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Bank Lending Channel of Monetary Policy: Evidence for Colombia, Using a Firms´ Panel Data[*][†]

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Abstract

In this paper we find empirical evidence of bank lending channel for Colombia, using a balanced panel data of about four thousand non-financial firms. We find that increases in the interest rate, proxiing for the monetary policy instrument, lead to a reduction in the proportion of bank loans, out of total debt, of the firms. This bank lending channel amplifies the effect of the traditional interest rate channel, which leads to a reduction in total debt and spending when monetary policy tightens. Our evidence suggests that firm size matters in the transmission of monetary policy through the bank lending channel: smaller firms have a higher probability of being credit rationed after a tightening of monetary policy than (otherwise identical) larger firms.

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1 Introduction

The mechanisms trough which monetary policy affects the economy have been subject of intense academic debate. The most commonly accepted monetary

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transmission channel, the traditional interest rate channel, suggests that a tightening of monetary policy reduces spending through its direct effect on consumption and investment. However, as Bernanke and Gertler (1995) point out, empirical studies of the interest rate channel have not been succesful in explaining how moderate increases in interest rates induced by monetary policy have led to shap decreases in GDP and aggregate demand components. These empirical findings have led to a vast literature that tries to identify and quantify other monetary transmission mechanisms, which complement and amplify the interest rate channel.

A long-standing question has been whether financial institutions in general, and banks in particular, play an important role in the transmission of monetary policy to the real economy. The literature identifies two channels in which financial institutions might play a significant role, namely, the balance sheet channel (or broad credit channel) and the bank lending channel (or narrow credit channel).

The balance sheet channel was first introduced by Bernanke and Blinder (1988). The main idea of this mechanism is that in the presence of imperfect capital markets, informational asymmetries between borrowers and lenders cause a gap in the cost of internal and external sources of funding to borrowers. In general, this gap has a negative relation with the collateral of the borrower. A contractionary monetary policy has the effect of increasing real interest rates, therefore reducing the value of assets that act as collateral, which has the effect of deteriorating credit worthiness of borrowers. Therefore, consumption and investment plans that would be profitable if financed entirely with internal sources of funding are no longer profitable when financed partially with external sources. This effect leads to a lower level of aggregate demand in the economy, magnifying the effects of the interest rate channel. Note that there is no specific role played by banks in the broad credit channel.

On the other hand, the bank lending channel gives a specific role to banks. The basic idea is that a contractionary monetary policy that reduces bank deposits creates a need for alternative funds in order to maintain the level of loans. If such alternative funds are scarce or not available, then banks will necessarily reduce their loan supply, affecting negatively consumption and investment plans. Therefore, the bank lending channel amplifies the effect on aggregate demand of a contractionary monetary policy.

In order to have a bank lending channel two conditions are required: first, some firms must be dependent on bank loans; second, the central bank must be

able to shift bank loan supply schedules. Regarding the first condition, there is evidence that suggests that small firms are bank dependent[1]. This occurs because banks have a comparative advantage in the sense of having lower costs of obtaining information about (and monitoring) their customers than other investors. Also, small firms generally lack access to securities markets. This suggests that the effect of the bank lending channell should be more important for countries with less developed capital markets.

With respect to the second condition, a contractionary monetary policy has the effect of reducing the aggregate level of deposits[2]. Since these are one of the least expensive sources of financing for banks, it will be costly (for some banks) and even impossible (for others)[3] to offset the shortage in deposits with other sources of funding. In particular, if the Modigliani-Miller financial irrelevance theorem (Modigliani and Miller, 1958) does not hold for the banking firm, some banks will not be able to obtain loanable funds required to maintain their level of lending, and therefore their loan supply will drop[4]. Then financial variables that measure banks' financial health can play an important role, in the sense that banks with weak balance sheets are more affected by informational asymmetries than banks with stronger balance sheets.

Empirical work on the existence of a bank lending channel has focused on the correlations among aggregate variables, such as bank debt, monetary policy instruments, and variables proxying for economic activity (see, for example, Romer and Romer (1990) and Ramey (1993)). However, this work is subject to an important identification problem, as with aggregate data it is impossible to identify shifts in the demand for loans from shifts in the supply of loans (see Kashyap and Stein (2000)). Several country-specific studies have used

[1] For the United States, see Fazzari et al. (1988).

[2] Bernanke and Blinder (1992) show that aggregate deposit fall immediately when the Fed tightens monetary policy. Using bank dissagregated data, Kashyap and Stein (1995) also provide evidence that supports this.

