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BANK LENDING CHANNEL AND THE MONETARY TRANSMISSION MECHANISM: THE CASE OF CHILE

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Resumen

Este documento analiza la evidencia sobre el canal del crédito bancario en Chile durante el período 1990-2002 sobre la base de información del sector bancario y del sector corporativo. En primer lugar, se realiza una estimación econométrica de un panel de bancos con el objeto de identificar los cambios de la oferta de crédito bancario en respuesta a modificaciones de la política monetaria. En segundo lugar, tomando en cuenta la evidencia recabada en el paso anterior, se construye una variable agregada cuyo objeto es capturar los principales mecanismos que caracterizan al canal del crédito bancario. Dicha variable se utiliza en la estimación de un VAR, que nos permite evaluar si este canal de transmisión amplifica o no el impacto de un cambio en la tasa de política monetaria sobre la actividad económica. Nuestra conclusión es que el canal del crédito bancario ha funcionado como un mecanismo de transmisión de política monetaria en Chile durante el período bajo análisis, teniendo un impacto independiente y significativo sobre la actividad económica.

Abstract

This paper analyses the evidence about the bank-lending channel in Chile during the period 1990-2002 using data from both the banking sector and the corporate sector. First, we estimate a panel data of banks to identify shifts in the loan supply curve in response to changes in monetary policy. Second, taking into consideration the evidence gathered in the previous step, we construct an aggregate variable aimed to capture the main forces behind the bank lending channel, and we estimate a VAR system to test whether or not this channel exacerbates the effect of a monetary policy shock over macroeconomic activity. We conclude that the bank-lending channel has operated as a monetary policy transmission mechanism in Chile during the sample period, having an independent and significant effect in terms of macroeconomic activity.

1. INTRODUCTION

   Modigliani and Miller (1958) undermined enthusiasm about the role of credit in the economy by suggesting that the capital structure of the firm was mostly irrelevant. Moreover, the strong and robust correlation between money and real variables found in the empirical literature in the 1960s provided strong support for the view that the main transmission mechanism for monetary policy was through changes in the cost of capital and their impact on investment (the interest rate channel).[1] In that view, banks were only important because they created money. In the 1970s, however, the new field of the economics of information underscored the relevance of capital market imperfections and the uniqueness of bank loans as against other forms of debt.[2] In this context, the "credit view" emerged as a new way of understanding the monetary policy transmission mechanism. This literature distinguishes among two subchannels, namely, the broad credit channel and the bank lending channel, although more recent interpretations of the role that banks play in the transmission of monetary policy highlight the interaction between the two channels.[3]

   This paper focuses on the bank lending channel, which emphasizes the role played by banks in the transmission of monetary policy.[4] Thus, if the Central Bank follows a tight monetary policy, interbank lending is curtailed and the supply of funds for banks drops. Some individual banks might succeed in lifting funds elsewhere, allowing them to insulate their loan portfolios against monetary policy. Other banks, however, are forced to curtail their supply of credit, especially in the face of a strong negative monetary shock. Such a decrease in the bank loan supply is likely to be heterogeneous, as well, in the sense that heavily indebted households and small and medium-sized enterprises (SMEs), which are presumably bank dependent, are crowded out of the market for bank loans and become severely financially constrained.[5] On the other hand,

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   1. See, for example, Friedman and Schwarts (1963).
   2. The seminal paper is Akerlof (1970), who draws on the market for used cars to illustrate the problem caused by asymmetric information between dealers and buyers. Later references include Jaffee and Russell (1976), Townsend (1979), Stiglitz and Weiss (1981), and Diamond (1984), among many others.
   3. See, for example, Huang (2003).
   4. The broad credit channel (also known as the balance sheet channel) is related to the supply of credit by all financial intermediaries, emphasizing the role of asymmetric information in the existence of an external financing premium. This premium is defined as the difference in the costs of external and internal financing. The external financing premium depends negatively on the net worth of a potential borrower and positively on the stance of monetary policy. Hence, it is a financial accelerator mechanism that amplifies the effects of monetary policy on investment and consumption decisions. See the appendix for an overview of how both the broad credit channel and the bank lending channel are related to the whole set of monetary transmission mechanisms.
   5. Because of their comparative advantages in information collection and processing, as well as their capacity to establish long-term relationships with their clients, banks are the only ones able to offer credit to certain types of borrowers. However, banks that serve clients without any other market alternative have to deal with an asymmetric information problem, since it is difficult for the market to value their loan portfolios. Those banks will therefore experience difficulties in substituting their financial sources. For Example, Goldberg, Cole, and White (2002), using a survey of small firms conducted by the Federal Reserve, find that larger banks rely on standard techniques based on financial statements to make their commercial loan decisions. Smaller banks tend to deviate from these criteria, supporting their

less binding adverse selection and moral hazard problems allow large enterprises to maintain, if not increase, their access to domestic bank loans and other domestic financial sources.[6] As a result, the bank lending channel exacerbates the impact of a negative monetary policy shock in aggregate spending.

In distinguishing between movements of the demand and supply of bank credit—a key issue for interpreting the evidence on the bank lending channel—we follow a strategy of identification through heterogeneity, by comparing economic agents that are more likely to be affected by financial frictions with economic agents that are less likely to be so affected. In the words of Gilchrist and Zakrajsek (1995), "By observing and measuring the differential behavior of economic agents under consideration, one can potentially attribute some, if not all, of the difference in behavior to frictions caused by credit markets."

Although we are well aware that the asymmetric nature of financial frictions also implies time varying differences, that is, in and out of times of tight monetary policy, we concentrate on explaining cross-sectional differences by following a two-step approach. First, we follow a panel data approach to test how bank characteristics (size, liquidity, and capitalization) affect the response of loan supply after a change in monetary policy. Second, using the evidence gathered in the previous step regarding the main forces behind the bank lending channel, we construct an aggregate variable—the low/high quality ratio—aimed at capturing the availability of bank credit to households and SMEs vis-à-vis large enterprises. Using the low/high quality ratio, we test—within a vector autoregression (VAR) system—whether the bank lending channel exacerbates the effect of a monetary policy shock over macroeconomic activity.

Our panel data approach is closely related to Hernando and Martínez-Pagés (2001) and, to a lesser extent, to Kashyap and Stein (1995, 2000) and Kishan and Opiela (2000).[7] Our VAR approach is mainly related to Gilchrist and Zakrajsek (1995). Using this two-step approach, we conclude that the bank lending channel has operated as a transmission mechanism of monetary policy in Chile within the sample period and that this mechanism has had a significant impact on macroeconomic activity.

