
25 percent-quantile	41,283	0.07	0.48	0.26	1.74	2.21	0.80	0.65	38,531
50 percent-quantile	42,773	0.09	0.49	0.27	1.87	2.27	1.12	0.70	40,484
75 percent-quantile	44,092	0.13	0.53	0.29	1.91	2.35	1.48	0.74	40,986
Minimum	39,981	0.00	–0.05	0.24	1.46	1.68	–0.01	0.23	36,701
Maximum	48,202	0.24	0.91	0.51	1.99	2.50	2.88	1.20	42,426

Source: Author's elaboration based on information from the Superintendence of Banks and Financial Institutions. Figures are expressed in million of U.S. dollars as of December 2002. [1] Income-generating assets include noncontingent loans, credit-note loans (excluding leasing contracts), past-due loans, and investment on financial securities. [2] Net income over income-generating assets (IGA). [3] Gross operating revenue over IGA. [4] Operating personnel costs over IGA. [5] Net profit over equity (monthly rate). [6] Interest income from credit activities, trading portfolio, and financial investments over IGA (monthly rate). [7] Number of employees.

(continues)

Table 1 (Continued)

(b) Concentration indicators of commercial banks ($n = 48$)

	Herfindahl all banks	Herfindahl private banks	C4 all banks (percent)	C4 private banks (percent)
Mean	0.13	0.10	67.17	59.44
Median	0.13	0.10	67.47	59.50
Std. dev.	0.00	0.00	1.01	0.86
25 percent-quantile	0.13	0.10	66.99	58.84
50 percent-quantile	0.13	0.10	67.47	59.50
75 percent-quantile	0.13	0.10	67.83	60.06
Minimum	0.12	0.09	63.68	57.30
Maximum	0.13	0.11	68.42	60.99

Source: Author's elaboration based on information from the Superintendence of Banks and Financial Institutions.

(c) Macroeconomic indicators (n = 48)

Descriptive statistics	Monthly inflation (annualized) (percent)	Percent variation IMACEC[1] (percent)	Ninety-day eight-year spread (basis points)[2]	Real exchange rate[3] (percent)
Mean	3.29	2.18	–115.6	5.35
Median	3.41	2.77	–103.0	4.50
Std. dev.	0.72	2.62	98.6	6.03
25 percent-quantile	2.61	1.02	–150.0	1.45
50 percent-quantile	3.41	2.77	–103.0	4.50
75 percent-quantile	3.77	3.74	–73.8	9.50
Minimum	1.91	–6.91	–375.5	–8.20
Maximum	4.63	5.96	72.3	18.60

Source: Author's elaboration based on information from the Superintendence of Banks and Financial Institutions, the Central Bank of Chile, and from the Santiago Stock Exchange. [1] IMACEC stands for Monthly Economic Activity Indicator. Percent variations are calculated over a twelve-month horizon. [2] The yield spread is measured as the difference between the interest rates paid on ninety-day and eight-year inflation-indexed bonds issued by the Central Bank of Chile. [3] The real exchange rate is defined as the nominal US$/Chilean peso exchange rate times the ratio of foreign inflation and domestic inflation. Foreign inflation is computed as the monthly percent variation in the Producer Price Index—or, alternatively, if not available, as the monthly percent variation in the Consumer Price Index—expressed in U.S. dollars, of trade partners corresponding with industrialized nations (United States, Japan, United Kingdom, and Canada), and euro-zone countries (Germany, France, Spain, Italy, the Netherlands, and Belgium). Percent variations are calculated over a twelve-month horizon.

loans averaged only 1.83 percent of total loans, while the rate of return on equity (ROE) and the interest income on income-generating assets (IGA) reached an average of 14 percent and 8.7 percent per year, respectively.[5] Provisions kept up with past-due loans—2.26 and 1.83 percent of total loans, repectively—while the loans rate was relatively stable over time as compared with ROE. (Indeed, the standard deviation of ROE reached 59 basis points over the sample period, while that of the loans rate amounted to only 12 basis points.)[6] On the other hand, employment in the financial sector showed little dispersion over the sample period, representing about 7.94 percent of the total labor force (for September–November 2002).

Figures on the concentration of the Chilean banking system are given in Panel (b) of Table 1. The Herfindhal index—computed as the square sum of the shares of IGA—for publicly and privately owned banks remained almost constant for the sample period.[7] On the other hand, the C4 index, which is calculated as the sum of the IGA shares of the four largest banks in Chile, exhibited slightly more variation, and averaged 67.1 percent for the sample period. Contrary to what one might have expected, concentration has not translated into more efficiency. Indeed, the ample correlation coefficient between the two variables is only 0.4. A similar conclusion is reached by Fuentes and Guzman (2002) in their study of the Chilean banking sector in the 1990s.

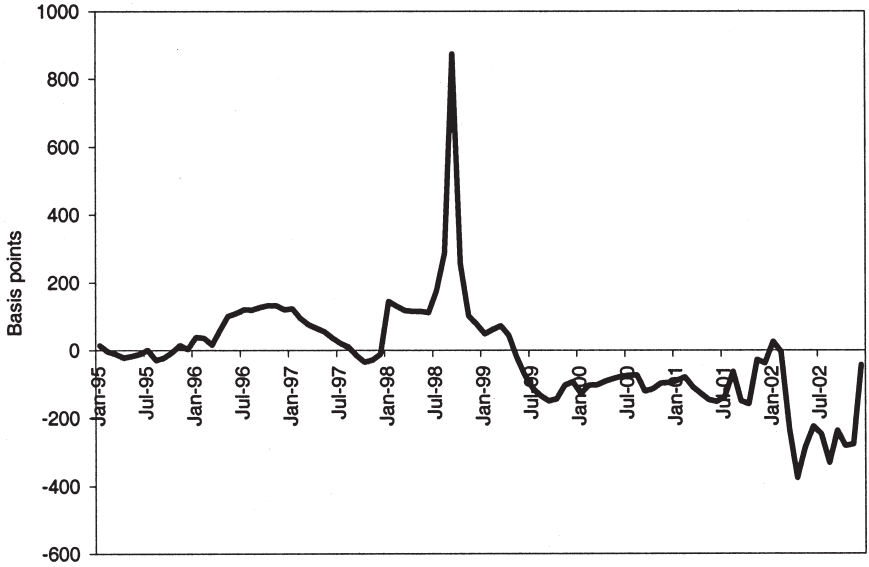
Although the above figures suggest a high level of concentration in the Chilean banking system, this is not the case for international standards. Using data previously collected by Beck et al. (1999), Levine (2000) finds that the sample median of concentration, which he defines as the share of total loans of the three largest banks, is 72 percent, which is greater than that computed for Chile (67 percent).

