Constrained Banks, Constrained Borrowers

The Effects of Bank Liquidity on the Availability of Credit

(Job Market Paper)

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January 2005

Abstract. Bank liquidity constraints affect investment only if bank credit cannot easily be substituted for other sources of finance. This paper provides evidence that banks are constrained and hold private information about borrowers that hinders substitution of financing sources. I test for liquidity constraints by showing that the amount of bank lending is sensitive to an exogenous change in the financial position of banks caused by a credit market intervention by the Argentine government. I estimate that lending increases by $0.7 for each dollar of additional liquidity. Furthermore, this expansion appears to be profitable: the additional loans are not more likely to default than other loans. Using loan level data from a public credit bureau, I track the effects of the liquidity shock on the composition and default risk of loans across borrowers for which the bank has an information advantage relative to other lenders. I find that when banks hold an information advantage they rely less on collateral to ration credit and are able to screen out high risk borrowers. Conversely, when banks are relatively uninformed they are reluctant to extend credit and attract high risk borrowers. The results suggest that adverse selection prevents full arbitrage by competing lenders and thus liquidity constraints propagate to bank-dependent borrowers. (JEL: D82, G21, G32, E52, O16)

* I thank Abhijit Banerjee, Esther Duflo, Sendhil Mullainathan and Antoinette Schoar for invaluable comments and discussions. This work also benefited greatly from the thoughts of Josh Angrist, David Autor, Serdar Dinc, Michael Greenstone, Dirk Jenter, Alexis León, Raj Mehra, Jun Pan, Verónica Rappoport and all the participants of the MIT Development/ Finance/Applied Micro lunches and seminars. Address comments to the author to dparavis@mit.edu.

1. Introduction

The question of how bank liquidity constraints affect lending, economic activity and business cycles has long been of concern to the academic literature on financial institutions. Financially constrained banks are the proposed culprit behind recent accounts of the Great Depression (Bernanke 1983) and capital crunch based explanations of the US recession of the early 90's (Sharpe 1995). They are also key for the existence of a lending channel of transmission of monetary policy (Bernanke and Blinder 1988; Holmstrom and Tirole 1997; Stein 1998). Given the major role financial intermediaries play in the allocation of capital, frictions that affect the ability of intermediaries to lend can have a large effect on the overall efficiency of investment. However, constraints faced by individual banks will matter for financial intermediation only if other providers of finance (bank or non-bank) cannot cover the excess credit demand. The question of whether banks are financially constrained is therefore relevant to the extent that lender substitution is not frictionless.

This paper provides evidence that banks are liquidity constrained and hold private information about borrowers that hinders firms from freely substituting across financing sources. It does so by using loan level data to follow the effect of an exogenous liquidity shock on the amount, composition, and default risk of bank lending. As a source of exogenous variation in banks' financial position, I exploit a government program that made limited amounts of financing available to banks in Argentina. This setting disentangles changes in bank liquidity from variations in investment opportunities –i.e. the opportunity to make profitable loans– and thereby allows a clean test of liquidity constraints. Also, novel data from a Public Credit Registry allows constructing the individual credit histories of all the borrowers in the financial system at the time of the government program. I classify loan recipients by their credit history and argue that banks have an information advantage on lending to borrowers for whom they have an established a relationship, and a disadvantage if they have no pre-existing relationship but other banks do. Comparing credit allocation rules and repayment performance across types of loan recipients shows that private information is likely to affect the ability of borrowers to switch lenders.

I test for liquidity constraints using information from monthly bank balance sheets between 1998 and 2000 to show that lending reacts to changes in the financial position of the bank induced by the program. The magnitude of the response is substantial, on the order of $0.7 per dollar of liquidity expansion. The program financing considered in this study is not large enough to affect the bank's marginal cost of capital, and is also uncorrelated with investment opportunities of the bank. Therefore, the sensitivity of lending to exogenous changes in liquidity provides evidence that banks face binding liquidity constraints.[1]

In the past, testing empirically for the existence of bank liquidity constraints has proved a difficult task. A broad literature on the lending channel highlights the time series correlation between the financial position of banks and loan growth (Bernanke and Gertler 1995; Hubbard 1995; Peek and Rosengren 1997; Ostergaard 2001), and the observation that this correlation is stronger for smaller, less capitalized banks, which are more likely to be constrained (Jayaratne and Morgan 2000; Kashyap and Stein 2000; Kishan and Opiela 2000; Ashcraft 2003). The interpretation of the findings as evidence of liquidity constraints has been questioned on the grounds of reverse causality and omitted variables. The observed patterns could arise in the absence of liquidity constraints when the shocks to bank liquidity are associated to changes in bank investment opportunities.[2] Using the expansion in available finance provided by the government program as a source of variation in bank liquidity avoids this problem. Furthermore, the program rules induced non-linearities in participation that allow dealing with the potential endogeneity of program resource allocation.[3] The exogenous shock to bank liquidity provides a test of the validity of the past work based on the comparison across banks sorted according to a proxy for liquidity constraints. I find that the

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[1] The test for existence of liquidity constraints is based on rejecting the predictions of the Modigliani-Miller (MM) proposition for banks. The optimal response of an unconstrained bank to a cash windfall that doesn't affect the marginal cost of capital is to reduce market priced liabilities or to distribute it among investors as dividends. Expanding lending would yield a return below the opportunity cost of capital. The same underlying logic is behind the investment-cash flow literature in corporate finance and the empirical work on the lending channel. See Stein (2003) for a recent survey on both.

[2] See Kashyap and Stein (2000) for the critiques on the time series correlation and Kaplan and Zingales (1997; 2000) for the concerns with interpreting the cross sectional patterns of investment sensitivity to liquidity as evidence of financial constraints in the context of non-financial firms.

[3] The program was implemented in several waves of exogenously determined timing and size. Also, the allocation of program resources across banks was given by a strict administrative rule. Using the interaction of the amount and timing of the waves and the administrative formula I simulate available financing from the program using only exogenous sources of variation. Simulated financing is then used to instrument for bank liquidity.

cross sectional variation in the sensitivity of lending to liquidity is small relative to its absolute size, which suggests that cross sectional comparisons tend to underestimate the magnitude of this elasticity.

A positive sensitivity of lending to liquidity is, however, also consistent with free cash flows theories of investment (Jensen 1986). The free cash flow and the liquidity constraints interpretations of the observed sensitivity of lending to liquidity have contrasting predictions on the profitability of the marginal loan. Under the free cash flow view, an exogenous expansion in available financing leads to a deterioration of the quality of bank investment. The loan level data used in this paper allows testing this implication by looking at the performance of loans issued during liquidity expansions. The results indicate that loans financed during liquidity expansions are not more likely to default than loans issued in other periods. This finding is consistent with the liquidity constraints interpretation and, under plausible assumptions, suggests constraints prevent banks from undertaking profitable lending opportunities.