The rest of the paper is organized as follows: section 1 describes the data, section 2 describes some methodological issues and presents the empirical results, and section 3 concludes.

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decisions with a much more personalized assessment of the entrepreneurs (of SMEs). In other words, the role played by asymmetric information is twofold: it affects the capacity of some banks to lift funds in situations of low market liquidity, and it generates a set of captive clients among banks.

6. For example, if large firms are at the same time being directly affected by an external shock that is restricting their access to international financial markets, they will satisfy their financial needs domestically, thereby further crowding other agents out of financial markets. In addition to taking bank loans, large Chilean enterprises have been actively issuing new domestic bonds in recent periods.

7. See Cavieres (2002) for a study about the bank lending channel in Chile that follows closely Kishan and Opiela (2000).

2. THE DATA

The data used in this paper come mainly from financial statements of banks and publicly listed enterprises.[8] Our dataset covers the period from the first quarter of 1990 to the second quarter of 2002. We also make use of several macroeconomic series, which are mostly taken from the Central Bank of Chile.

When using bank statements, we consider only banks that are active participants in the credit market, excluding branches of foreign banks that are mainly devoted to cash and portfolio management activities.[9] This diminishes the problems associated with heterogeneous demand shocks, because the share of different types of loans in the banks' portfolios does not differ significantly (see table 1). Even after this adjustment, our data-set is quite representative of the credit market, accounting for more than 90 percent of total loans at any point in time (see figure 1).

Figure 1. Share in the Loans Market of Banks Included in the Sample
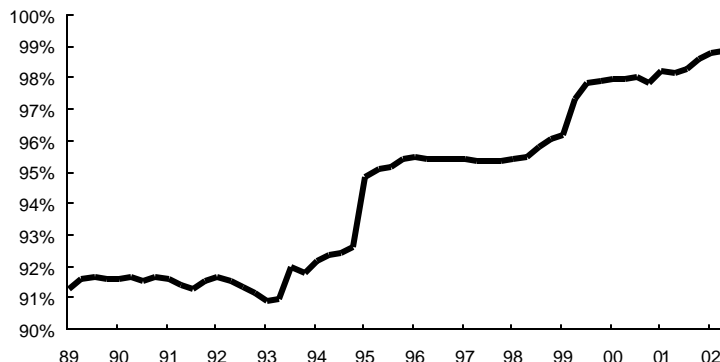
Source: SBIF.

From these bank statements we collect total loans, consumer loans, and commercial loans. The distinction between consumer loans and commercial loans points also toward a better identification of movements in the supply of credit.[10] Indeed, evidence indicates a differential behavior of various types of loans during the business cycle (see figure 2), which suggests that different types of loans may be affected distinctly by demand shocks.

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8. The bank statements are published in the statistical bulletin of the Superintendencia de Bancos e Instituciones Financieras (SBIF); the statements of publicly listed enterprises are taken from a dataset assembled by the Santiago Stock Exchange (Bolsa de Comercio de Santiago) containing all the information provided by the Ficha Estadística Codificada Uniforme (FECUS), a standardized statement that every public firm in Chile is required to file quarterly.

9. When estimating the panel data, the original dataset is adjusted slightly to take into account mergers that occurred during the sample period. We follow the intermediate strategy proposed by Hernando and Martinez-Pagés (2001), generating a new bank when a merger of banks of similar sizes takes place. If the merger is between banks of significantly different sizes, the data of the merged bank is considered as data of the largest merging institution and no new bank appears.

10. As suggested by Hernando and Martinez-Pagés (2001).

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Table 1. Characteristics of the Banking System[a]

| Characteristic	Size (percentile)				Capitalization (percentile)			
	<25	25-50	50-75	>75	<25	25-50	50-75	>75
Market share (percent)								
Total assets	3.9	10.0	23.1	63.0	29.5	40.0	22.8	7.7
Loans	1.1	4.5	20.5	73.9	36.6	46.2	16.5	0.8
Deposits	1.4	5.2	20.6	72.8	35.5	46.0	17.2	1.3
Size indicator								
Average number of bank-branches	2.7	12.5	31.3	113.6	78.7	87.3	29.3	1.2
Average total assets[b]	12134.2	32117.3	71943.6	205512.1	122427.5	180963.9	97109.9	34402.5
Asset composition (percent)	12.9	20.3	40.2	53.1	55.4	51.6	32.2	4.7
Loans	11.6	18.9	38.9	50.7	53.5	49.3	30.0	3.1
Loans to firms	*44.3*	*44.7*	*57.4*	*57.0*	*59.4*	*58.9*	*53.4*	*48.3*
Consumer loans	*13.6*	*27.0*	*10.3*	*6.1*	*11.7*	*7.8*	*8.7*	*5.5*
Mortgage loans	*0.5*	*2.6*	*12.3*	*16.4*	*11.6*	*17.6*	*20.3*	*0.1*
Other loans	*41.7*	*25.7*	*19.9*	*20.5*	*17.3*	*15.8*	*17.6*	*46.1*
Securities	6.8	7.8	9.6	14.7	8.8	12.8	10.6	4.6
Other assets	81.6	73.3	51.5	34.6	37.7	38.0	59.3	92.3
Liabilities composition (percent)								
Deposits	51.2	68.4	63.9	62.5	66.3	64.3	61.1	52.0
Overnight deposits	7.5	4.8	8.6	14.1	11.4	12.7	13.4	7.2
Time deposits	43.8	63.6	55.3	48.4	54.9	51.6	47.7	44.8
Morgage bonds	0.4	2.0	14.7	16.9	17.1	18.4	18.1	0.1
Foreign loans	8.0	9.5	6.7	7.7	4.6	4.2	5.7	2.8
Subordinate bonds	0.0	0.2	1.8	1.7	2.3	2.3	1.2	0.0
Stock of provisions	1.4	2.6	2.4	2.6	2.1	1.9	2.0	1.0
Capital and reserves	38.9	17.3	10.4	8.6	7.6	8.9	12.0	44.0

Source: SBIF and authors calculations.
a. This analysis if performed for the whole sample period (1990–2002). Percentiles are calculated for each period.
b. Millions of pesos.