[3] Because demand deposits are insured, they are less subject to informational asymmetries relative to other sources of funding (i.e. large time deposits). Meanwhile, other sources of funding for banks are uninsured, which makes them more likely to suffer information problems. Therefore, bank characteristics that are not so important for the obtention of deposits become very relevant for the acquisition of other sources of funds, such as large CDs.

[4] Another way in which a contractionary monetary policy can affect bank lending is through its impact on the capitalization ratio. Banks face interest rate risk given their role in maturity transformation: they hold long term assets (many of them with a fixed interest rate), which they finance issuing short term liabilities. Therefore, a contractionary monetary policy, which increses short-term interest rates, increases the debt of the banks and decreases the net present value of its assets, thus reducing bank profits. If banks cannot reduce dividend payments substantially, then equity is reduced. Given the minimum capitalization requirements, some banks that initially had a low capitalization ratio, will have to cut lending to meet the capitalization requirement as a short term response.

microeconomic data to overcome this identification problem. Most of these studies have focused in identifying this channel using bank-specific data (for instance, see Alfaro et al. (2005), for the case of Chile, Altunba et al. (2002) for a list of European countries, Huang (2003) for the case of the UK, and Gómez González and Grosz (2007) for the case of Argentina and Colombia). The empirical evidence shows that more solvent and liquid banks are more capable of maintaining the level of their credit investments when faced with a tightening of monetary conditions, without needing to resort to other alternative sources of finance.

In the case of non-financial firms, however, there is very limited empirical evidence, particularly for developing countries. The identification problem affecting the evidence on the bank lending channel can be solved by comparing the movements of bank loans and other sources of financing on firms´ balance sheets after changes in the monetary policy instrument. After a tightening of monetary policy, the traditional interest rate channel would imply a reduction in the demand for loans and other types of debt equally. Therefore, a reduction in the proportion of firms´ bank debt out of total debt provides evidence of a fall in the supply of bank loans, consistent with the operation of a bank lending channel.

This study uses a panel data of firm-specific variables for the period 1995 - 2007, and provides evidence of a bank lending channel for Colombia. We are particularly interested in the effect of firm´s size on the reponse of the firm´s financing after a monetary policy shock. The literature linking liquidity constraints to capital market conditions points out that the propensity of a firm to be credit rationed depends on the firm size. Due to adverse selection in a market with asymmetric information, the likelihood of credit rationing tends to increase as firm size decreases (Stiglitz and Weiss, 1981). In a seminal empirical study on financial constraints, Fazzari et al (1988) find evidence that liquidity constraints tend to be more binding as firm size decreases. Consistent with the literature on financial constraints, in this study we show that the bank lending channel is stronger for smaller firms.

The rest of the paper is organized as follows. Section 2 presents a model, based on the one developed by Kashyap, Stein, and Wilcox (1993), which has testable implications for the empirical analysis. Section 3 discusses the data. Section 4 presents the empirical analysis and results, and Section 5 concludes.

2 A simple model for testing the bank lending channel using firm-specific data

Following Kashyap, Stein, and Wilcox (1993), firms choose the optimal combination of bank debt (B) and non-bank debt (N) in order to minimize the financial cost of their total debt (D). This cost has two components: i) the direct payment of interests on each corresponding type of debt, $r_B B + r_N N$, where r_B stands for the interest rate on bank debt and r_N stands for the interest rate on non-bank debt; ii). and, a *relationship* benefit that has the effect of reducing banking costs, which is created on the long-term relationship establisehd by the firm with a bank, given by $R = f\left(\frac{B}{D}\right) D$, where $f(\cdot)$ is a twice continuously differentiable, strictly increasing, strictly concave function, and *cap* represents the solvency of the firm, which is exogenously given. Further, assume Inada conditions hold.