Having found banks are constrained, the rest of the paper is devoted to test whether borrowers can easily substitute bank credit for other sources of finance. The paper documents how lending behavior is consistent the predictions of well known models of private information in lending relationships (Sharpe 1990; Rajan 1992; Petersen and Rajan 1995; Von Thadden 2001). The common assumption in this literature is that banks elicit private information about borrower creditworthiness through the relationship. As a result, competing uniformed lenders face adverse selection and a potential winner's curse when attempting to bid a borrower away from an informed bank. Uninformed lenders are reluctant to extend credit to borrowers that are switching from informed sources of finance, and attract borrowers of a low average quality when they do so. [4]

The paper proceeds by distinguishing borrowers for which a bank has an information advantage relative to other lenders. I make a distinction between loan recipients that had a previous relationship with the bank ('existing' borrowers) and those that did not ('new'

[4] The winner's curse term is borrowed form the theory of competitive bidding under asymmetric information and common values. Broeker (1990), Rajan (1992), and Von Thadden (2001) all model lender competition for corporate borrowers as a bidding game with common values. The mixed strategy equilibria of these models predict that informed lenders capture informational rents, interest rates are above the market rate, some borrowers switch lenders and uninformed lenders make zero profits in expectation.

borrowers). Within the category of new borrowers, those with a pre-existing relationship with other banks are considered as 'switching' borrowers. Banks presumably have an informational advantage over other lenders when issuing credit to existing borrowers, and a disadvantage when lending to switching ones. The exogenous change in loan supply induced by the program is then used to estimate how the average characteristics of borrowers and the probability of default change across these three types of borrowers during lending expansions. Changes in average observable borrower characteristics provide information about the margin along which banks ration credit. And variations in the average rate of default reflect the default risk of the marginal loan of the bank relative to the infra-marginal one.[5]

The results indicate, first, that when banks hold an informational advantage they rely less on collateral requirements to ration credit. Banks extend additional credit to existing borrowers during liquidity expansions with no decrease in the collateral to loan ratio. Since existing borrowers can increase the amount of collateral pledged in response to the lending expansion, this result implies that the access to credit of existing borrowers is not constrained by collateral. Instead, existing borrowers appear to be rationed using past performance: the proportion of existing borrowers that hold non-performing debt with the issuing bank increases during lending expansions. On the other hand, the evidence indicates new borrowers and switching borrowers are rationed using collateral, even though information on switching borrowers' past performance is publicly available through the Public Credit Registry. This suggests banks hold relationship-specific information about credit quality of existing borrowers and allocate credit accordingly.

Second, the findings suggest that banks can select low credit risk loan recipients among observationally equivalent existing borrowers. During credit expansions banks expand lending to borrowers with a worse past repayment performance. Even though past performance is a good predictor of future loan performance on average, I find that loans issued to existing borrowers during credit expansions are not more likely to default.

[5] If banks use some observable borrower characteristic to ration credit, e.g. collateral, then collateral requirements must drop when loan supply expands exogenously. Similarly, if the average probability of default increases during en exogenous loan expansion, then the marginal borrower of the bank must have a higher probability of default than the infra-marginal one.

Third, the evidence is consistent with the adverse selection prediction. During lending expansions, the default rate on loans to switching borrowers increases four times as much as for new borrowers with no credit history at all. Banks are also reluctant to issue loans when relatively uninformed. Banks allocate 0.5% of the flow of lending to switching borrowers, compared to 12.5% to new ones with no credit history, and 87% to existing borrowers.

Overall, my results suggest that liquidity constrained banks have important implications for the aggregate availability of credit to firms that are dependent on bank finance. The effects of monetary policy or aggregate shocks on output and investment are amplified when the ability of financial institutions to raise finance is constrained.[6] The capacity of banks to produce private information on borrower quality plays an important role in this transmission mechanism. The findings suggest that bank lending is special and that "financial institutions do matter" (Allen 2001).

The paper proceeds as follows. Section 2 provides the institutional and analytical framework for the empirical analysis. Section 3 describes the data. Section 4 is devoted to the estimation of the lending sensitivity to liquidity. It discusses previous literature, presents the empirical specification and the identification strategy, and comments the results. Section 5 focuses on the relationship between bank liquidity, loan recipient characteristics and default risk. Section 6 concludes.

2. Setting and Conceptual Background

2.1. The Argentine Banking System in the 90s

The Argentine banking sector and regulatory system were thoroughly overhauled twice during the 1990s. The period following the hyperinflation period that ended in 1990 was marked by the creation of an independent regulatory agency within the Central Bank, the abolition of deposit insurance, and an increase of capital requirements above Basel standards. The 1992-

[6] A growing empirical literature that links bank liquidity to aggregate investment and output in the US often finds contradictory results. For example, Ashcraft (2003) finds that state output is not significantly affected by changes in loan supply, while Peek and Rosengren (2000) find there is a significant effect on state level real estate activity. The inconsistency in the evidence has often been attributed to a potentially high elasticity of substitution between bank and non-bank sources of financing. However, this evidence is based on cross sectional comparisons of banks, which I found tends to underestimate the effects of changes in bank liquidity.

1994 period was characterized by fast economic growth, sharp rises in assets prices and fast development of the financial system.

The Tequila crisis in 1995 provoked widespread bank panics that put in evidence the weaknesses of the regulation. The regulatory system was amended again to introduce a combination of market discipline and supervision. Amendments included, among other things, the creation of a Public Credit Registry to ease the monitoring and disclosure of the risk composition of bank assets.[7] All the empirical results of this paper are estimated restricting the sample to the period that follows this second regulatory reform.

The banking system in this period is characterized by rapid deposit growth (Figure 1) and a large inflow of foreign capital.[8] Another feature of the post reform banking sector was its imperviousness to large emerging market shocks (1997 Asian crisis, 1998 Russian moratorium and 1999 Brazil devaluation). Finally, during the period of analysis the local currency was pegged to the dollar and thus the monetary authority had almost no control over the amount of money. This setting of liquidity growth, capital inflows and limited monetary intervention is ideal for addressing the empirical questions posed in the introduction.

2.2. Program Characteristics

The Credit Program to Small and Medium Sized Firms (referred to as MYPES for its Spanish acronym) was implemented in Argentina between 1993 and 1999 and provided financial intermediaries limited financing at a subsidized interest rate (average dollar deposit rate). The program was funded by the Inter-American Development Bank (IDB) and had the objective of increasing formal intermediary lending to small businesses. The MYPES falls into the category of what is known in the development agency jargon as an *on-banking* or a *two-step lending* program. The common feature of on-banking programs is to make financing available to existing financial intermediaries, with the condition that a proportional amount must be lent in turn to a narrowly defined group of borrowers. This type of credit market intervention is widely used in developing countries. The IFC (World Bank) alone allocated during the last

[7] Other reforms were the creation of a limited, fully funded deposit insurance; the replacement of reserve requirements with liquidity requirements, which decline with the residual maturity of each liability; the requirement of annual bank ratings provided by a rating agency registered with the Central Bank; mandatory bank subordinated liability of 2% of deposits each year and; the privatization of most government owned banks.