Panel (c) of Table 1 shows macroeconomic indicators for our sample period. The monthly inflation rate averaged only 3.3 percent (annualized) and stayed below 5 percent for the whole sample period. Meanwhile, the annualized growth rate of the economy—measured by the twelve-month variation in the monthly indicator of economic activity—was about 2.2 percent on average. Figures on the yield spread—measured as the difference between the interest rates paid on ninety-day and eight-year inflation-indexed bonds issued by the Central Bank of Chile—indicate that monetary policy was loose over the sample period. As Kozicki (1997) points out, the distance between short and long rates is usually reduced as monetary policy tightens.[8]

Except for the beginning of 1999, the spread remained negative in almost all subsequent months and dropped even further toward the end of the sample. This pattern differs noticeably from what is observed between 1995 and 1998. In that period, the yield spread reached a peak of 874 basis points in September 1998 when the Central Bank of Chile engaged a very tight monetary policy following the outbreak of the Asian crisis (see Figure 1).

The last column of Panel (c) gives account of the evolution of the real exchange rate—measured as the nominal U.S. dollar/Chilean peso exchange rate times the ratio of foreign inflation and domestic inflation. Most of the sample period was

Figure 1. **Yield Spread of Ninety-Day and Eight-Year Interest Rates Paid on Chile's Central Bank Bonds: 1995–2002**



Source: Central Bank of Chile.

Notes: Bonds are inflation-indexed. The spread is computed as the difference of the interest rates paid on ninety-day and eight-year bonds.

characterized by an increasing real exchange rate and, therefore, by improvements in domestic competitiveness.

The following two tables provide detailed information on the banking sector. Loan shares by economic activity for all commercial banks operating between January 1999 and December 2002 are shown in Table 2. Banks primarily offered loans to firms in the manufacturing and the financial-services sectors (13 and 26 percent, respectively) and to households through consumption and mortgage loans (9 and 10 percent, respectively). By contrast, mining (1.6 percent); electricity, gas, and water (1.2 percent); and transportation, storage, and communications (3.1 percent) stood out as the economic sectors that received the least funding.

The data used for our estimation involve nineteen banks for the period 1999–2002 on a monthly frequency (see Appendix) We excluded from the sample very small foreign banks, foreign banks that only serve financial institutions, insurance, real estate, and business-services companies; and domestic banks engaged primarily in providing consumption loans or consumption leasing. Two mergers took place over the sample period. Banco de A. Edwards merged with Banco de Chile in December 2001, consolidating under the name of Banco de Chile; and

Table 2

Average Loan Share by Economic Activity Classified by Bank: January 1999–December 2002 (in percent)

	Economic sector											
Bank	10	20	30	40	50	60	70	80	90	1	2	Total
ABN AMRO Bank*	3.8	2.9	24.1	0.7	2.2	12.8	3.5	34.3	4.2	1.9	9.4	100
Banco Bice	9.0	0.9	17.2	2.7	7.3	8.4	3.3	18.0	26.7	1.0	5.6	100
Banco de A. Edwards[1]	5.4	1.1	10.2	1.1	8.9	13.4	1.9	20.3	21.7	7.1	9.0	100
Banco de Chile	10.3	2.3	11.6	1.6	7.5	11.7	2.8	18.1	3.2	12.5	18.3	100
Banco de Credito e Inversiones	5.9	1.0	11.4	1.6	5.6	14.0	3.7	21.4	11.6	6.8	17.0	100
Banco de La Nacion Argentina*	3.7	7.2	19.3	0.1	2.6	19.0	4.0	42.8	0.0	1.4	0.0	100
Banco del Desarrollo	7.6	0.8	5.2	0.7	17.9	12.6	3.9	13.8	12.9	4.2	20.5	100
Banco del Estado de Chile	4.5	0.2	4.7	1.2	6.1	12.3	0.9	18.3	3.9	5.8	42.2	100
Banco do Brasil*	17.1	7.5	15.7	0.0	1.4	17.2	17.4	23.5	0.2	0.1	0.0	100
Banco Falabella	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.6	0.0	88.2	9.2	100
Banco Internacional	1.8	0.9	15.8	0.1	11.1	26.3	2.9	32.0	0.9	0.7	7.5	100
Banco Santander-Chile*	4.4	0.9	6.4	1.8	2.2	7.9	1.5	11.4	28.1	15.4	19.9	100
Banco Santiago[2]	3.3	0.9	21.3	0.5	2.6	12.9	3.8	16.0	14.6	7.2	16.9	100
Banco Security	7.8	0.2	14.5	2.6	11.1	9.5	4.5	30.6	15.8	0.5	3.0	100

Banco Sudameris*	10.3	1.1	31.6	0.8	2.6	25.4	2.7	19.6	5.7	0.1	0.0	100
BankBoston*	3.5	0.1	10.0	1.8	1.5	9.4	2.9	13.9	29.1	11.9	16.0	100
BBVA Banco BHIF*	1.4	0.0	0.6	0.0	6.0	17.7	0.6	24.4	13.4	9.8	26.1	100
Citibank N.A.*	4.3	0.3	13.7	1.4	1.5	5.6	3.7	10.1	9.6	31.1	18.6	100
CorpBanca	7.6	2.8	10.3	1.4	7.1	13.9	2.9	17.4	17.9	14.1	4.7	100
Dresdner Banque*	17.8	2.2	31.7	0.6	3.9	13.9	3.1	24.5	1.8	0.1	0.3	100
HSBC Bank USA*	4.4	3.1	14.2	1.2	2.1	26.2	1.8	45.6	1.2	0.1	0.0	100
JP Morgan Chase Bank*	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	100
Scotiabank Sud Americano	2.2	0.9	4.4	0.9	1.9	47.4	1.2	20.7	1.8	5.2	13.5	100
Bank of Tokyo-Mitsubishi*	13.8	0.5	27.5	4.7	0.0	19.4	0.5	33.4	0.1	0.1	0.0	100
Mean	6.3	1.6	13.4	1.2	4.7	14.9	3.1	25.5	9.3	9.4	10.7	
Minimum	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.6	0.0	0.0	0.0	
Maximum	17.8	7.5	31.7	4.7	17.9	47.4	17.4	100.0	29.1	88.2	42.2	

Source: Author's elaboration based on information from the Superintendence of Banks and Financial Institutions. * Indicates foreign bank; 10 = agriculture, livestock farming, and foresting; 20 = mining; 30 = manufacturing; 40 = electricity, gas, and water; 50 = construction; 60 = commerce; 70 = transportation, storage, and communications; 80 = financial institutions, insurance, real estate and services; 90 = community, social and personal services; 1 = consumption loans or consumption leasing; 2 = mortgage loans or housing leasing. [1] It merged with Banco de Chile in December 2001. [2] It merged with Banco Santander-Chile in August 2002.