The problem faced by the firm is to (Problem P)

$$\min_{B,N \geq 0} r_B B + r_N N - f\left(\frac{B}{D}\right) D$$

subject to the constraint

$$B + N = D$$

Assuming $r_B - r_N < f'(1)$, the first order condition of this problem is

$$r_B - r_N = f'\left(\frac{B}{D}\right)$$

Let i be the monetary policy instrument. Differentiating the first order condition with respect to i, we get

$$\begin{aligned} \frac{d\left(r_B - r_N\right)}{di} &= \frac{d\left[f'\left(\frac{B}{D}\right)\right]}{di} \\ &= f'\left(\frac{B}{D}\right) \frac{d\left(\frac{B}{D}\right)}{di} \end{aligned}$$

Thus

$$\frac{d\left(\frac{B}{D}\right)}{di} = \frac{d\left(r_B - r_N\right)}{di} \frac{1}{f'\left(\frac{B}{D}\right)}$$

Note that the second argument of the right-hand side of the last equation is negative, due to the concavity of $f(\cdot)$. Therefore, the sign of the response of the optimal debt mix, $\left(\frac{B}{D}\right)$, to a change in the monetary policy instrument, will be the opposite of the sign of the movement of the interest rate spread between bank and non-bank debt induced by the change in i:

$$sign\left\{\frac{d\left(\frac{B}{D}\right)}{di}\right\} = -sign\left\{\frac{d\left(r_B - r_N\right)}{di}\right\}$$

If a tightening of monetary policy leads to a decrease in the supply of bank credit, relative to other sources of finance, then $sign\left\{\frac{d(r_B - r_N)}{di}\right\} > 0$, implying $sign\left\{\frac{d\left(\frac{B}{D}\right)}{di}\right\} < 0$. This is a testable implication of the model. If bank debt, as a fraction of total debt, decreases when the interest rate used as the monetary instrument increases, we can consider there is evidence of the operation of a bank lending channel.

3 Data source

The data for firms was collected by the Superintendencia de Sociedades, the organism that regulates non-financial firms in Colombia. The sample consists of a panel of annual observations on firms from 1995 to 2007. For each year, more than six thousand firms submit information about their balance sheets. The panel is unbalanced, due to the entry and exit of firms, and also to the fact that some firms report their balances for some years but not for others (not necessarily for consecutive years).

After eliminating the data base for firms that have an early exit or a late entry, or that do not report for the whole span of time, we are left with a balanced panel of around four thousand non-financial firms belonging to various economic sectors. We collected several financial variables from those firms´ balance sheets.

4 Empirical specification and results

Based on the model presented above, the empirical specification in the panel approach is the following:

$$\left(\frac{B}{D}\right)_{it} = \gamma_i + \sum_{j=1}^{2}\left(\frac{B}{D}\right)_{it-j}\alpha + \sum_{j=0}^{2} i_{t-j}\beta + \sum_{j=0}^{2} size_{t-j}\eta + + \sum_{j=0}^{2} cap_{t-j}\phi + \sum_{j=0}^{2} i_{t-j}size_{t-j}\delta + \sum_{j=0}^{2} i_{t-j}cap_{t-j}\lambda + \xi_{it}$$

where $(\alpha, \beta, \gamma, \delta, \eta)$ is the vector of unknown parameteres we wish to estimate, i represents the real interbank interest rate, cap is a financial variable proxiing for the solvency of the firm, $size$ represents the size of the firm, measured as the firm´s total assets, and ξ_{it} represents the error term, which is assumed to be identically and independently distributed. We are particularly interested in the sign of β, which we expect to be negative. A solvency variable is included in order to control for other financial factors which might influence the proportion of bank debt out of total debt a firm holds.

The inclusion of $size$ as a regressor follows the literature linking liquidity constraints to capital market conditions, which shows that smaller firms face a higher probability of being credit rationed than larger firms of similar financial conditions.

It is natural to consider that the current level of $\frac{B}{D}$ strongly depends on past levels of $\frac{B}{D}$ (see Gómez González and Grosz (2007)). For that reason, lags of the dependent variable are included as regressors in the empirical equation. Thus, we have a dynamic panel data model. In order to estimate this model, we use the Arellano and Bond (1991) GMM methodology, which corrects the inconsistency of the within estimator and provides heteroscedastic-consistent parameter estimates. Additionally, this methodology allows controlling for non-observable firm effects and for potential endogeneity of the variables included as regressors. The lag structure was defined following standard information criterion.

Estimations were run on firts differenced data to remove firm-specific effects. Instrumental variables of $t-2$ lagged values of the variables were used, to account for possible endogeneity in the model.

The main results are summarized in Table 1, which presents the long run coefficients for the monetary policy instrument, $size$, the interaction variable, and the lagged dependent variable.

Table 1: Dependent variable is $\frac{B}{D}$

Variable	Coefficient	Standard error
Lagged $\frac{B}{D}$	-0.255*	0.010
Interest rate	-0.092*	0.0394
Solvency	0.000	0.000
Solvency Interaction	0.005	0.005
Size	-0.000	0.000
Size Interaction	0.001	0.002

$*$ Significant at the 5% level.