[8] By 1998 foreign-owned banks held 53% of the assets and 46% of the loans of the financial system.

decade more resources to small firms through on-banking "than through any other individual program" (Barger 1998). The MYPES required banks to issue $1 of loans to eligible borrowers for every $0.75 of program financing received.[9] Firms with less than 20 workers and less than $200,000 in annual sales were eligible to receive program loans.

In previous research (Paravisini 2003) I show that *eligible borrowers'* debt increased by less that 10 cents for every dollar of program financing received by participating banks. I also show that banks circumvented the allocation rule by picking the best performing borrowers among their eligible clients and re-labeling existing debt as 'program loans'. The intuition of how re-labeling was put into practice is shown in Figure 2, which shows the monthly evolution of the average debt of firms that received program loans. Debt is plotted relative to the month firms received the program loan (labeled as month 0 on the horizontal axis). Each column represents the total bank debt of the firms and distinguishes three separate sources: program debt (black), other debt from bank that issued program debt (white), and other debt from other banks (grey). The graph shows that program debt substituted dollar for dollar debt previously held by loan recipients with the bank. The conclusion there was that banks were largely unconstrained in their use program financing, which makes it possible to treat as an exogenous source of liquidity to the bank.

Program financing was distributed in 12 waves between 1993 and 1999. The amount of resources allocated to each wave varied under the discretion of the IDB. The yearly flow of program financing is plotted in Figure 3. The plot displays two peaks: one during years 1995 and 1996 and another one in 1999. The first peak coincides with a period of massive deposit drains triggered by the Tequila crisis (see Figure 1) and with the subsequent regulatory reforms. The second peak was driven by an 'administrative rush' to finish allocating the program resources before year 2000. According to MYPES managers, a second phase of the program (MYPES II) was planned to begin in 2000 and financing for this phase was conditional on the complete execution of the budget of the first one. I will take advantage of the fact that each wave of the program provides an independent shock to liquidity and perform estimations restricting the sample to the final waves. This avoids the potential bias

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[9] To avoid confusion between loans from the government to the banks and the associated loans from the banks to eligible firms, I will call loans to banks "program financing" and loans to firms "program loans to firms".

that may arise from the program being purposely timed to provide liquidity to weaker banks when they most needed it.

A month prior to the beginning of each wave, the Central Bank of Argentina announced publicly the amount to be distributed and banks submitted an application to participate. Resources in the wave were allocated among all participant banks according to an administrative formula based on bank characteristics.[10] The formula assigned a higher fraction of the wave resources to banks with a smaller average size of loans and a higher proportion of loans in poor provinces.[11] Each participating bank was assigned a point score according to these characteristics[12] and the wave resources were allocated proportionally to each bank's score. I will use this formula later to predict the expected amount of available program financing to each bank in each wave. The resulting predicted available financing is uncorrelated with bank investment opportunities, which makes it suitable for use as an instrument for liquidity when estimating the sensitivity of lending to the financial position of the bank.

Of the 126 financial institutions in the sample between 1995 and 2001 (see the data description in the next subsection), 29 received program financing at least in one wave. The number of banks that participated in each wave varied between 5 and 15, and participation was positively correlated with the amount of resources to be distributed in each wave (see Figure 3). During interviews, executives of participating banks acknowledged that although the program provided a cheap source of finance, the amount at stake was sometimes too small

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[10] Formally, banks submitted in the application the amount of financing required. If the sum of the requested financing of all applicants exceeded the amount of resources in the wave, financing was distributed among applicants according to the formula. However, the financing demand surpassed available resources in every wave, and the formula was used to allocate resources in each of them.

[11] Originally, the banks had to submit also in their application the fraction of matching resources the bank would commit to the ensuing loans to eligible firms and the interest rate they would charge on these loans. Both of these variables were to be included in the distribution formula if the requested financing exceeded the amount of resources in the wave. However these variables were dropped from the formula after the first two waves because there was no cross sectional variation in the bids. The matching funds bid was exactly the minimum matching funds required by the program ($1 for every $3 of program financing) in 98% of the cases. And the interest rate bid matched a "suggested" rate provided by the government. The difference between the highest and the lowest interest rate bid in any wave was at most 0.06 percentage points and zero 81% of the time. This variation was negligible relative to the average interest rate of 13.7% during the period.

[12] The point score according to average loan size is shown in Table 1. The point score according to regional distribution allocated a weight of 30 to loans issued in the riches provinces (Capital Federal, La Pampa y Santa Cruz) and 100 to loans issued in the poorest (Formosa, Catamarca, Santiago del Estero, Chaco, Jujuy, Misiones, Corrientes, Salta, Chubut y Tucumán). Loans to other provinces received a weight of 70.

to compensate the red tape costs involved in participating.[13] Since program participation was likely to be related to factors affecting the lending-liquidity sensitivity (e.g., negative deposit shocks, new investment opportunities) I will exploit changes in wave size as an exogenous source of variation in participation. The descriptive statistics of banks by their participation status show how the endogenous participation decision might produce biased estimates if unaccounted for (see Table 2). Participating banks are on average smaller and more likely to be constrained than non-participating ones. A comparison of participating versus non-participating banks could lead to an upward bias in the estimate of the sensitivity of lending to liquidity. All the specifications used in the empirical section of this paper will include bank fixed effects, which will account for the potential time invariant differences across banks.

Banks had three months to use the allocated resources or pay a penalty equal to twice the interest rate of the unused balance. The unused balance would be reassigned in the next wave of the program among the participating banks in that wave. Also, banks bore the credit risk of the loans to the eligible firms: repayment of program financing was not contingent on firm loan performance. However, the repayment schedule of the program financing matched exactly the schedule of the associated firm loan. The duration of loans to firms was limited to 36 months (plus 12 months of optional grace period). The descriptive statistics of the program loans to firms (Table 3) show that the median duration of program firm loans was 36 months and the median grace period was zero. This suggests banks also selected eligible firms in order to maximize the time they could hold program financing within the imposed constraint.

Finally, the MYPES program was small relative to the size of the financial system: it allocated around $90 million among participating banks, which represented 0.1% of total loans in 1995. This implies that the program had a small impact on aggregate liquidity and was unlikely to influence interest rates, which allows focusing on the partial equilibrium effects of the liquidity expansion. On the other hand, the amount of financing was sizeable relative to banks that participated in the program: financing represented about 1.8% of stock and 10.6% of the flow of loans during the months of implementation.

[13] Participating banks had to provide the program administrators with a database containing the characteristics of the recipients of the loans associated with the program. They also had to send monthly reports of the repayment performance of these loans.