Banco de Santiago merged with Banco Santander-Chile in August 2002, consolidating under the name of Banco Santander Santiago. Given that Banco de A. Edwards was small relative to Banco de Chile, for estimation purposes, the merged banks were reconstructed backward as the sum of the two before the merger. In the case of Banco de Santiago and Banco Santander-Chile, given that the two banks were about the same in size, we reconstructed the series of each one as if they had continued separately from August through December 2002.[9]

Table 3 shows indicators of all commercial banks in the sample, controlling for size, liquidity, and capitalization. Panel (a) shows that the largest banks exhibit lower credit risk but lower capitalization than smaller banks.[10] For all sizes, the greatest share of loans corresponds to firms loans, followed by mortgage loans. In addition, the figures show that size and efficiency are not correlated. When controlling for liquidity, Panel (b) shows that more liquid banks are also more capitalized and smaller sized. Both Panel (b) and (c) suggest that the cost of reserves is increasing in both liquidity and capitalization.[11] In addition, that efficiency does not seem to depend on either liquidity or capitalization, and loans composition is almost invariant to both liquidity and capitalization.

Econometric Model

Our estimation procedure is based on dynamic panels. The basic structure of a dynamic panel is given by a model of the form (see, for example, Hsiao 2003)

$$y_{it} = \gamma y_{i,t-1} + \delta' z_i + \beta' x_{it} + v_{it} \quad i = 1,2,...,N;\ t = 1,...,T, \tag{1}$$

where $|\gamma| < 1$, $v_{it} = \alpha_i + u_{it}$.

$$E(\alpha_i) = E(u_{it}) = 0 \quad E(\alpha_i z_i') = E(\alpha_i x_{it}') = 0' \quad E(\alpha_i u_{jt}) = 0$$

$$E(\alpha_i \alpha_j) = \begin{cases} \sigma_\alpha^2 \text{ if } i = j \\ 0 \text{ if } i \neq j \end{cases} \qquad E(u_{it} u_{js}) = \begin{cases} \sigma_\alpha^2 \text{ if } i = j,\ t = s \\ 0 \text{ otherwise} \end{cases},$$

z_i is a $K_2 \times 1$ vector of time-invariant exogenous variables, such as a constant term; x_{it} is $K_1 \times 1$ of time-varying exogenous variables; γ is 1×1; and δ and β are $K_2 \times 1$ and $K_1 \times 1$ vectors of parameters, respectively.

By taking the first difference of Equation (1), we eliminate the individual effect α_i:

$$\begin{aligned} y_{it} - y_{i,t-1} = \gamma(y_{i,t-1} - y_{i,t-2}) + \beta'(x_{it} - x_{i,t-1}) \\ + u_{it} - u_{i,t-1} \quad t = 2,...,T. \end{aligned} \tag{2}$$

Table 3

Indicators of Commercial Banks in the Sample Classified by Size, Liquidity, and Capitalization: January 1999–December 2002

	<50 percent				50–75 percent				>75 percent			
	Mean	Std. dev.	Min	Max	Mean	Std. dev.	Min	Max	Mean	Std. dev.	Min	Max
(a) Size												
Credit risk[1] (percent)	2.3	1.7	0.6	10.3	2.7	1.0	1.5	5.1	1.6	0.5	1.2	3.1
Liquidity[2]	1.1	0.4	0.6	2.8	0.8	0.1	0.6	1.3	0.7	0.2	0.3	1.0
Capitalization[3] (percent)	15.9	10.8	6.2	56.4	10.6	3.6	5.5	20.3	8.2	1.3	5.8	10.9
Past-due loans[4] (percent)	1.7	1.7	0.3	10.1	2.4	0.8	1.1	4.9	1.6	0.3	1.1	2.7
Reserves cost[5] (percent)	3.3	2.8	0.5	23.3	2.7	1.1	0.8	8.1	2.4	1.1	0.8	11.2
Size[6] (percent)	1.5	1.2	0.1	3.8	5.2	1.5	3.8	9.1	16.0	3.5	9.1	22.3
Efficiency[7] (percent)	0.5	0.5	–2.5	7.2	0.6	0.2	0.2	1.2	0.5	0.1	0.2	0.8
Personnel[8]	486	506	44	2,820	2,113	709	1,185	3,752	5,309	1,673	3,183	7,827
IGA	656	511	52	1,733	2,200	645	1,578	3,938	6,904	1,513	3,752	10,210
Firms loans (percent)	45.9	15.2	15.8	73.8	40.8	4.9	29.5	49.9	40.0	3.7	31.3	49.9
Consumer loans (percent)	2.4	4.0	0.0	22.3	11.4	7.4	3.5	28.9	6.9	1.9	4.0	11.6
Mortgage loans (percent)	5.8	6.4	0.0	21.7	14.0	5.9	3.8	23.1	20.1	9.3	9.9	39.0
Observations	435				212				217			

(continues)

Table 3 (Continued)

	<50 percent				50–75 percent				>75 percent			
	Mean	Std. dev.	Min	Max	Mean	Std. dev.	Min	Max	Mean	Std. dev.	Min	Max
(b) Liquidity												
Credit risk (percent)	2.0	0.8	0.7	4.3	2.1	1.1	0.6	9.9	2.7	2.2	0.6	10.3
Liquidity	0.7	0.1	0.3	0.9	1.0	0.1	0.9	1.1	1.4	0.4	1.1	2.8
Capitalization (percent)	9.3	3.2	5.5	29.9	11.9	4.2	6.8	26.4	20.2	13.3	8.5	56.4
Past-due loans (percent)	2.0	0.9	0.4	5.2	1.7	1.1	0.3	3.9	1.9	2.1	0.3	10.1
Reserves cost (percent)	2.6	1.4	0.7	12.2	3.0	1.8	0.6	14.0	3.4	3.3	0.5	23.3
Size (percent)	9.4	6.7	0.3	22.3	4.0	4.6	0.3	16.8	1.5	1.2	0.1	4.7
Efficiency (percent)	0.5	0.1	0.1	1.3	0.5	0.2	–0.3	1.4	0.5	0.7	–2.5	7.2
Personnel	3,239	2,372	86	7,827	1,354	1,436	94	4,717	553	760	44	2,924
IGA	4,043	2,891	132	10,210	1,686	196	125	7,364	643	542	52	2,014
Firms loans (percent)	39.5	6.9	16.4	60.6	46.9	12.5	15.8	73.8	46.9	15.2	25.8	73.6
Consumer loans (percent)	6.4	3.7	0.1	17.9	5.3	7.8	0.0	28.9	4.8	7.7	0.0	28.6
Mortgage loans (percent)	15.6	10.0	0.0	39.0	8.9	6.0	0.0	18.3	5.5	6.2	0.0	18.0
Observations	432				216				216			