The results in Table 1 provide strong evidence of the presence of a bank lending channel of monetary policy in Colombia: increases in the interest rate induce reductions in the proportion of bank debt of firms, even after controlling for other variables which affect significantly the dependent variable, such as solvency, size and its own lagged values. Colombian firms, independently of their size, experiment a reduction of bank credit as a proportion of their total sources of finance, after a monetary policy tightening.

Note that the interaction variables do not appear to affect significantly the dependent variable. Thus, we do not find evidence, under this specification, that differences on firm size or solvency explain differences in the response of firms to changes in the interbank interest rate. In other words, we do not find evidence that firm size or firm solvency affect the magnitude of the bank lending channel in Colombia.

As a robustness test for the evidence of a bank lending channel presented before, we separate firms into four groups according to their size. Group 1 is composed by the firms in the lowest quartile (smallest firms), while Group 4 is composed by the firms in the highest quartile (largest firms). The intuition behind grouping firms this way, is that a tightening of monetary policy should affect more the firms in the lowest quartile, in the sense that these will be more credit constrained than firms in higher quartiles (according to the credit constraints literature). We run the same regression we ran above for each group of firms excluding, obviously, *size* and the interaction between this variable and the interest rate from the group of regressors. Results are presented in tables 2 to 5.

Table 2: Dependent variable is $\frac{B}{D}$ (GROUP 1)

Variable	Coefficient	Standard error
Lagged $\frac{B}{D}$	-0.232*	0.020
Interest rate	-0.199*	0.083
Solvency	0.000	0.000
Solvency Interaction	0.005	0.007

∗ Significant at the 5% level.

Table 3: Dependent variable is $\frac{B}{D}$ (GROUP 2)

Variable	Coefficient	Standard error
Lagged $\frac{B}{D}$	-0.299*	0.019
Interest rate	-0.092	0.074
Solvency	-0.000	0.000
Solvency Interaction	-0.010	0.016

∗ Significant at the 5% level.

Table 4: Dependent variable is $\frac{B}{D}$ (GROUP 3)

Variable	Coefficient	Standard error
Lagged $\frac{B}{D}$	-0.300*	0.019
Interest rate	-0.112	0.077
Solvency	0.002	0.002
Solvency Interaction	0.024	0.034

∗ Significant at the 5% level.

Table 5: Dependent variable is $\frac{B}{D}$ (GROUP 4)

Variable	Coefficient	Standard error
Lagged $\frac{B}{D}$	-0.204*	0.020
Interest rate	0.047	0.078
Solvency	-0.002	0.002
Solvency Interaction	-0.145	0.099

∗ Significant at the 5% level.

Tables 2 to 5 provide interesting evidence about the way in which the bank lending channel operates. Particularly, note that only the smallest firms (those belonging to Group 1) appear to reduce significantly the proportion of bank debt out of total debt when the interbank interest rate increases. Those firms pertaining to the other groups do not appear to be significantly affected in their financing structure when monetary policy tightens. Therefore, there is evidence

that the bank lending channel operates fundamentally over small firms. This result is consistent with the credit constraints literature, that establishes that in a world with asymmetric information firms with lower collateral have a higher probability of being credit rationed by banks than larger (otherwise identical) firms.

Our evidence suggests that the solvency of the firm, proxied by *cap*, does not have any effect on the debt structure of firms. We also find that the probability of being credit rationed does not vary with the degree of solvency of the firm.

5 Conclusions

In this paper we find empirical evidence of a bank lending channel for Colombia, using a balanced panel data of about four thousand non-financial firms. We find that increases in the interest rate, proxiing for the monetary policy instrument, lead to a reduction in the proportion of bank loans, out of total debt, of the firms. This bank lending channel amplifies the effect of the traditional interest rate channel, which leads to a reduction in total debt and spending when monetary policy tightens.

Our result agrees with, and complements, those obtained by Gómez González and Grosz (2007), who provide evidence of the existence of a bank lending channel in Colombia using bank-specific financial variables.

We also find evidence sugesting that firm size matters in the transmission of monetary policy through the bank lending channel: smaller firms have a higher probability of being credit rationed after a tightening of monetary policy than (otherwise identical) larger firms. This result agrees with the literature linking financial constraints to credit market conditions, that suggests that the propensity of a firm to be credit rationed depends inversely on the firm´s size.

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