To summarize, the program provided banks with a limited amount of low cost, medium term financing. The cross sectional and time series variation of the *available* program financing and the probability of bank participation in the program can be predicted using wave size and timing and a cross sectional allocation rule which are independent of investment opportunities or deposit shocks. The predicted available financing can then be used as an exogenous shifter of bank liquidity to estimate the effects of liquidity shocks on the lending decision of banks. Next I discuss how financing frictions can affect the response of bank lending to the availability of new sources of subsidized finance and how this can be used to develop a test for financing frictions.

2.3. Financing Constraints and Lending Behavior

2.3.1. Loan Sensitivity to Bank Liquidity

In a world without financing frictions, profit maximizing banks will be able to raise any amount of finance in the capital market at a constant cost, r_m, and lend until the marginal return on loans is equal to the marginal cost of finance. If banks face a declining schedule of marginal loan profitability, lending beyond this point yields a return lower than r_m. If a bank receives one dollar of subsidized financing (at a rate $r_s<r_m$), it will use it to repurchase a dollar debt and earn r_m-r_s. The alternative is to issue $1 in new loans, which would yield a return below r_m-r_s. Thus in a frictionless world, an extra dollar of available cheap financing will increase the infra-marginal profits of the bank, but will not affect either total loanable funds (total financing minus reserve requirements) or lending as long as banks hold some financing at the market rate.

In an alternative scenario with informational asymmetries and agency problems bank external financing is costly. Banks will be unable to raise unlimited amounts of financing at the market rate because issuing debt either could be a bad signal of the quality of banks assets or increases the incentives of self-interested managers to engage in opportunistic behavior (Stiglitz and Weiss 1981; Myers and Majluf 1984; Jensen 1986). These frictions imply that the marginal cost of external financing is not constant at r_m, but increasing in the amount of externally raised finance. Banks will lend until the marginal cost of finance is equal to the marginal return on loans, but now a $1 of subsidized financing will shift out the marginal cost of external finance. When banks face financing frictions, an increase in available cheap finance leads to an expansion total bank loanable funds and in lending.

This discussion suggests a simple test for financial constraints in the context of the program described in the last subsection. A positive relationship between bank loanable funds and the availability of program financing when banks hold liabilities priced at the market rate (e.g. uninsured CDs, subordinated debt or any bank liability other than deposits) can be taken as evidence of financing frictions. If this relationship exists, changes in the availability of program financing can be used as an exogenous source of variation of bank liquidity to estimate the magnitude of the sensitivity of lending to bank liquidity. The methodology parallels that of Banerjee and Duflo (2004), who use the expansion of a directed credit program in India to test whether non-financial firms are credit constrained.

To put these ideas in a conceptual framework, I consider an adaptation of Froot, Scharfstein and Stein (1993), Kaplan and Zingales (1997) and Stein (2003) reduced form two-period models to the case of financial firms. This framework is intended to convey the intuition behind the empirical strategy to test for liquidity constraints and not to explain optimal bank investment and financing decisions under asymmetric information. Banks choose the amount of lending, L, and external financing, e, to maximize expected profits:

$$\max_{L,e} \frac{1+\lambda}{1+r} f(L) - (1+r_s)s - [1 + r_m + \theta C(e)]e \tag{2-1}$$

$$\text{s.t. } L = s + e$$

where $f(L)$ is the expected gross return on loans and s represents subsidized finance and r is the discount rate. Also, r_m and r_s are the market and the subsidized price of external finance respectively. The cost of external financing, $r_m+\theta C(e)$, is equal to the market rate when there are no financing frictions ($\theta=0$), and increasing in the amount external funds [$C'>0$, $C''>0$] otherwise ($\theta>0$). Expected return on loans, $f(\ )$, is an increasing and concave function of lending due to, for example, an increasing and convex profile in the probability of default of potential borrowers. Finally, λ represents the potential private benefits managers derive from investment.

The level of lending that maximizes expected profits when there are no financing frictions, L^*, equates the market cost of financing and the PDV of the marginal expected return on loans:

$$\frac{1+\lambda}{1+r} f'\left(L^*\right) = 1 + r_m \tag{2-2}$$

as long as the amount of subsidy does not exceed L^* ($s \leq L^*$). In a frictionless world, an increase in the amount of subsidized financing will lead to a one for one reduction in external financing ($de^*/ds=-1$), and bank total funding and lending will be unchanged. This result is depicted in Figure 4.

On the other hand, if $\theta>0$, lending will be given by the first order condition of the bank's program (2-1):

$$\frac{1+\lambda}{1+r} f'\left(\hat{L}\right) = 1 + r_m + \theta g\left(\hat{L}-s\right)$$
$$\text{with } g\left(\hat{L}-s\right) = C\left(\hat{L}-s\right) + \left(\hat{L}-s\right)C'\left(\hat{L}-s\right) \tag{2-3}$$

Since *g( )* is increasing and *f '( )* is decreasing, it follows that $d\hat{L}/ds > 0$. In words, total funding and lending are increasing in the amount of subsidized finance (see Figure 5). It is also easy to show that $d^2\hat{L}/dsd\theta > 0$, which implies that the sensitivity of lending to subsidized finance is increasing in the magnitude of the financing frictions. This result will be useful later to check whether the loan-liquidity sensitivity changes along observable proxies of financing constraints.

2.3.2. Lending Profitability and Default Risk

Liquidity constraints reduce the ability of banks to make loans. However, the fact that banks are constrained in the amount the can lend is not sufficient to conclude that banks are lending below the optimal level. Empire-building bank managers may have a tendency to 'over-lend' [$\lambda>0$ in (2-2)] and liquidity constraints may arise optimally to limit this behavior (Stulz 1990; Hart and Moore 1995).

If banks are inefficiently constrained, the marginal loan of the bank must yield positive expected profits. The empirical setting provided by the government program allows testing this implication under certain assumptions. The liquidity shock provides a shift in the marginal cost of financing that allows tracing the characteristics of the marginal loan of the bank. In the context of the previous analytical framework, the shift in the marginal cost curve in Figure 5 traces down the slope of the expected marginal return on lending.

Looking at actual loan profitability requires loan level data on interest rates and monitoring/screening costs which is unavailable. I will look instead at default risk, which will be inversely related to loan profitability as long as the interest rate on the marginal loan does not change substantially when lending expands. This assumption is reasonable if banks choose to ration borrowers instead of raising the interest rate to clear the market as in Stiglitz and Weiss (1981). The optimal interest rate is below the market clearing level because increasing the interest rate makes profile of borrowers riskier, both because it attracts riskier applicants and because it induces borrowers to take more risk. If borrowers are credit rationed, constrained banks need not reduce the interest rate in order to expand credit when facing a positive liquidity shock. Furthermore, constrained banks can use observable signals of borrower quality or collateral requirements to ration credit without facing a risk-return trade-off.[14] In the empirical section I will show evidence that is consistent with banks rationing credit using observable borrower characteristics.