We also collect our proxies for bank characteristics—size, liquidity, and capitalization—which are based on how the existing empirical literature about the bank lending channel captures the potential problems associated with asymmetric information.[11] Size is defined as the bank's share of the total assets of the banking system; liquidity is defined as the ratio of liquid assets to total assets; and capitalization is defined as the seasonally adjusted ratio of capital and reserves to total assets. Table 2 presents the main descriptive statistics on this set of bank characteristics.

Figure 2. Annual Growth of Total Loans
All banks; percent of moving average
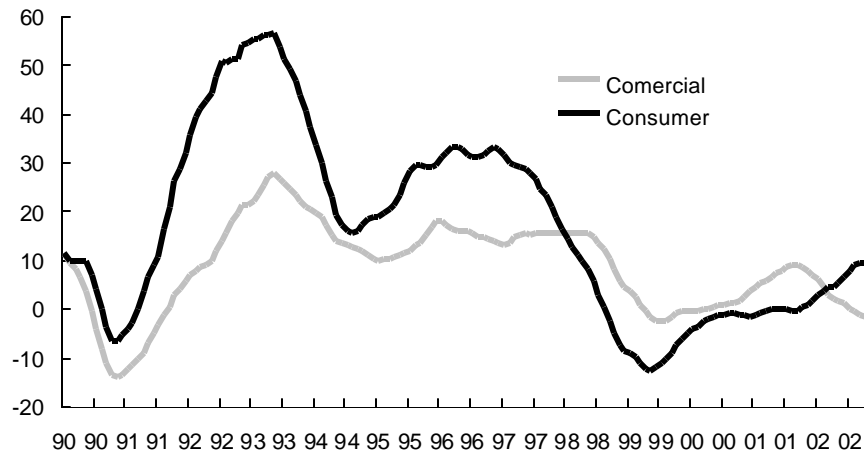
Source: SBIF.

From the statements of publicly listed enterprises, we take the total large corporate sector bank debt. Using this variable as the denominator and the consumer loans of the banking system as the numerator, we construct a variable that we call the low/high quality ratio, to capture the availability of bank credit to households and SMEs vis-à-vis large enterprises. Two features of this ratio deserve further explanation: the extent to which consumer loans capture not only household credit but also loans directed to SMEs; and the relation of this ratio to a flight to quality. With regard to the first feature, we could have measured credit to SMEs more directly using data that is available by size of loans, but this series is only available since 1996, and with less than a quarterly frequency. However, when we graph the small business loans and consumer loans together (see figure 3), the two series follow a relatively similar path (the correlation is over 90 percent). Credit to SMEs is, in fact, known to usually take the form of a consumer credit in the Chilean banking industry, whereas credit to large enterprises follows a very different path.

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11. See, for example, Kashyap and Stein (1995, 2000) and Kishan and Opiela (2000).

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Table 2. Descriptive Statistics of Bank Characteristics
Percent

Characteristic	Mean	Standard Error	Minimum	Maximum	percentile25	percentile50	percentile75
Size	4.21	4.01	0.03	19.04	0.87	3.24	5.92
Liquidity	20.69	9.01	4.48	53.92	13.41	19.58	27.26
Capitalization	8.76	9.43	1.09	63.44	4.64	5.68	7.95

Source: Authors calculations.

With regard to the second feature, our low/high quality ratio is
(inversely) related to the indicator of a flight to quality constructed
by Caballero (2002) using precisely the share of large loans from the
available data by size of loans. Although our story is different from
Caballero's, in the sense that we are trying to pin down the effect of a
monetary policy shock instead of an external shock, the operative
financial mechanism is basically the same: indebted consumers and
especially SMEs are crowded out of the banking system by large firms,
thus becoming severely financially constrained. Figure 4 shows a severe
flight-to-quality effect in 1998–99, a period of extremely tight
monetary policy.

**Figure 3. Small Loans and Consumption Loans**
Annual growth
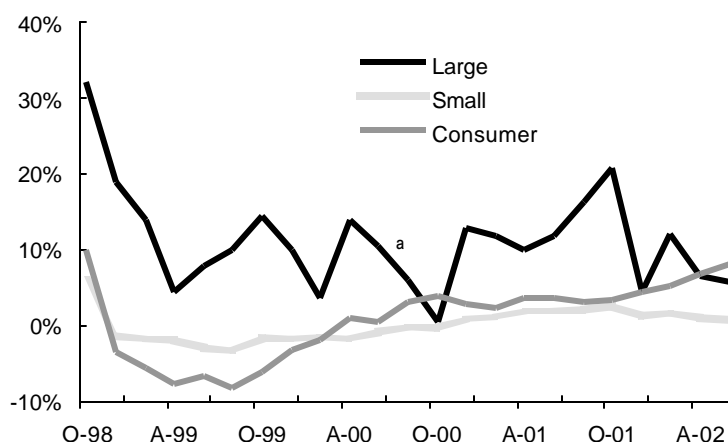
Source: SBIF.

To identify the effect of a monetary policy shock on the supply of
bank loans, we need an indicator that is closely tied to monetary
policy. The international empirical literature offers several
alternatives, but the set of choices in the case of Chile is limited by
data availability. Within this limited choice set, we choose the term
spread, defined as the difference between the monetary policy rate and
the PRC8.[12] As explained in Gertler (2000), a positive movement in the
term spread (so defined) simply reflects that the monetary tightening is

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12. The PRC8 are long-term indexed bonds issued by the Central Bank of
Chile. See Estrella and Mishkin (1998) for a positive assessment of the
predictive power of the term spread; see Gertler (2000) for an explanation of
the close relationship between the term spread and monetary policy, particularly
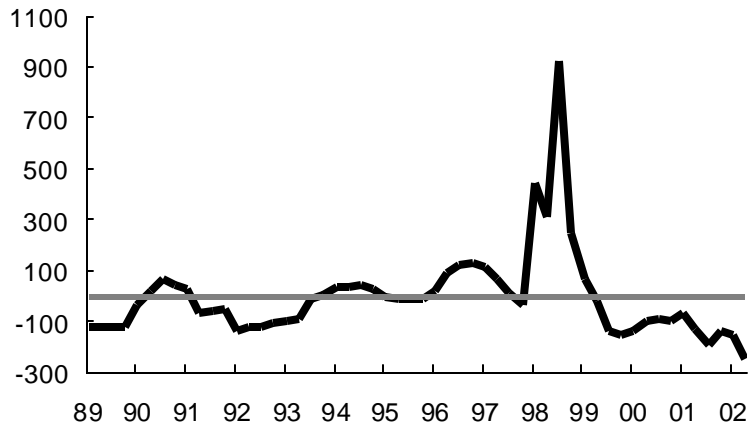in periods of significant monetary tightening.

inducing a fall in long-term rates, since there are expectations of a
drop in the short-term interest rate in the near future (see figure 5).