(c) Capitalization

Credit risk (percent)	2.0	0.9	0.7	4.4	1.9	0.7	0.9	9.9	2.9	2.2	0.6	10.3
Liquidity	0.8	0.2	0.3	1.4	1.0	0.2	0.6	1.4	1.3	0.5	0.6	2.8
Capitalization (percent)	8.1	1.2	5.5	9.9	11.1	0.7	9.9	12.7	23.4	11.5	12.7	56.4
Past-due loans (percent)	1.9	1.1	0.3	5.2	1.6	0.8	0.3	3.1	2.2	2.0	0.4	10.1
Reserves cost (percent)	2.4	1.5	0.7	14.0	2.9	1.2	0.7	9.9	3.9	3.3	0.5	23.3
Size (percent)	9.5	6.6	0.8	22.3	3.5	4.2	0.4	21.0	1.6	1.7	0.1	6.4
Efficiency (percent)	0.5	0.1	–0.3	1.3	0.5	0.2	0.1	1.4	0.6	0.7	–2.5	7.2
Personnel	3,246	2,397	122	7,827	1,098	1,210	92	6,779	805	1,094	44	3,222
IGA	4,116	2,872	371	10,210	1,507	1,784	168	8,480	685	733	52	2,731
Firms loans (percent)	44.1	8.7	27.7	71.7	47.9	13.6	23.5	73.8	36.5	11.4	15.8	67.0
Consumer loans (percent)	5.5	3.5	0.1	17.9	5.0	5.0	0.1	16.8	6.9	9.8	0.0	28.9
Mortgage loans (percent)	15.5	9.2	0.3	39.0	8.5	8.1	0.0	23.1	6.0	6.7	0.0	22.9
Observations		431				218				215		

Source: Author's elaboration based on information from the Superintendence of Banks and Financial Institutions. [1] Loans provisions over income-generating assets (IGA). [2] (One-year maturity loans + liquid assets)/one-year maturity deposits. [3] Equity over IGA. [4] Past-due loans in dollars to total loans. [5] (Cash + deposits in the Central Bank of Chile)/IGA. [6] IGA bank "i" over IGA for all banks. [7] Operating efficiency. [8] Number of employees.

Given that $(y_{i,t-1} - y_{i,t-2})$ is correlated with $(u_{it} - u_{i,t-1})$, an instrument for $(y_{i,t-1} - y_{i,t-2})$ is needed. In fact, all $y_{i,t-2-j}$, $j = 0, 1, \ldots$ satisfy the conditions $E[y_{i,t-2-j}(y_{i,t-1} - y_{i,t-2})] \neq 0$ and $E[y_{i,t-2-j}(u_{it} - u_{i,t-1})] = 0$. And, therefore, they all are valid instruments. Let $w_{it} = (y_{i0}, y_{i1}, \ldots, y_{i,t-2}, x'_i)'$, with $x'_i = (x'_{i1}, \ldots, x'_{iT})$, and $\Delta = 1 - L$ where L is the lag operator. Then we have the following set of moment conditions

$$E\left(w_{it}\Delta_{it}\right) = 0 \qquad t = 2,...,T. \tag{3}$$

The $(T - 1)$ first-differenced equations of (1) stacked in matrix form are

$$\Delta y_i = \Delta y_{i,-1}\gamma + \Delta X_i\beta + \Delta u_i \qquad i = 1,...,N, \tag{4}$$

where Δy_i, $\Delta y_{i,-1}$, and Δu_i are $(T - 1) \times 1$ vectors of the form $(y_{i2} - y_{i1}, \ldots, y_{iT} - y_{i,T-1})'$, $(y_{i1} - y_{i0}, \ldots, y_{i,T-1} - y_{i,T-2})'$, $(u_{i2} - u_{i1}, \ldots, u_{iT} - u_{i,T-1})'$, respectively, and ΔX_i is a $(T - 1) \times K_1$ matrix whose elements are $(x_{i2} - x_{i1}, \ldots, x_{iT} - x_{i,T-1})'$. In total, there are $T(T - 1)(K_1 + 1/2)$ moment conditions, which in matrix form can be represented as

$$E\left(W_i\Delta u_i\right) = 0, \tag{5}$$

where

$$W_i = \begin{pmatrix} w_{i2} & 0 & \cdots & 0 \\ 0 & w_{i3} & \cdots & 0 \\ \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & \cdots & w_{iT} \end{pmatrix}$$

is of dimension $[T(T - 1)(K_1 + 1/2)] \times (T - 1)$. Given that the dimension of W_i (i.e., number of moment conditions) exceeds the number of parameters to be estimated, $K_1 + 1$, the generalized method moment (GMM) is utilized.

Specifically, the Arellano–Bond GMM estimator of $\theta = (\gamma, \beta')'$ is obtained by minimizing

$$\left(\frac{1}{N}\sum_{i=1}^{N}\Delta u_i' W_i'\right)\Psi^{-1}\left(\frac{1}{N}\sum_{i=1}^{N}W_i\Delta u_i\right), \tag{6}$$

where

$$\Psi = E\left(\frac{1}{N^2}\sum_{i=1}^{N}W_i\Delta u_i\Delta u_i' W_i'\right).$$

Testing for the Existence of a Bank Lending Channel in Chile

Evidence from Balance-Sheet Data

In this section, we concentrate on testing the existence of a bank lending channel by looking at the relationship between different loan categories and monetary policy. Descriptive statistics of aggregate loans, loan portfolio (firms, consumption, mortgage), and loans by main economic sectors (manufacturing, commerce, and financial services) between January 1999 and December 2002 are given in Table 4. The figures show that loans are primarily commercial and are concentrated on financial services.

In order to carry out our estimation, we used the Arellano–Bond technique described in the previous section. We fitted separate models for each loan category, and include as explanatory variables four lags of the dependent variable; the contemporaneous value and four lags of macroeconomic variables that control for demand-side innovations (real exchange rate devaluation and economic growth); the contemporaneous value and four lags of an indicator of tightness of monetary policy (yield spread); the contemporaneous value and four lags of a measure of credit risk faced by each bank (loan provisions over IGA); and one lag of the interaction of capitalization, size, liquidity, and efficiency with the yield spread.[12]

The inclusion of credit risk and interaction terms of bank characteristics with the yield spread are aimed at identifying the loan supply from the loan demand. First, we would expect the loan supply to shift upward as provisions become an increasing share of assets, at least in the long run. As discussed in "The Chilean Banking Sector in Figures," above, provisions closely follow the evolution of past-due loans and, consequently, they proxy for default risk (a similar measure of default risk is used by Worms [2003]).[13]

Second, under the assumption of homogeneous loan demand across banks, cross-sectional heterogeneity in bank responses to monetary policy should be captured by the interaction terms of bank characteristics with the yield spread. In other words, at least some banks will be unable to frictionlessly offset a reduction in interbank funds with alternative sources.[14] As Hernando and Martinez Pages (2001) point out, if there is a bank lending channel, the coefficients on the interaction terms should be positive. For instance, a relatively liquid bank will more easily protect its lending portfolio by drawing down on its large buffer stock of securities.