The previous discussion can be expressed in terms of the analytical framework of the subsection 2.3.1 by writing the expected return on lending, *f(L)* solely as a function of the optimal constant gross return on loans, R^*, and the resulting average probability of default of loans, p^*, as:

$$f(L) = R^*\left[1 - p^*(L)\right] \tag{2-4}$$

where the probability of default is increasing and convex in the amount of lending.[15] If banks are severely constrained, such that they are operating in the flat portion of the marginal expected return curve in Figure 4, the default risk will not change when lending expands. A finding that the default risk of lending does not change when lending expands would indicate

[14] For example, banks can lend only to borrowers that are able (and willing) to pledge high collateral. A higher collateral (per dollar of lending) increases the payment to the bank in case of default and reduces the probability of default. Pledging collateral may serve as a signal of good borrower type, since it is costlier to pledge for bad entrepreneurs who fail more often. Also, collateral decreases the payment to the borrower in case of default, which reduces the incentives to misbehave.

[15] As suggested by the discussion on Stiglitz and Weiss, the probability of default will in general depend on the gross return R. The asterisks emphasize that the amount of lending is chosen given an optimal interest rate. The underlying assumption is that the effect of changing the amount of lending on the optimal interest rate is of second order.

that not all borrowers in the same risk class are obtaining credit and implies banks can expand credit profitably when the liquidity constraints are relaxed.

3. Data Sources

Before heading into the empirical specifications and results I first describe the sources of data used in this paper. First, I use detailed information on balance sheets and monthly earnings reports for all the banks in the Argentine financial system between 1995 and 2001 from the Central Bank of Argentina. As I argued in the description of the program, the preferred estimates will be based on the 1998-2000 sub-sample, when the final waves of the program took place.

The second source of data is the Public Credit Registry database, or CDSF for its acronym in Spanish (Central de Deudores del Sistema Financiero). Each observation in this database represents a loan i held by firm j with bank k at month t. It containts monthly data on all loans held by firms or individuals with more than $50 of debt with a financial institution in Argentina. The CDSF is available for all borrowers after January 1998.[16] For every loan, the data available are: the name of the debtor, the name of the bank, the principal withstanding, the amount of collateral posted and a code describing the debt situation. This code ranges from 1 to 6, where 1 represents a good standing loan and 5 and6 represent unrecoverable loans. The categories are precisely defined in terms of the days behind in payment, debt refinancing and bankruptcy filings (Gutiérrez-Girault 2002).[17]

This data allows building the credit history of every borrower in the financial system. I construct measures of loan performance of loans issued at month t by looking at the debt situation code at month t+12 and t+24. I also construct two measures of ex-ante credit quality: the collateral to loan ratio and a dummy equal to one if the loan recipient has some

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[16] The collection of this data started in early 1996. However, the accounts of what information was available before 1998 and when are contradictory. See for example Escudé et. al. (2001) and Fakenheim, M. and A. Powell (2003). However, all research conducted by the BCRA and others using the CDSF only includes post 1998 data.

[17] Situation 1 (normal): all payments on time. Situation 2 (with potential risk): small and occasional delays in repayment. Situation 3 (with problems): delays in repayment between 90 and 180 days. Repays accrued interest but requires principal refinancing. Situation 4 (high insolvency risk): repayment delays between 180 and 360 days, bankruptcy filings for more than 5% of the firm's equity, has principal and interest refinancing requiring principal condoning, the bank received payments in kind. Situation 5 (unrecoverable): bankruptcy declared. Situation 6 (unrecoverable by technical disposition): late repayments of more than 180 days with intervened financial institutions.

non-performing debt at the time of receiving a loan. And finally, this dataset allows measuring these variables for different types of borrowers. I look in particular at loan recipients with a previous relationship with the issuing bank and those without one ('existing' and 'new'). Among the new borrowers, those that have a previous credit history with other financial institutions are also considered ('switching' borrowers). The loan level descriptive statistics by type of borrower are shown in Table 7.

It is important to note a feature of the CDSF related to the information reported about credit lines (including credit cards) and credit commitments. Since the bureau was created for regulatory reasons to measure bank asset risk, credit limits and not actual amounts of credit outstanding are reported. That is, if a firm opens a credit line for up to $100,000 with a bank, then the CDSF will show a loan of $100,000 for every month the line is available regardless of the actual amount borrowed. This feature is actually an advantage in our application since the outcome of interest is the availability of credit.

A third source of data is the program database, collected and managed by the Ministry of Economy in Argentina. This database has detailed characteristics about firms that received loans from the program, such as characteristics of the loan (date of initiation, principal, duration, grace period, amount of each payment, grace period, interest rate), characteristics of the firm (number of workers, annual sales), and name of the intermediary bank that made the loan.[18] The program database and the CDSF could be linked using a unique tax identification code (CUIT).

4. Measuring the Lending-Liquidity Sensitivity

4.1. Empirical Specification and Previous Research

The usual specification used in the lending channel literature looks at the relationship between loan growth and a measure of changes in the bank liquidity, typically given by changes in monetary policy (Bernanke and Gertler 1995; Hubbard 1995; Kashyap and Stein 2000; Kishan and Opiela 2000), deposit growth (Jayaratne and Morgan 2000; Ashcraft 2003), internal cash (Ostergaard 2001) or stock price (Peek and Rosengren 1997):

[18] The firm program loan descriptive statistics shown in Table 3 are calculated using the program database.

$$L_{it} = \alpha_i + \alpha_t + \beta D_{it} + \gamma X_{it} + \varepsilon_{it} \tag{4-1}$$

where L_{it} is loan growth of bank i at month t, D_{it} represents a measure of the liquidity shifter, α_i and α_t are bank and month fixed effects, X_{it} is a set of controls and ε_{it} is the error term. The main caveat in this literature is that the sources of variation in bank liquidity are likely to be correlated with investment opportunities in loans, which would lead to a biased estimation of β in (4-1). For example, an increase in deposits, internal cash or stock prices may signal better future lending prospects of the bank and will be correlated with loans even in the absence of financing constraints.

This problem has been approached in several ways. First, by introducing a measure of investment opportunities among the controls (e.g. Tobin's q, level of economic activity). Second, by looking at the differences in the lending-liquidity sensitivity across banks that are more likely to face financing constraints according to observable characteristics (e.g. smaller, less capitalized banks). Both of these approaches are also used in the early literature on the investment-cash flow sensitivity and have been criticized from empirical and theoretical grounds. Poterba (1988) and Erickson and Whited (2000) suggest the observed correlation between investment and cash flow can be entirely driven by measurement errors in q. Furthermore, the cross sectional variations in the investment-cash flow sensitivity appear in the data even for firms that are not likely to be financially constrained (Kaplan and Zingales 1997; 2000), and can be induced by models without financing frictions (Alti 2003). The same caveats are likely to apply when looking at the sensitivity of bank investment (lending) to liquidity, as long as bank deposits, cash flow or stock price are correlated with bank investment opportunities. The third and most convincing approach is to look at the lending-liquidity sensitivity in a 'natural experiment' setting, in which the shock to the financial position of the bank is independent of its investment opportunities (Stein 2003).