Figure 4. Annual Growth in Low/High Quality Ratio and Term Spread
Percent, moving average
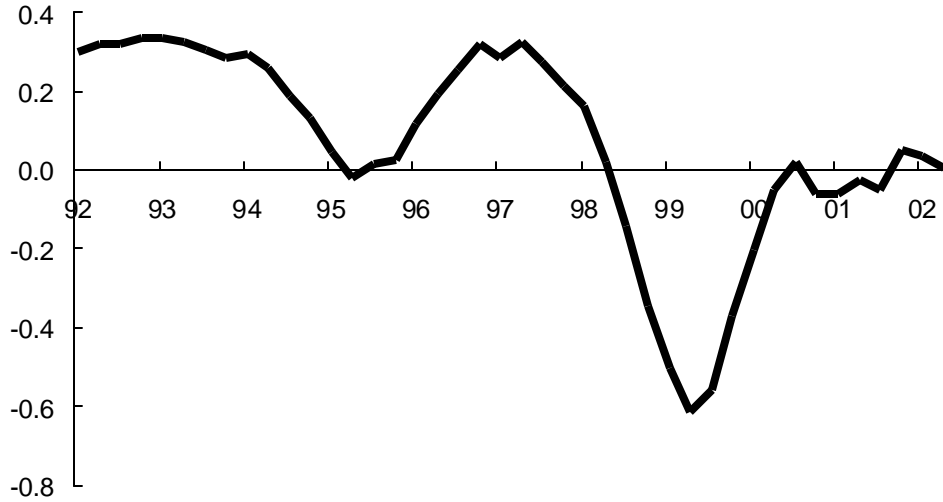
Source: Central Bank of Chile and authors calculations.

Figure 5. Term Spread
Basis points

Source: Central Bank of Chile.

Finally, we use several macroeconomic series in the panel and the VAR system. Specifically, in the panel of banks we use the annual growth of real GDP to capture changes in income, and the annual depreciation of the real exchange rate to capture movements in relative prices. Both variables are intended to control for demand effects. In the VAR system, we use three additional endogenous variables (besides the low/high quality ratio and the term spread): namely, a proxy for macroeconomic activity (in logs and seasonally adjusted), the consumer price index (in logs and seasonally adjusted), and real exchange rate (in logs). We use six different proxies for macroeconomic activity: real GDP, industrial production, business investment, durable goods consumption, unemployment rate, and residential investment. In addition to these endogenous variables, every VAR model includes the following set of exogenous variables: terms of trade, inflation target, external output, and a time trend.[13]

3. METHODOLOGICAL ISSUES AND EMPIRICAL RESULTS

Our main goal in this section is to analyze whether the bank lending channel played any role as a transmission mechanism for monetary policy in the Chilean economy during the period 1990 to 2002 and, if so, whether this transmission mechanism plays any significant macroeconomic role. We follow a two-step approach. First, we use a panel data of banks to identify shifts in the loan supply curve in response to changes in monetary policy by exploiting the heterogeneity among banks. Such an exercise lets us gather evidence about where the bank lending channel has operated most strongly. Second, we use that knowledge to construct a variable that is likely to be a good proxy of how the bank lending channel exacerbates the monetary policy shock, thus having an independent and significant impact on aggregate spending. This variable is the low/high quality ratio, which captures the availability of bank credit to households and SMEs vis-à-vis large enterprises. Here again, we appeal to heterogeneity for identification purposes, this time among borrowers. Finally, we embed the low/high quality ratio within a VAR system to test whether the bank lending channel exacerbates the effect of a monetary policy shock over macroeconomic activity.

3.1 First Step: A Panel Data of Banks

As discussed in the introduction, a tight monetary policy reduces the amount of funds available for the banking system, and some banks are unable to offset the reduction in interbank funds owing to information problems. How do bank characteristics affect the response of loan supply following a monetary policy shock? To answer this question, we follow a panel data approach in which bank characteristics (size, liquidity, and capitalization) interact with the term spread (our indicator of monetary policy) to disentangle the differential behavior of banks with regard to total loans, consumer loans, and commercial loans.

In this panel model, the dynamic structure is adequately handled by introducing one lag for the endogenous variable and four lags for the

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13. This is justified on the grounds that Chile is a small open economy with an inflation target regime operating since the early 1990s. In particular, by including the terms of trade, we are controlling for external shocks. Hence, if we find that the low/high quality ratio influences economic activity following a monetary policy shock, we can interpret the flight-to-quality effect as being domestically driven.

term spread, the variables aimed at controlling for demand effects, and the variables related to bank characteristics. Although including a lag of the dependent variable is trivial in the time-series context, the fixed-effects estimator is severely biased in a dynamic context. Instead of following the traditional approach to dealing with such a problem— namely, the Arellano and Bond generalized method of moments (GMM) procedure—we use the bias-corrected estimator proposed by Hahn and Kuersteiner (2002).[14]

The empirical specification within this panel data approach is the following:

$$y_{it} = \rho y_{it-1} + \sum_{j=0}^{4} \mathbf{x}'_{it-j}\beta + \mathbf{z}'_{it-1}\gamma + \sum_{j=1}^{4} \mathbf{x}_{3it-j}\mathbf{z}'_{it-1}\phi + \sum_{s=1}^{4}\sigma D_{st} + u_{it},$$

where y_{it} represents the annual growth of total loans, commercial loans, and consumer loans, respectively; $\mathbf{x}_{it}$ is a vector of macroeconomic variables aimed at controlling demand-side shocks (annual growth of GDP and annual depreciation of the real exchange rate) in addition to the monetary policy indicator (term spread); $\mathbf{z}_{it}$ denotes a vector of bank-specific variables (liquidity, size and capitalization); D is a set of seasonal dummies; u_{it} is i.i.d; $i = 1, \ldots, N$ represents the number of banks included in the dataset; and $t = 1, \ldots, T$ is the time index from 1990:1 to 2002:2. Note that the bank-specific explanatory variables $\mathbf{z}_{it}$ are included with one lag to account for potential endogeneity.