Our estimation results are presented in Tables 5, 6, and 7. The equation of total loans (Table 5) shows that the interaction terms of size, liquidity, and efficiency with the yield spread have the expected sign and are statistically significant. For example, an increment of 1 percent (e.g., 100 basis points) in the yield spread will be offset by size by 0.237 percent within one period (one month). Long-run coefficients measure the marginal impact of each regressor on the dependent variable after a four-month period. For example, a 1 percent increase in the annualized

Table 4

Descriptive Statistics of Loans: January 1999–December 2002 (n = 48)

	Loans by economic sector			Loans by type			
	Manufacturing	Commerce	Financial services	Firms	Consumption	Mortgage	Total loans
Observations	48	48	48	48	48	48	48
Mean	4,011	4,986	6,687	16,881	2,927	6,842	40,696
Median	4,097	4,539	6,672	16,993	2,886	6,920	40,301
Std. dev.	244	724	339	984	204	483	2,293
25 percent-quantile	3,944	4,353	6,401	15,944	2,816	6,612	38,838
50 percent-quantile	4,097	4,539	6,672	16,993	2,886	6,920	40,301
75 percent-quantile	4,180	5,691	6,988	17,798	3,034	7,221	43,021
Minimum	3,344	3,945	6,104	15,578	2,464	5,857	37,318
Maximum	4,307	6,169	7,414	18,493	3,410	7,649	44,098
Coefficient of variation (percent)	6.08	14.53	5.08	5.83	6.98	7.06	5.63

Source: Author's elaboration based on information from the Superintendent of Banks and Financial Institutions. Figures are expressed in US$ millions as of December 2002.

Table 5

Total Loans

Interaction of bank characteristics and the yield spread

Variable	Coefficient	Percent-point effect*	*t*-test	*p*-value
Size	3.949	0.237	2.764	0.006
Liquidity	0.399	0.381	2.829	0.005
Capitalization	0.214	0.027	0.426	0.670
Efficiency	13.627	0.068	5.609	0.000

Long-run coefficients (percent points)

Variable	Coefficient	Standard deviation	*t*-test	*p*-value
IMACEC	0.213	0.019	10.724	0.000
Yield spread	–1.544	0.306	–5.047	0.000
Real depreciation	–0.334	0.014	–23.376	0.000
Credit risk	–0.615	0.163	–3.771	0.000

Specification tests

		Value	*p*-value
Overidentifying restrictions (Sargan)	150.867	0.809	
Autocorrelation	Lag 4	0.406	0.684
	Lag 8	–1.648	0.099
	Lag 14	–1.097	0.272
	Lag 18	–1.070	0.284

Notes: * Evaluated at sample means. The explanatory variables include four lags of the dependent variable, the contemporaneous value, and four lags of the annualized growth rate the Monthly Indicator of Economic Activity (IMACEC), the yield spread, credit risk, and of the real exchange rate depreciation, and the first lag of the interaction of the yield spread and size, liquidity, capitalization, and efficiency. The instruments are the fifth through the ninth lags of the dependent variable and of bank characteristics.

Table 6

Loan Portfolio Composition

(a) Consumption

Interaction of bank characteristics and the yield spread

Variable	Coefficient	Percent-point effect*	*t*-test	*p*-value
Size	5.168	0.310	7.959	0.000
Liquidity	0.827	0.790	7.571	0.000
Capitalization	–1.063	–0.135	–2.677	0.007
Efficiency	2.731	0.014	0.593	0.553

Long-run coefficients (Percent points)

Variable	Coefficient	Standard deviation	*t*-test	*p*-value
IMACEC	0.237	0.029	7.991	0.000
Yield spread	–1.451	0.197	–5.047	0.000
Real depreciation	–0.329	0.017	–19.882	0.000
Credit risk	–0.493	0.103	–4.799	0.000

Specification tests

		Value	*p*-value
Overidentifying restrictions (Sargan)	167.055	0.824	
Autocorrelation	Lag 4	0.874	0.382
	Lag 8	1.026	0.305
	Lag 14	0.216	0.829
	Lag 18	–0.864	0.388

(b) Firms

Interaction of bank characteristics and the yield spread

Variable	Coefficient	Percent-point effect*	*t*-test	*p*-value
Size	3.135	0.188	2.279	0.023
Liquidity	1.383	1.321	6.161	0.000
Capitalization	–4.032	–0.512	–3.532	0.000
Efficiency	35.381	0.177	3.377	0.001

(continues)

Long-run coefficients (percent points)

Variable	Coefficient	Standard deviation	*t*-test	*p*-value
IMACEC	0.394	0.049	8.021	0.000
Yield spread	–1.441	0.262	–5.496	0.000
Real depreciation	–0.311	0.015	–20.797	0.000
Credit risk	–0.460	0.090	–5.087	0.000

Specification tests

		Value	*p*-value
Overidentifying restrictions (Sargan)	138.371	0.948	
Autocorrelation	Lag 4	–2.673	0.010
	Lag 8	–2.150	0.032
	Lag 14	–0.430	0.667
	Lag 18	–0.989	0.323

(c) Mortgage

Interaction of bank characteristics and the yield spread

Variable	Coefficient	Percent-point effect*	*t*-test	*p*-value
Size	3.029	0.182	4.901	0.000
Liquidity	0.983	0.939	8.606	0.000
Capitalization	–2.309	–0.293	–5.226	0.000
Efficiency	14.984	0.075	4.019	0.000

Long-run coefficients (percent points)

Variable	Coefficient	Standard deviation	*t*-test	*p*-value
IMACEC	0.264	0.010	25.421	0.000
Yield spread	–1.613	0.130	–12.402	0.000
Real depreciation	–0.281	0.016	–17.688	0.000
Credit risk	–0.466	0.078	–6.013	0.000

(continues)

Table 6 (Continued)

Specification tests

		Value	*p*-value
Overidentifying restrictions (Sargan)	161.348	0.894	
Autocorrelation	Lag 4	–1.026	0.305
	Lag 8	0.226	0.821
	Lag 14	–0.610	0.541
	Lag 18	1.861	0.063

Note: * Evaluated at sample means. The explanatory variables include four lags of the dependent variable, the contemporaneous value, and four lags of the annualized growth rate of the Monthly Indicator of Economic Activity (IMACEC), the yield spread, credit risk, and the real exchange rate depreciation, and the first lag of the interaction of the yield spread and size, liquidity, capitalization, and efficiency. The instruments are the fifth through the ninth lags of the dependent variable and of bank characteristics.