I use a natural experiment approach in this paper by exploiting the expansion of available financing provided by the government program as the source of variation in bank liquidity, as was described in section 2.3.1. The relationship between loan growth and liquidity is estimated as in (4-1), with liquidity measured as the growth of the bank loanable funds, F:

$$L_{it} = \alpha_i + \alpha_t + \beta F_{it} + \varepsilon_{it} \tag{4-2}$$

Loanable funds are the sum of equity, deposits and other liabilities, minus reserve requirements. Growth refers to the proportional growth rate, calculated as the change in the log of the variable.[19] Changes in the *predicted availability* of program finance, $\widetilde{E}$, are used as an instrument for F and estimate β in (4-2) by 2SLS. Section 4.2 discusses in detail how the availability of program finance is predicted using the predicted probability of participation and argues that conditional on bank and month fixed effects, predicted program financing can be regarded as exogenous. The estimated β_{2SLS} can be interpreted as the elasticity of lending to changes in liquidity. The first stage of this estimation represents the effect of the expansion in the predicted available financing on bank liquidity:

$$F_{it} = \alpha_i + \alpha_t + \varphi \widetilde{E}_{it} + \eta_{it} \tag{4-3}$$

The discussion in section 2.3.1 suggests that a positive estimation of the sensitivity of liquidity to available finance, φ, will occur only if banks face financing constraints.

The sensitivity obtained through 2SLS can be compared with the estimate that results when using deposits as an instrument for liquidity. Which estimate will be higher is a priori ambiguous. On the one hand, as previously argued, changes in deposits are likely to be caused by factors that also affect the demand for bank credit. This would lead to upward biased estimations of the sensitivity of lending to liquidity. On the other hand, banks are likely to endogenously choose to lend out a lower proportion of a liquidity expansion when it is less liquid. Since the program provided medium term financing (3 years on average) which is less liquid than deposits, it is reasonable to expect a higher sensitivity of lending to liquidity shocks induced by the program.

I will also verify whether the loan-liquidity sensitivity varies across observable measures of financing frictions by estimating the following specifications:

$$L_{it} = \alpha_i + \alpha_t + \beta_1 F_{it} + \beta_2 F_{it} \times DumSmall_i + \varepsilon_{it} \tag{4-4}$$

$$L_{it} = \alpha_i + \alpha_t + \beta_1 F_{it} + \beta_2 F_{it} \times DumLowCap_i + \varepsilon_{it} \tag{4-5}$$

Here the liquidity measure is interacted with a dummy equal to one if the bank is in the lowest 20% of the assets distribution (4-4), and equal to one when in the lowest 20% of the equity to capital ratio (4-5). The instruments in each of these specifications are the expansion in

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[19] That is, $\ln(X_t)-\ln(X_{t-1}) \approx (X_t - X_{t-1})/ X_{t-1}$ when $X_t - X_{t-1}$ is small.

available finance as before, and also the interaction between the available finance and the DumSmall and DumLowCap dummies respectively. The coefficients on the interaction term, β_2, will be positive if small and less capitalized banks indeed have a higher lending-liquidity sensitivity than other banks.

4.2. Dealing with Endogenous Program Financing

The key assumption in the previous empirical strategy is that program financing affects bank liquidity in a way uncorrelated with investment opportunities, deposit shocks or other factors that affect either bank liquidity or the decision to lend. As the description of the program in Section 2.2 suggested, *actual* program participation and available financing were likely to be correlated with these factors since banks facing a greater need for liquidity were more likely to apply for program financing. This section describes how the potential endogeneity in participation and financing are dealt with using the time series variation of wave size and the cross sectional allocation rule of the program.

4.2.1. Predicted Probability of Participation

Bank executives commented that when the amount of resources in a program wave was small, the potential funding from the program was too low to justify the administrative costs of participating. Potential funding available to a bank in each wave was driven by two main factors: in the one hand, total available financing, decided in every wave by the IDB; in the other hand, the share of the wave resources that a given bank would receive if it were to participate, in turn determined by the number of participants in the wave as well as by predetermined characteristics of the banks. Bank participation can then be predicted based solely with variables that are uncorrelated with the lending decision after controlling for bank and month fixed effects.

First, the participation choice is modeled by assuming bank *i* participates in program wave *w* only if the potential financing that can be obtained from participation exceeds a bank and wave specific parameter η_{iw}.[20] Potential financing, h(.), is a function of wave size, A_w, and the point score bank i obtains according to its average loan size ($Zsize_{iw}$) and regional loan distribution ($Zregion_{iw}$). Potential financing bank i expects to receive from the program in a

[20] This is a version of the standard linear latent index models commonly used in econometric program evaluations [for an early example, see Heckman and Hotz (1989)].

certain wave will be a non-linear function of these parameters for two reasons. First, the actual administrative function, discussed in detail in the next subsection, is also non-linear in wave size and bank scores. And second, because potential financing also depends on the expected number and characteristics of other participating banks.[21] I assume an arbitrary and flexible functional form for potential financing. In particular, I choose a second-degree polynomial on wave size and the point scores:[22]

$$h(A_w, Zsize_{iw}, Zregion_{iw}) = \sum_{s=0}^{2}\sum_{u=0}^{2}\sum_{v=0}^{2} \xi_{s,u,v} A_w^s Zsize_{iw}^u Zregion_{iw}^v \tag{4-6}$$

Assuming η_{iw} is normally distributed, the probability that bank *i* participates in wave *w*, p_{iw}, is given by:

$$p_{iw} = Pr(h(A_w, Zsize_{iw}, Zregion_{iw}) > \eta_{iw}) = \Phi(h(A_w, Zsize_{iw}, Zregion_{iw})) \tag{4-7}$$

where Φ is the normal cumulative distribution function. The parameters of this participation model can be estimated using maximum likelihood (probit) and used to obtain a predicted probability of participation, $\hat{p}_{iw}$. It is possible that banks tried to game the resource allocation formula by manipulating the loan size and distribution to increase their share of program resources. To avoid introducing this source of bias in the estimation of the probability of participation, the region and size point scores do not vary by wave. Instead I use the scores

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[21] The participation decision of banks can be formally modeled as a private value auction. Suppose N banks are deciding whether to participate in a program wave of size A. For simplicity assume all banks are equal except for their cost of participation, η, which is private information. Thus, the amount of resources in a wave is evenly distributed across the banks that decide to participate. The common knowledge p.d.f. of the cost among potential participants is $f(\eta)$. Optimal participation will be given by a cutoff rule: bank i participates if $\eta_i < \eta^*$. So the probability bank i participates is given by:

$$p = \int_0^{\eta^*} f(\eta)\, d\eta$$

The expected program financing net of participation cost that a bank will receive if it decides to join the program is:

$$A\sum_{j=0}^{N-1}\frac{1}{1+j}p^j(1-p)^{N-1-j}\binom{N-1}{j} - \eta_i$$

Finally, the cutoff η^* is defined implicitly by the value of η that equates the net expected program financing to zero.