We disentangle loan-supply from loan-demand effects by looking at cross-sectional differences in the response of bank loans to a monetary policy shock. Were these differences to be related to indicators of the degree of informational asymmetries (size, liquidity, or capitalization), it would support the existence of the bank lending channel. More specifically, if the bank lending channel holds, we should expect a positive and significant cross-coefficient between the term spread and bank characteristics.

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14. The Arellano and Bond GMM procedure is subject to substantial finite sample bias, as shown by Alonso-Borrego and Arellano (1999) and Hahn, Hausman, and Kuersteiner (2002). For a more technical discussion of the methodological issues, see Brock and Franken (2003).

Table 3. Long-Run Coefficients and Standard Errors

Dependent variable	Coefficient	Standard Error
1. Growth of total loans		
Real GDP growth	0.57	0.19
Real exchange rate devaluation	–0.93	0.11
Term spread	–4.31	0.46
Bank characteristic and term spread:		
Liquidity	7.83	1.56
Size	13.24	2.83
Capitalization	–1.43	3.85
2. Growth of consumer loans		
Real GDP growth	1.09	0.19
Real exchange rate devaluation	–0.20*	0.10
Term spread	–2.65	0.57
Bank characteristic and term spread:		
Liquidity	6.41	1.66
Size	3.44	3.89
Capitalization	5.39	1.37
3. Growth of commercial loans		
Real GDP growth	–0.02	0.37
Real exchange rate devaluation	–1.71	0.21
Term spread	–6.85	0.99
Bank characteristic and term spread:		
Liquidity	13.59	4.01
Size	2.22	4.21
Capitalization	–3.94	6.28

*Statistically significant at the 1 percent level.
**Statistically significant at the 5 percent level.

 Table 3 shows the long-run coefficients for each of the explanatory variables. First, note that the long-run coefficient for the annual growth of real GDP, when statistically significant, is positive. Second, the long-run coefficient for annual real depreciation is always significant and negative. Third, the long-run coefficient of the term spread, which is positively related with a tighter monetary policy, is always significant and negative. Finally, regarding the interaction of bank characteristics with monetary policy, the results show that liquidity is always significant and positive, size is positive and significant only for total loans, and capitalization is positive and significant only for consumer loans.
 Table 4 shows the overall effects of a tight monetary policy in terms of the annual growth rate of total loans, consumer loans, and commercial loans.[15] As can be seen from the table, tightening monetary policy results in a larger drop in the growth rate of total loans for small

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 15. The overall effects include the direct effect of monetary policy plus the interactive effects of bank characteristics with monetary policy. If the parameter is nonsignificant, it is computed as being equal to zero. Bank characteristics are evaluated at three representative levels for each category.

banks than for large banks.[16] In addition, the drop in the growth rate of all types of loans is larger for less liquid banks than for more liquid banks.[17] In the case of consumer loans, the bank lending channel operates through less capitalized banks.[18]

Table 4. Overall Effect of a Monetary Policy Shock on the Growth Rate of Loans

Type of loan	Size (percentile)			Capitalization (percentile)			Liquidity (percentile)		
	25	50	75	25	50	75	25	50	75
Total	–4.2	–3.9	–3.5	–4.3	–4.3	–4.3	–3.3	–2.8	–2.2
Consumer	–2.6	–2.6	–2.6	–2.4	–2.3	–2.2	–1.8	–1.4	–0.9
Commercial	–6.9	–6.9	–6.9	–6.9	–6.9	–6.9	–5.0	–4.2	–3.1

Our preliminary results thus support the idea that the bank lending channel has operated in Chile. Furthermore, consumer loans seems to capture better the role played by informational asymmetries in the response of bank loans to monetary policy shocks. Indeed, both liquidity and capitalization have played a restrictive role for consumer loans, while commercial loans have only been affected by liquidity. We argued above that consumer loans are a reasonably good proxy for bank credit directed to both households and SMEs. Hence, our results in this first step suggest that the decrease in banks' loan supply may have actually been heterogeneous, affecting more SMEs and, to a lesser extent, highly indebted households than large enterprises. The next step concentrates on providing more solid evidence along this line.

3.2 Second Step: A VAR System Including an Aggregate Proxy for the Bank Lending Channel

The fact that the banks' loan supply affects borrowers heterogeneously can be exploited to identify how the bank lending channel exacerbates a monetary policy shock. We therefore construct the low/high quality ratio to capture the availability of bank credit to households and SMEs vis-à-vis large enterprises.[19] More specifically, we ask the following question regarding the impact of monetary policy on the real sector of the economy: does the bank lending channel play any significant macroeconomic role as a monetary transmission mechanism? To answer this question, we analyze whether the low/high quality ratio has marginal predictive power over a set of macroeconomic variables.

We expect a negative monetary policy shock to reduce the low/high quality ratio (flight to quality), which would strongly affect bank-dependent households and SMEs by eliminating their only source of

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16. A one percentage point increase in the term spread accounts for an annual reduction of 4.2 percent in total loans when the bank is small, but only 3.5 percent when the bank is large.

17. A one percentage point increase in the term spread accounts for an annual reduction of 3.3 percent in total loans, 1.8 percent in consumer loans, and 5.0 percent in commercial loans for a less liquid bank. On the other hand, a one percentage point increase in the term spread accounts for an annual reduction of only 2.2 percent in total loans, 0.9 percent in consumer loans, and 3,1 percent in commercial loans for a highly liquid bank.

18. A one percentage point increase in the term spread accounts for an annual reduction of 2.4 percent in consumer loans when the bank is less capitalized, but only 2.2 percent when the bank is more capitalized.

19. See section 1 for a more detailed explanation of this particular variable.

external funding.[20] For example, casual evidence for the Chilean economy shows that SMEs have quite limited access, if any, to bond issuing or capital raising in the stock market.[21] In other words, the decline in the low/high quality ratio represents a decrease in portion of the banks' loan supply directed to those economic agents (households and SMEs) who bear the largest share of the costs associated with information problems. This may, in turn, have a significant effect on economic activity.[22]

The empirical approach used in this section consists in estimating a set of VAR models in levels, each of which includes the low/high quality ratio that accounts for the existence of the bank lending channel. Four endogenous variables are also included, namely, the term spread as the indicator of the monetary policy stance, a proxy for macroeconomic activity (with six different alternatives), the real exchange rate, and the price level. Finally, every model includes a set of exogenous variables: terms of trade, inflation target, external output, and a time trend.[23]

To assess the macroeconomic importance of the bank lending channel, we test for the marginal predictive power of the credit variable (low/high quality ratio) by carrying out Granger causality tests and reporting the corresponding p values. A rejection of the null hypothesis that the credit variable is irrelevant for predicting macroeconomic activity is one piece of evidence in favor of the bank lending channel. This evidence has to be complemented with two simultaneous conditions, however: rejection of the null hypothesis that the term spread is irrelevant for predicting the credit variable and failure to reject the null hypothesis that the proxy for macroeconomic activity is useless in predicting the credit variable. In other words, the bank lending channel requires that lagged values of the term spread be significant in predicting the credit variable, which in turn must be significant in predicting either macroeconomic activity or other macroeconomic variables.