Table 7

Loans by Economic Sector

(a) Manufacturing

Interaction of bank characteristics and the yield spread

Variable	Coefficient	Percent-point effect*	*t*-test	*p*-value
Size	7.818	0.469	2.192	0.028
Liquidity	1.823	1.741	2.975	0.003
Capitalization	0.963	0.122	0.380	0.704
Efficiency	61.352	0.307	3.119	0.002

Long-run coefficients (percent points)

Variable	Coefficient	Standard deviation	*t*-test	*p*-value
IMACEC	0.328	0.033	9.918	0.000
Yield spread	–2.538	0.130	–3.010	0.003
Real depreciation	–0.280	0.022	–12.607	0.000
Credit risk	–0.472	0.298	–1.587	0.113

(continues)

Specification tests

		Value	*p*-value
Overidentifying restrictions (Sargan)	163.642	0.559	
Autocorrelation	Lag 4	–1.445	0.148
	Lag 8	–1.659	0.097
	Lag 14	1.326	0.184
	Lag 18	–1.236	0.216

(b) Commerce

Interaction of bank characteristics and the yield spread

Variable	Coefficient	Percent-point effect*	*t*-test	*p*-value
Size	2.467	0.148	1.856	0.063
Liquidity	1.859	1.775	3.346	0.001
Capitalization	–1.169	–0.148	–0.464	0.643
Efficiency	46.283	0.231	4.029	0.000

Long-run coefficients (percent points)

Variable	Coefficient	Standard deviation	*t*-test	*p*-value
IMACEC	0.286	0.048	6.023	0.000
Yield spread	–1.350	0.782	–1.723	0.085
Real depreciation	–0.253	0.057	–12.607	0.000
Credit risk	–0.400	0.350	–1.141	0.254

Specification tests

		Value	*p*-value
Overidentifying restrictions (Sargan)	159.474	0.649	
Autocorrelation	Lag 4	–1.547	0.121
	Lag 8	–1.908	0.056
	Lag 14	–1.742	0.082
	Lag 18	–0.067	0.946

(continues)

Table 7 (Continued)

(c) Financial services

Interaction of bank characteristics and the yield spread

Variable	Coefficient	Percent-point effect*	*t*-test	*p*-value
Size	10.788	0.647	2.012	0.044
Liquidity	0.900	0.859	1.606	0.108
Capitalization	4.832	0.613	1.433	0.152
Efficiency	41.942	0.210	1.508	0.132

Long-run coefficients (percent points)

Variable	Coefficient	Standard deviation	*t*-test	*p*-value
IMACEC	0.293	0.063	4.675	0.000
Yield spread	–2.851	0.782	–3.859	0.000
Real depreciation	–0.166	0.057	–5.623	0.000
Credit risk	–0.518	0.350	–0.939	0.348

Specification tests

		Value	*p*-value
Overidentifying restrictions (Sargan)	159.474	0.649	
Autocorrelation	Lag 4	–1.748	0.080
	Lag 8	1.286	0.198
	Lag 14	–0.768	0.442
	Lag 18	–0.871	0.383

* Evaluated at sample means. The explanatory variables include four lags of the dependent variable, the contemporaneous value, and four lags of the annualized growth rate of the Monthly Indicator of Economic Activity (IMACEC), the yield spread, credit risk, and the real exchange rate depreciation, and the first lag of the interaction of the yield spread and size, liquidity, capitalization, and efficiency. The instruments are the fifth through the ninth lags of the dependent variable and of bank characteristics.

growth rate of economic activity will translate into a 0.213 percent increase of total loans after four months. By contrast, increments in the yield spread, real depreciation, and credit risk will have a contractionary effect on total loans.

Table 6 shows estimation results for consumption, firms loans, and mortgage loans. Interaction terms between size and liquidity have the expected sign and are

statistically significant in all cases. In particular, firms and mortgage loans appear as especially sensitive to bank liquidity. On the other hand, long-run coefficients do not differ much across categories, except that firms' loans have a higher elasticity with respect to economic growth, and mortgage loans are more sensitive to monetary policy tightening.

We also looked at the transmission of monetary policy to loans by economic sectors. In particular, we focused on those three sectors with the largest average loans shares: manufacturing (13.4 percent), commerce (14.9 percent), and financial services (25.5 percent), which correspond to sectors 30, 60, and 80, respectively, in Table 2. Table 7 presents our results. The interaction terms of bank characteristics with the yield spread have the expected sign and are statistically significant in general. In particular, tight monetary policy will, to a lesser extent, affect the manufacturing and the financial-services loans of larger banks. In addition, in terms of magnitude, liquidity appears as the most important bank characteristic to mitigate the effect of contractionary monetary policy. (In the financial-sector equation, liquidity is statistically significant only at the 10.8 percent level). This liquidity effect is also reported by Hernando and Martinez Pages (2001).

As for bank capitalization, we are unable to draw general conclusions. When looking at the bank loan portfolio (Table 6), we conclude that well-capitalized banks display stronger responses to monetary policy. However, when classifying loans by economic sectors, such a conclusion no longer holds. In fact, capitalization is statistically insignificant for the three sectors.

In looking at economic sectors, it is interesting to note that we are able to detect greater dispersion in the response to macroeconomic shocks. In particular, the manufacturing and the financial-services sectors are more sensitive to economic activity and display greater responses to monetary policy than does commerce. To illustrate, a 1 percent increase in the yield spread today would translate into a 2.85 percent decrease in financial-services loans within four months. Such a decrease would only amount to 1.35 percent for commerce loans. As for real depreciation, manufacturing and commerce loans are more responsive than financial services. Credit risk, in turn, shows statistical significance only for manufacturing loans (at 11 percent).

Model specification for all loan categories in Tables 6 and 7 seems correct. The Sargan test does not reject the null hypothesis that the moment equations are correctly specified, and the residuals of the moment equations do not, in general, exhibit lingering correlation.

Finally, Table 8 reports the overall effect of tight monetary policy over total loans, consumer loans, and mortgage loans when classifying banks by size and liquidity. As we see, banks located in the twenty-fifth percentile of size are much more adversely affected by an increase in the yield spread. A similar result holds for banks in the twenty-fifth percentile of liquidity.

Based on the information reported in Tables 6 through 8, we conclude that the existence of a bank lending channel in Chile is supported by the data. As Kashyap

Table 8

Overall Effect on Loans of a 100-Basis-Point Increase in the Yield Spread
(percentage points)

	Size percentile			Liquidity percentile		
Loan type	25th	50th	75th	25th	50th	75th
Total	–3.016	–1.895	–1.166	–2.752	–1.786	–1.165
Consumer loans	–1.912	–0.863	–0.197	–2.395	–1.768	–1.139
Mortgage	–1.906	–0.611	–0.235	–2.598	–1.832	–1.376

Note: The overall effect is computed as the sum of the direct effect of a change in the yield spread and the interaction effect of each bank characteristic with the yield spread. The interaction effects are computed by introducing dummy variables for the 25th and 75th percentiles. The 50th percentile is the omitted category.

and Stein (2000) pointed out, the bank lending channel ultimately rests on the idea that banks cannot inexpensively substitute interbank funds when monetary policy tightens. But if this is the case, the effect of monetary policy on lending has to be more pronounced for some banks than for others. That is indeed what we have found: banks respond asymmetrically to monetary policy, depending on their size, liquidity, and efficiency.