[22] $h(A_w, Zsize_{iw}, Zregion_{iw}) = \xi_0 + \xi_1 A_w + \xi_2 Zsize_{iw} + \xi_3 Zregion_{iw} + \xi_4 A_w Zsize_{iw} + \xi_5 A_w Zregion_{iw} + \xi_6 Zsize_{iw} Zregion_{iw} + \xi_7 A_w^2 Zsize_{iw} + \xi_8 A_w^2 Zregion_{iw} + \xi_9 A_w Zsize_{iw}^2 + \xi_{10} A_w Zregion_{iw}^2 + \xi_{11} Zsize_{iw}^2 Zregion_{iw} + \xi_{12} Zsize_{iw} Zregion_{iw}^2 + \xi_{13} A_w Zsize_{iw} Zregion_{iw} + \xi_{14} A_w^2 Zsize_{iw} Zregion_{iw} + \xi_{15} A_w Zsize_{iw}^2 Zregion_{iw} + \xi_{16} A_w Zsize_{iw} Zregion_{iw}^2 + \xi_{17} A_w^2 Zsize_{iw}^2 Zregion_{iw} + \xi_{18} A_w^2 Zsize_{iw} Zregion_{iw}^2 + \xi_{19} A_w Zsize_{iw}^2 Zregion_{iw}^2 + \xi_{20} A_w^2 Zsize_{iw}^2 Zregion_{iw}^2$

corresponding to the first time the banks are observed in the sample. This is, the following probit specification is estimated:

$$p_{iw} = \Phi\ (\ h(A_w,\ Zsize_i,\ Zregion_i)\ ) \qquad (4\text{-}8)$$

where the variation in participation across waves and across banks are given by the interaction between wave size and initial bank characteristics. To see how close predicted participation fits actual participation, Figure 6 plots the actual and the predicted number of bank participations by year.[23] The plot shows that the predicted participation series tracks the actual one quite well.

4.2.2. *Predicted Availability of Program Financing*

When a bank participates in a wave, the amount of program finance it will receive depends on the amount of resources in the wave and the number and characteristics of all the participating banks in that wave. The administrative allocation formula stipulated that each bank would receive a fraction of the resources available in the wave that was proportional to the ratio of their score points relative to the sum of the scores of all participating banks, or:

$$E_{iw} = A_w \left[\frac{Zregion_{iw}}{2 \cdot \sum_{j}^{n_w} Zregion_{jw}} + \frac{Zsize_{iw}}{2 \cdot \sum_{j}^{n_w} Zsize_{jw}} \right] \qquad (4\text{-}9)$$

E_{iw} is the *actual* amount of financing bank i receives from the program when it participates in wave w, and is a function of wave size, A_w, bank i's point scores, $Zsize_{iw}$ and $Zregion_{iw}$, the number of participants in the wave, n_w, and the sum of all participants' point scores.

I use the predicted probability of participation from the previous subsection to estimate the expected sum of the characteristics of program participants. This is done by summing the bank characteristics of all banks (participating and non-participating) weighted by the predicted probability of participation ($\hat{p}_{iw}$). Using this expected sum in (4-9) I predict the amount of program financing bank i would have received if it had participated in wave w:

[23] The predicted number of participants in a wave is just the sum of the predicted probabilities of participation across all banks. If the same bank participates in two waves during a year it counts as two participations for the graph.

$$\widetilde{E}_{iw} = A_w \left[\frac{Zregion_i}{2 \cdot \sum_j^N \hat{p}_{jw} Zregion_j} + \frac{Zsize_i}{2 \cdot \sum_j^N \hat{p}_{jw} Zsize_j} \right] \tag{4-10}$$

where the region and size point scores of each bank are taken when first observed in the sample to avoid the rule gaming bias discussed before. Equation (4-10) gives us an approximation of the expected increase in the availability of program financing of bank i at wave w. To calculate the changes in available financing by month ($\widetilde{E}_{it}$) I assume, first, that banks drew the available finance in three equal parts during the months following the date a wave begins; and second, that the program financing was repaid in 36 equal monthly parts after being received. The first assumption follows since banks had three months to draw the resources from the credit line in the Central Bank without penalty. The second assumption attaches to program financing the same repayment schedule of the median firm loan as described in Table 3.

In the last two lines of Table 2 show the descriptive statistics of the resulting available financing variable (in levels and as a proportion of loans outstanding) by bank participation status. Available financing represents about 7.6% of loans during the sample period. Changes in this predicted available finance are used as an instrument for changes in bank liquidity in specification (4-2).

The use of a rule based non-linear allocation as an instrument for the actual one is applied in another context by Angrist and Lavy (1999) when evaluating the effects of class size on test scores. In that case the endogenous variable to be instrumented, class size, varies with enrollment in a non-linear fashion due to a maximum class size rule. This allows instrumenting class size while still controlling for enrolment and unobservable school characteristics. In this paper, the amount of program financing and the probability of participation in the program vary non-linearly with wave size and predetermined bank characteristics. As previously argued, wave size varies for exogenous reasons in the final waves of the program and all time invariant bank characteristics will be controlled for using bank fixed effects specifications.

4.2.3. Identification Checks

First, I check whether the predicted available financing variable is correlated with the actual program financing received by the banks. Figure 7 shows that the expected predicted stock of available finance tracks the actual stock quite well in the time series. [24] A regression version of this comparison, which also accounts for the cross sectional variations in financing and includes bank and month fixed effects, implies estimating the following regression of actual financing on predicted financing:

$$E_{it} = \alpha_i + \alpha_t + \varphi_1 \widetilde{E}_{it} + \eta'_{it} \tag{4-11}$$

The estimated φ_1 is close to one and statistically significant, which implies that the administrative formula was strictly applied.

Next I revisit one of the key identification assumptions mentioned at the beginning of this section: that the predicted financing expansion should not be correlated with other shocks to liquidity or to investment opportunities. To check this I estimate a regression of actual and predicted program financing on lagged deposit growth and lagged bank cash flow. The estimated parameters are shown in Table 4. Column 1 shows that actual financing was in fact negatively and significantly correlated with lagged shocks to deposits (2 and 4 lags). This was expected if banks decided to participate in the program when they received a negative shock to deposits. However, columns 2 and 3 show that predicted financing is not. There is also no correlation between past cash flows and predicted available financing growth. These results corroborate that the predicted financing variable rids of the potential endogenous correlation that might be present in the actual financing variable.