Table 5 shows the Granger causality test for each VAR model. The results support the hypothesis that the low/high quality ratio predicts macroeconomic variables in all cases. These results also indicate that the lags of the term spread are significant for predicting macroeconomic variables in just three out of six cases.[24] On the other hand, macroeconomic variables are not helpful for predicting the low/high quality ratio in each case, whereas the term spread is helpful for predicting the low/high quality ratio in all cases. The empirical

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20. See footnote 5.

21. This is consistent with the international empirical evidence, which shows that finding alternative sources of credit is quite difficult for SMEs.

22. The drop in the supply of bank credit pushes SMEs to curtail their productive activities, which are usually labor intensive. This has a strong impact in terms of job destruction, since the affected workers are generally unskilled and thus difficult to absorb into other sectors in the economy. Given that increasing unemployment rates are strongly correlated with consumer confidence (in the United States and elsewhere), aggregate demand falls. Hancock and Wilcox (1998) find that small banks engage in "high power" credit activities, in that a one-dollar drop in their credit supply has a large impact on economic activity, measured in terms of unemployment, real wages, GDP, and number of bankruptcies.

23. We use a two-step procedure to define the optimal lag structure (Johansen, 1995): the first step uses the Schwarz-Bayesian criterion; the second step adds additional lags for eliminating any evidence of serial correlation detected by the multivariate LM test statistics for residual serial correlation.

24. At the 5 percent level of significance.

evidence thus strongly supports a causality running from monetary policy
to credit and from credit to macroeconomic activity.

Table 5. VAR Pairwise Granger Causality/Block Exogeneity Wald Tests[a]
P values from exclusion test

| | Low/high quality mix ratio[bcd] | | | |
| | Variables exclude from: | | | |
Models classified according to proxies for macroeconomic activity	*Macroeconomic activity equation*	*P values (percent)*	*Low/high quality mix ratio equation*	*P values (percent)*
GDP[e]	Monetary policy shock	95.6	GDP	73.6
	Low/high quality mix ratio	0.0	Monetary policy shock	0.2
Industrial production[e]	Monetary policy shock	4.5	Industrial production	90.7
	Low/high quality mix ratio	0.5	Monetary policy shock	0.6
Business investment[e]	Monetary policy shock	68.7	Business investment	66.5
	Low/high quality mix ratio	0.0	Monetary policy shock	0.2
Durable consumption[f]	Monetary policy shock	0.2	Durable consumption	52.6
	Low/high quality mix ratio	1.9	Monetary policy shock	3.3
Unemployment rate[e]	Monetary policy shock	44.7	Unemployment	95.6
	Low/high quality mix ratio	0.0	Monetary policy shock	0.8
Residential investment[f]	Monetary policy shock	3.1	Residential investment	55.4
	Low/high quality mix ratio	1.9	Monetary policy shock	2.5

a. This table shows the results obtained from six VAR models. Each one uses a different option for measuring macroeconomic activity: real GDP, industrial production, business investment, durable consumption, the unemployment rate, and residential investment. Each proxy is added one at time to the base VAR. The base model comprises five variables: real GDP, the consumer price index, the term spread, the low/high quality mix ratio, and the real exchange rate. The exogenous variables are the terms of trade, the inflation target , external output, and a time trend.

b. The numbers in the table are the *p* values for the null hypothesis that some variables contain no information for the dependent variable. For each model, we choose the equations that represent both the proxy for macroeconomic activity and the credit variable (low/high quality mix ratio). We then test, respectively, whether the term spread and the credit variables do not Granger cause macroeconomic activity and whether macroeconomic activity and monetary policy do not Granger cause the credit variable. In other words, if the *p* value is lower than 5 percent, we can reject the null hypothesis.

c. Ratio of credit bank loans for consumer and small firms to short-term bank debt of all firms, from FECUS dataset.

d. The exogenous variables are a time trend, the inflation target, the terms of trade, and external output.

e. Endogenous variables have two lags, exogenous variables have two lags.

f. Endogenous variables have three lags; exogenous variables have two lags

To study the dynamics of the bank lending channel, we estimate a
structural vector autoregression (SVAR) and report impulse responses to
a monetary policy shock. The set of identifying assumptions is borrowed
from a vast list of authors who use this type of identification scheme
in VAR models.[25] Variables are thus divided into three recursive sets:
nonpolicy variables that are not contemporaneously affected by the
policy variables; policy variables; and nonpolicy variables that are
contemporaneously affected by the policy variables.[26] In other words,
the Central Bank's feedback rule is identified by dividing the set of
nonpolicy variables into variables that cause a policy reaction and
variables that are affected by the policy reaction. For the policy
variables, we assume the following sequence of events: the Central Bank
first sets an inflation target, which is an exogenous variable, and it

25. See, for example, Christiano, Eichenbaum, and Evans (1996, 1997, 1999);
Eichenbaum and Evans (1995); Strogin (1995); Bernanke and Blinder (1992);
Bernanke and Mihov (1998); and Gertler and Gilchrist (1994). For the case of
Chile, see Bravo and García (2002).
26. In our particular case, we use an exactly identified VAR because
additional identifying restrictions in the parameters do not change the results
obtained in the impulse response functions.

then sets the monetary policy stance.[27] For the nonpolicy variables, we assume a recursive causal relationship ordered as follows: price level, output, and the credit variable.[28] Our positioning of the variable used as a proxy for the bank lending channel (low/high quality ratio) in last place is based on the assumption that the Central Bank is able to affect it contemporaneously through the monetary policy stance, since capital markets tends to respond faster than goods and labor markets.[29]

Figure 6 displays the estimated impulse responses represented by black lines. The low/high quality ratio decreases following the monetary policy shock, a result that is consistent with a flight-to-quality effect as described above. GDP declines about two quarters after a tightening in monetary policy. The maximum decline occurs about a year after the shock, and the effect gradually dies out thereafter. We observe a similar pattern when GDP is substituted with industrial production or unemployment rate, although the effect seems to be more persistent in the latter case.