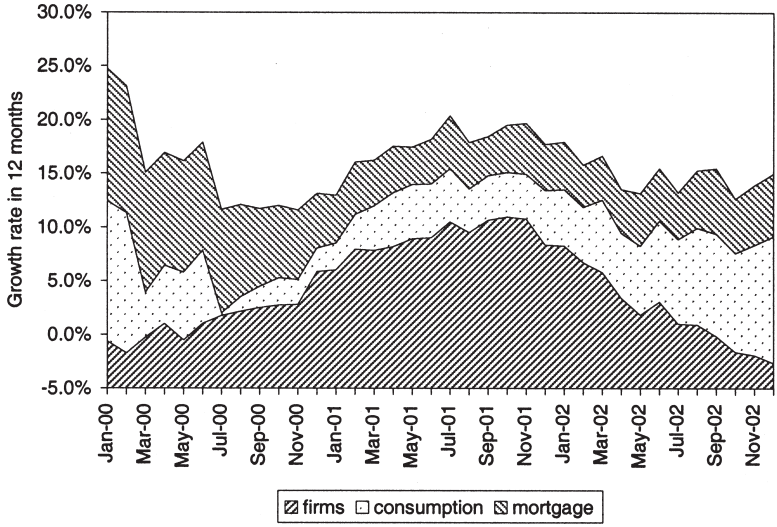
Behavior of Loans Composition at the Aggregate Level

We next seek further evidence of the bank lending channel by studying whether, on the aggregate, certain types of loans might be more adversely affected by negative monetary shocks. As Figure 2 shows, the evolution of the twelve-month growth rates of different loan categories was quite heterogeneous between 1999 and 2002, which coincides with a period of loose monetary policy.[15] Mortgage and consumption loans grew at the expense of firm loans (Panel [a]), while commerce loans experienced a high expansion between March 2001 and June 2002 as opposed to financial-services loans (Panel [b]).

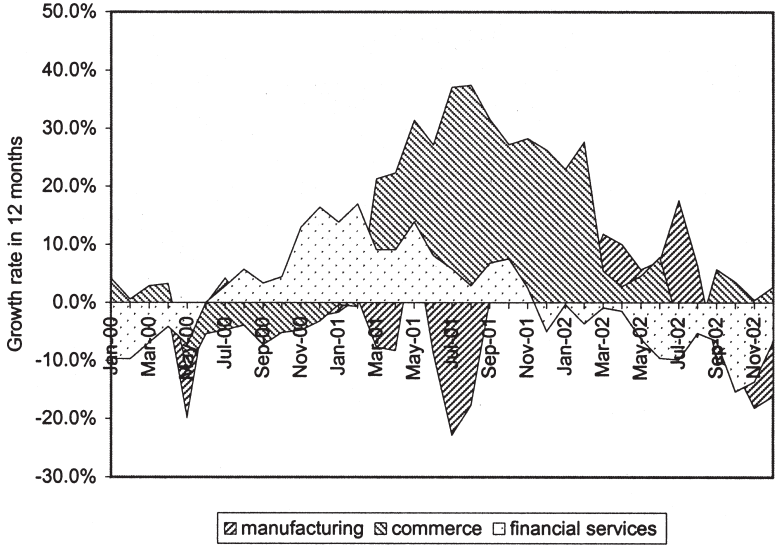
Based on this evidence, we focus on two ratios: consumption to firm loans, and commerce to firm loans. In order to quantify the response of each ratio to a negative monetary shock, we estimate separate vector autoregressive models (VAR), in which we also include the yield spread, economic growth, and real depreciation (for an application of this technique to monetary transmission, see Lown and Morgan 2002). Impulse–response functions were computed by Pesaran

Figure 2. **Twelve-Month Growth Rates of Different Loans Categories: 1999–2000**

(a) Loan portfolio composition



(b) Loans by economic sector



Source: Author's elaboration based on information from the Superintendent of Banks and Financial Institutions.

and Shin's (1998) methodology, which does not depend upon the order given to the variables in the VAR.

Figure 3 illustrates that following tight monetary policy, banks prefer to provide lending to firms than to households.[16] This can be interpreted as a fight-to-quality effect of the sort described by Caballero (2002).[17] In particular, a 100-basis-point increase in the yield spread would translate into a 0.87 percent decrease in the consumption-to-firms-loans ratio in three months. Similarly, those firms in the commerce sector will see their bank loans shrink relative to other economic sectors, as monetary policy tightens.

In sum, based on micro and macro data, we can conclude that Chile's banking sector is not immune to monetary policy. First, at the micro level, banks respond asymmetrically to monetary shocks depending upon bank size, liquidity, and efficiency. Furthermore, based on evidence for different loan categories, liquidity appears to protect banks the most against negative monetary shocks. Second, in the aggregate, contractionary monetary shocks bias bank portfolios toward higher-quality loans.

Conclusions

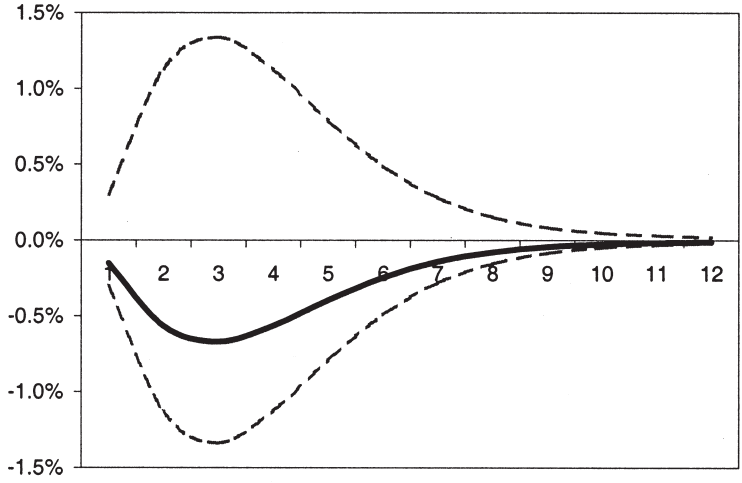
To date, there is no consensus about how friction in the credit market affects the transmission of monetary policy to the real economy. The traditional money channel states that when a central bank reduces its reserves, commercial banks are forced to reduce their demand for deposits. If prices are sticky, in the short run, a decrease in real monetary holdings should lead to higher real interest rates. This will translate into a contraction of interest-sensitive components of aggregate spending and, therefore, into lower economic growth.

Another existing stream refers to the credit market. Bernanke and Gertler (1995) suggest two channels by which monetary policy affects the credit market: the balance-sheet channel and the bank lending channel. The balance-sheet channel states that changes in monetary policy affect borrowers' balance sheets and income statements, including their net worth, cash flows, and liquid assets. The bank lending channel states that tight monetary policy shifts the supply of intermediated credit. Given that banks rely on demand deposits as an important source of funds, a contractionary monetary shock will reduce bank reserves and, therefore, the availability of bank loans. A key assumption for this result is that banks cannot offset reduced deposits with other sources of funds, such as certificates of deposit and new stock issues.