When both investment and durable consumption replace GDP, these two components of aggregate output decline during the first year and a half. Such a result differs from the international empirical evidence. For example, Bernanke and Gertler (1995) find evidence that in the United States the decline of durable consumption and residential investment precede business fixed investment. Their interpretation is against the conventional monetary policy transmission mechanism that operates through an earlier decline in investment. In the Chilean case, however, the impulse responses indicate that durable consumption and both types of investment decrease at approximately the same time. We interpret this as evidence that both transmission mechanisms are relevant for Chile.

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27. This assumption is consistent with the fact that the monetary policy rate is used as a fine-tuning policy, given a known inflation target.

28. The assumption behind this order is that the price level is stickier than output, a fact that is consistent with the high level of backward indexation in the Chilean economy (Jadresic, 1996).

29. To illustrate the identifying assumptions described above, assume that the Central Bank contemporaneously knows the evolution of the inflation rate but is not able to affect it. If the economy faces an inflationary shock (an oil shock, for instance), the Central Bank could respond with a change in the monetary policy rate. This, in turn, will have an immediate impact on other variables, such as the low/high quality ratio and the exchange rate. Only then may monetary policy affect variables such as GDP, investment, consumption, and inflation.

Figure 6. Response to Structural One S.D. Innovations ± 2 S.E on Monetary Policy Shock[a]

Low/high quality mix ratio

GDP

Industrial Production

Business Investment

Durable Consumption

Unemployment Rate

Residential Investment
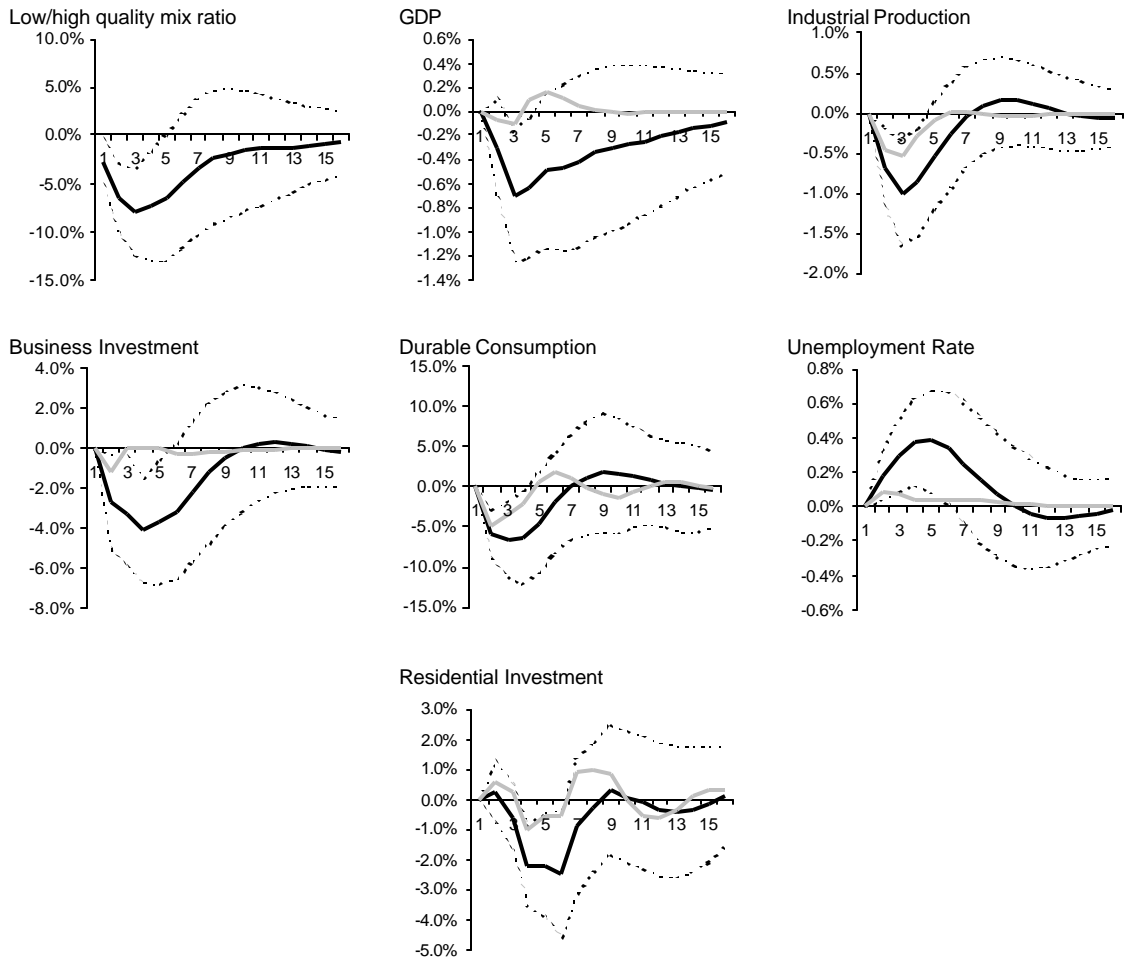
a. For VAR specification, see table 5. Black lines for the BLC (low/high quality ratio) are endogenous; Gray lines for the BLC (low/high quality ratio) are endogenous.

The empirical strategy described above allows us to compare the impulse responses to a monetary policy shock in two different systems, in which the variable used as a proxy for the bank lending channel (low/high quality ratio) is first defined as endogenous (black lines) and then as exogenous (gray lines). Shutting down the bank lending channel effect on other macroeconomic variables following a monetary policy shock establishes a measure of the macroeconomic relevance of the bank lending channel: namely, the difference between the two impulse responses[30]. To determine whether this difference is statistically significant, we display the dashed lines that represent a 95 percent confidence interval for each impulse response function when the bank lending channel is endogenous. If the impulse response functions calculated under the assumption that the credit variable is exogenous fall outside this confidence interval, we interpret this as evidence in favor of the macroeconomic relevance of the bank lending channel.

What do we find? The bank lending channel is unambiguously relevant in terms of GDP, business investment, and the unemployment rate, since the responses of these variables are definitely much weaker if the bank lending channel is exogenously included in the system. The other results also support the macroeconomic relevance of the bank lending channel to a degree, since durable consumption, residential investment, and industrial production are on the brink of being statistically different from the case of an endogenous bank lending channel.[31]

4. Concluding Remarks and Directions for Future Research

We conclude that the bank lending channel operated as a monetary policy transmission mechanism in Chile during the period 1990–2002, with an independent and significant effect in terms of macroeconomic activity. The way that the bank lending channel seems to have operated in Chile is consistent with the international empirical evidence: first, some banks—less liquid banks and, to a lesser extent, small and less capitalized banks—are forced to curtail their supply of credit following a monetary policy shock; second, the access of households and SMEs to external financing is severely restricted following the drop in the supply of bank credit; third, the uneven distribution of the drop in the supply of bank credit, which can be associated to a flight-to-quality effect, has a significant influence in terms of macroeconomic activity. By pushing toward a better understanding of the way in which the bank lending channel operates as a transmission mechanism of monetary policy in Chile, our paper contributes to an improvement of the monetary policy decision framework.

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30. From the Granger causality tests, we already know that the empirical evidence strongly supports a causality running from monetary policy to credit and from credit to macroeconomic activity. What we are doing here, therefore, is determining whether the flight-to-quality effect occurs as a result of a monetary policy shock or is driven by other factors.

31. We are using a relatively small data set given the relatively large set of variables included in the VAR system, meaning that we are dealing with large sampling uncertainty. The 95 percent confident interval is thus a rather strict test. For instance, researchers tend to use +/–1 standard deviation when dealing with large sampling uncertainty, meaning that a 67 percent confidence interval for the true impulse response function is considered good enough for the purpose at hand (see, for example, Stock and Watson, 2001). If we use the latter benchmark, the macroeconomic relevance of the bank lending channel is unambiguously supported for all variables used as a proxy for macroeconomic activity.

Our focus in this paper is on explaining cross-sectional differences among economic agents (banks, firms, and, to a lesser extent, households). The evidence gathered in this paper therefore points toward a bank lending channel operating across the sample period, abstracting from the asymmetries related to times in and out of tight monetary policy and from the evolution of certain features in the economy that may affect the strength of the bank lending channel. For example, information problems are likely to be less binding in periods of relatively loose monetary policy, rendering the bank lending channel much less relevant as a transmission mechanism in comparison with periods of a tighter monetary stance. In particular, the large monetary policy shock in 1998–99 probably represents the bank lending channel operating at its maximum strength, although the counterfactual exercise of what would have happened had the exchange rate been allowed to depreciate sharply points to the possibility of a financial accelerator mechanism as well, through larger balance sheet effects. Another example is the role played by the increase in the capital-base of banks during the 1990s, as well as the more widespread use of credit scoring. Both trends have probably strengthened the capacity of banks to deal with informational asymmetries.

This study underscores at least four avenues for future research that may deepen our knowledge of the functioning of the credit channel, in general, and the bank lending channel, in particular, as transmission mechanisms for the monetary policy in the Chilean economy: (i) improvements in measuring the monetary policy shock; (ii) improvements in measuring the costs for bank-dependent borrowers associated with a drop in banks' credit supply; (iii) improvements in incorporating the effects of policy changes and financial sector developments; and (iv) improvements in assembling more comprehensive datasets at the microeconomic level.

The different transmission mechanisms of monetary policy can be illustrated by means of the diagram in figure A1 (Kuttner and Mosser, 2002). The transmission mechanism process begins with the Central Bank's definition of a monetary policy rate. The interbank rate then converges to this objective through the regulation of the liquidity of the financial system. Once the liquidity of the financial system is adjusted, different mechanisms start operating in the transmission channel. Four of these are activated by market interest rates moving in tandem with the interbank interest rate. These are the interest rate channel, in which an increase in the cost of capital reduces the domestic aggregate demand through a fall in investment and in the consumption of durable goods; the exchange rate channel (in open economies), which operates through the effect of the uncovered interest rate parity on net imports; the asset price channel (stocks, bonds, and real states), which generates a wealth effect that has an impact on consumers' decisions; and the broad credit channel (broad credit channel), which is also related to the market value of assets and which is described in the introduction. The transmission mechanism of monetary policy does not end there, however. It is possible to distinguish two additional channels, namely, the monetarist channel related to changes in relative prices of assets and the bank lending channel (bank lending channel), the main issue of our paper.

Figure A1. Channels of Monetary Policy Transmission
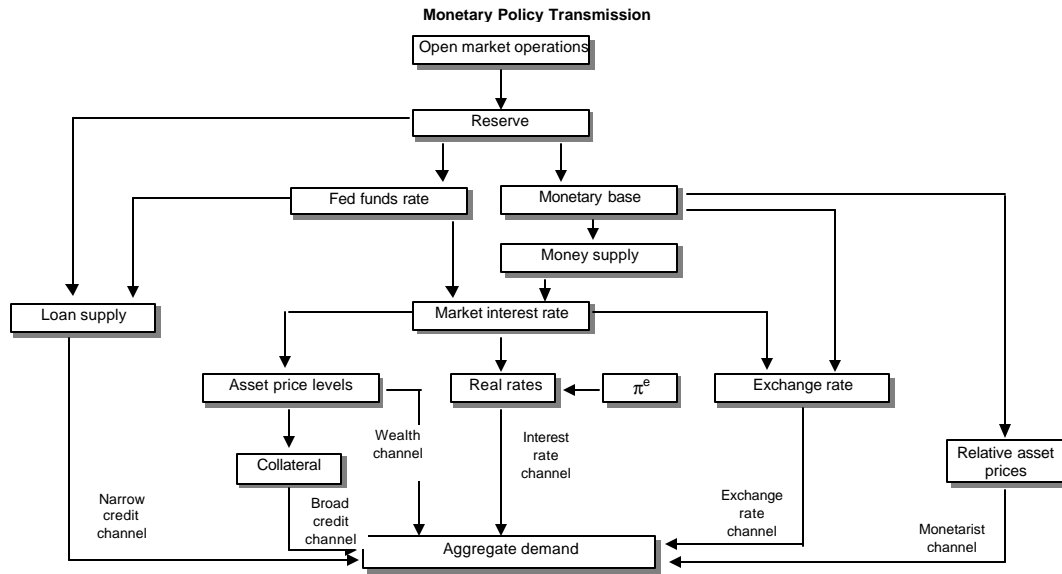
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