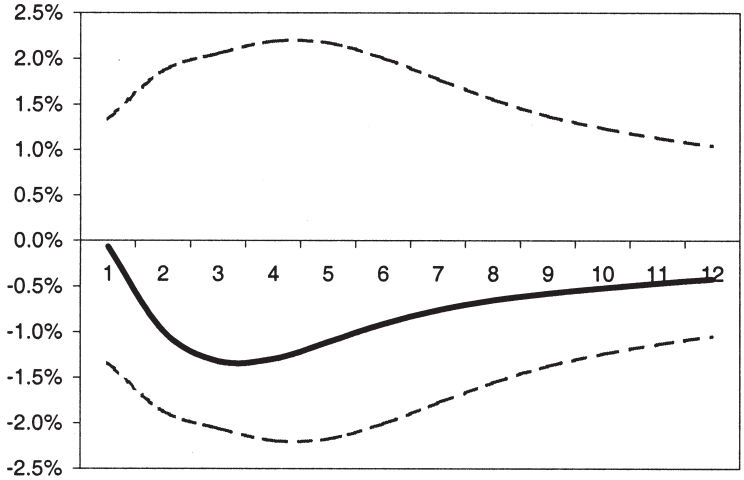
This paper focused on testing the existence of a bank lending channel in Chile. Our sample comprised nineteen banks that operated in Chile from January 1999 to December 2002. Over that period, banks primarily offered loans to firms in the manufacturing and the financial-services sectors (13 and 26 percent of total loans, respectively) and to households through consumption and mortgage loans (9 and 10 percent of total loans, respectively). Our estimation results support the existence

Figure 3. **Responses to One Standard Deviation Shock to the Yield Spread**

(a) Consumption/firm loans ratio



(b) Commerce/firm loans ratio



Notes: Time is measured in months. Separated VAR models are computed in each case. In addition to the corresponding ratio and the yield spread, each model includes the growth rates of both IMACEC and the real exchange rate. The shock to the yield spread is about a 65-basis-point increase. The impulse–response functions are computed by the Pesaran and Shin (1998) method of generalized impulse–response functions. Dashed lines are ±2 S.E.

of a bank lending channel. We find that banks respond asymmetrically to monetary shocks depending upon bank size, liquidity, and efficiency. In particular, tight monetary policy will be especially detrimental to banks with less liquid assets. In addition, we conclude that, in the aggregate, monetary shocks alter the loan portfolio decisions of the banking sector.

Notes

1. Fixed-maturity deposits that are negotiable depending on their face value.

2. The monetary channel assumes that loans and other bank assets are perfect substitutes, and that money—banks' liability—plays a preponderant role. Therefore, under this theory, a bank's asset composition changes randomly following a monetary shock.

3. Nilsen (2002) argues that the ratio of accounts payable to sales is not affected systematically by the terms of TC, that is, it is robust to the transaction motive. Ng et al. (1999) conclude that suppliers are reluctant to change the terms of TC in response to either a change in prices or a change in interest rates.

4. Recently, the Monetary Transmission Network (MTN) conducted a three-year project in which economists from the European Central Bank (ECB) and all national central banks of the Euro system studied the transmission of monetary policy in the newly formed Euro area (see www.ecb.int).

5. IGA are defined as noncontingent loans, credit-note loans (excluding leasing contracts), past-due loans, and investment on financial securities. This definition follows that of Fuentes and Guzman (2002).

6. We define the loans rate as the sum of interest income from credit activities, trading portfolio, and financial investments over IGA.

7. The only publicly owned bank in Chile is the Banco Estado.

8. The yield spread is usually defined as the long rate minus the short rate. Therefore, a low yield spread reflects relatively tight monetary policy.

9. In December 2001, the IGA share of Banco de A. Edwards, with respect to all banks, was 7.4 percent, whereas that of Banco de Chile reached 19.6 percent. The IGA shares of Banco Santander-Chile and Banco de Santiago were 13.1 and 15.6 percent, respectively, in August 2002.

10. We calculate credit risk as loans provisions over IGA.

11. We calculate costs of reserves as (Cash + deposits in the Central Bank of Chile)/IGA.

12. As instruments, we used the fifth through the ninth lag of the dependent variable and of bank characteristics. All computations were carried out with the GMM routine of TSP/GiveWin 4.5.

13. Worms (2003) points out that, in the short run, the coefficient on default risk might be positive if banks increase loans in order to enable firms to solve their liquidity problems. However, in the long run, an increase in default risk should shift the loan supply upward.

14. As discussed early in the paper, the literature on the bank lending channel stresses the role of reserve requirements on deposits in the transmission of monetary shocks. However, monetary policy in Chile is conducted rather differently. In order to minimize the difference between the monetary policy interest rate and the observed interbank lending rate, the Chilean central bank controls liquidity by adjusting the amount of new bond issuances, and through repo and anti-repo operations. The repo operations consist of purchases of central bank bonds owned by financial institutions, which allow the central bank to inject liquidity into the financial system. By contrast, anti-repo operations are sales of short-maturity central bank bonds aimed at reducing liquidity. Requirements on legal reserves are

not actively used as an instrument of monetary policy. In fact, they have not been changed since the 1980s. Currently, reserve requirements are 9 and 3.6 percent for short- and long-maturity liabilities, respectively. For more details on the conduct of monetary policy in Chile, see Massad (1998).

15. For instance, the twelve-month growth rate in January 2000 is computed as the growth rate between January 1999 and January 2000.

16. In Chile, consumption loans usually include funding provided to unipersonal companies.

17. Flight to quality describes the tendency of investors to require larger default premiums on investments under uncertain economic conditions.

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Appendix

IFI code	Banks in the sample
1	Banco de Chile
9	Banco Internacional
11	Dresner Banque Nationale de Paris*
12	Banco del Estado de Estado
14	Scotiabank Sud Americano*
16	Banco de Creditos e Inversiones
17	Banco do Brasil S.A.*
27	CorpBanca
28	Banco Bice
29	Banco de A. Edwards[1]
33	Citibank N.A.*
35	Banco Santiago[2]
37	Banco Santander-Chile*
39	BankBoston, National Association*
40	Banco Sudameris*
46	ABN AMRO Bank*
49	Banco Security*
504	BBVA Banco BHIF*
507	Banco del Desarrollo

Notes: [1] It merged with Banco de Chile in December 2001. Given that Banco de A. Edwards was small relative to Banco de Chile, the merged banks were reconstructed backward as the sum of the two before the merger. [2] It merged with Banco Santander-Chile in August 2002. Given that the two banks were about the same in size, we reconstructed the series of each one as if they had continued separate from August through December 2002. * Foreign bank.