4.3. First Stage: the Effect of a Credit Expansion on Loanable Funds

The discussion in Section 2.3 about the effects of financing frictions on lending behavior led to the conclusion that a change in the availability of cheap financing will affect bank liquidity only when banks are constrained. The relationship between available financing and liquidity is embodied in the first stage regression (4-3). A positive relationship between the available finance growth and liquidity (loanable fund growth), φ, would be consistent with financing constraints.

[24] The expected predicted stock is the predicted stock times the probability of participation summed across all banks.

Table 5 shows the estimated parameters of the first stage. There is a positive and significant relationship between credit expansion growth and bank liquidity in the entire sample of banks (Column 1). As an additional specification check, the first stage regression is estimated again dividing the sample between banks with a high average probability of participation in the program and banks with a low probability of participation, which is a predetermined bank characteristic since it is based on pre-program data only. Banks are defined as having a high average probability of participation if they are in the top quartile of the probability distribution estimated using (4-8). The results are shown in columns 2 and 3 of Table 5. As expected, predicted available finance has a positive and significant effect on the liquidity of banks with a high probability of participation in the program, and an insignificant effect on low-probability banks.

This discussion suggests a graphical version of the first stage estimates. The loanable funds of banks with a high average probability of participation in the program should increase relative to the loanable funds of banks with a low average probability of participation, when the available financing increases. To check this is the case, the top panel of Figure 8 plots the predicted and the actual available program finance to banks in the top quartile of the distribution of the predicted probability estimated from (4-8). The bottom panel shows the ratio between the loanable funds of high-probability and low-probability of participation banks. The time series of both graphs follows a similar pattern, which indicates that the liquidity of banks that were likely to participate in the program increased when available program financing expanded.

The results suggest that banks increased their holdings of loanable funds as a result of the expansion of available cheap financing. This is opposite to the predicted response for an unconstrained profit maximizing bank in section 2.3. Such a bank would have reduced holdings of other more expensive liabilities and kept liquidity unchanged. The fact that the predicted financing expansion is driven only by exogenous sources of variation, assures that the expansion in liquidity is not driven by other confounding factors that affect either liquidity directly or the demand for loans. Thus, the evidence supports the hypothesis that banks are liquidity constrained. The next step is to explore the relationship between bank liquidity and lending of constrained banks.

4.4. 2SLS Estimation: The Sensitivity of Lending to Bank Liquidity

This section uses specification (4-2) to obtain the 2SLS estimate of the sensitivity of lending to bank liquidity, β, using the predicted expansion of available financing as a liquidity shifter. All the results that follow are estimated using the entire sample of banks. Table 6 shows the OLS and the 2SLS estimation results of β. The preferred estimate of the lending-liquidity sensitivity is 0.745 (column 3), obtained from restricting the sample to the final waves of the program. Considering that the average loans in the sample are $536 million and average loanable funds $616 million, the estimated elasticity implies that loans increase by $0.66 for every dollar of liquidity expansion. Figure 9 shows this result graphically: the ratio of loans by high-probability to low-probability (average) of participation banks also increases when available program financing is expanding (as shown in Figure 8 for loanable funds).

The estimate of the sensitivity of lending to bank liquidity is lower (0.481) when all the waves of the program are used in the sample. Recall that the initial waves of the program coincided with massive deposit drains from the banking system. A negative bias in the loan-liquidity estimate during this period would result if the fall in deposits of program banks was relatively larger than for the rest of the banks. The rest of the results in the paper will be estimated using the restricted sample.

As an additional specification check, the estimation is repeated including in the sample only those banks that participated at least once in the program, but excluding all banks that participated in every wave. If the identification strategy is valid this estimate should be the same as using the entire sample of banks. The estimated β for an unreported estimation using the restricted sample of banks is 0.66 with a standard error of 0.29, which is statistically indistinguishable from the estimate using the entire sample. This result suggests that the use of predicted finance as an instrument for changes in bank liquidity deals successfully with the endogeneity of bank selection into the program.

In order to compare the results with the previous literature I estimate the sensitivity of lending to liquidity across banks of different size and capitalization using specifications (4-4) and (4-5). The coefficient of interest in this specification is the interaction term, β_2, which will be positive if banks in the lowest quintile of the asset or capitalization distributions have a higher sensitivity of lending to changes in bank liquidity. Both point estimates are positive, but neither of them is statistically significant (Columns 5 and 6 of Table 6). These results hint at the potential bias that may result when identifying financing constraints relying on cross sectional variations in the sensitivity of lending to liquidity. The magnitude of the cross sectional variation may be very small in proportion to the actual level of this sensitivity, and might lead to underestimate the importance of the effect of financing frictions on bank lending.

Summarizing the finding of this section, an increase in available financing produces an increase in bank liquidity that is consistent with the existence of financing frictions. The sensitivity of lending to changes in liquidity that results from these frictions can have a substantial magnitude and has potentially been underestimated by previous research. I now turn to analyze the effects of financing constraints on bank lending behavior, and in particular on lending risk.

5. Liquidity and Lending Risk

5.1. Specifications with Loan Level Data

The following version of (4-2) is used to estimate the change in bank loan default risk and average borrower characteristics due to a liquidity expansion:

$$Y_{ijt} = \alpha_i + \alpha_t + \alpha_s + \varphi DumExp_{it} + \omega_{it} \qquad (5\text{-}1)$$

Every observation represents a loan j given by bank i at month t. The left hand side variable is a measure of loan default or borrower characteristics. Loan default is measured as a dummy equal to one when a loan issued at time t has defaulted by time t+12. I also look at defaults at t+24 to check for potential changes in the timing of defaults. As mentioned previously, I use loan collateralization and loan recipient past performance as measures of observable borrower quality. Collateralization is the ratio of collateral to the amount of loan j. Past performance is measured as a dummy equal to one if the recipient of loan j has any non-performing debt between t-1 and t-12.

The variable of interest on the right hand side is $DumExp_{it}$, a dummy equal to one when bank i receives program financing at month t. Financing expansion months are defined as the three months following the date a program wave begins. I instrument this variable with the predicted probability of program participation, described in section 4.2. The estimated φ can be interpreted as the change in the average of the dependent variable (averaged over bank-month cells) that results from a liquidity expansion. For example, assume (5-1) is estimated using the default at t+12 dummy as the dependent variable and we obtain $\varphi=0.05$. This result indicates the fraction of loans issued by a bank that defaults after 12 months increases by 5 percentage points when the bank receives a liquidity expansion. The rest of the right hand side variables are α_i and α_t, bank and month dummies as in (4-2), and α_s, an industry dummy. The industry dummy allows controlling for potential changes in the industry composition of the loan portfolio of the banks. Finally, ω is the error term.

The descriptive statistics of the loans issued during the sample period are shown in Table 7. Of the 750,526 loans in the sample, 130,201 were issued to *new* borrowers, or borrowers without a previous relationship with the bank. On average, 12.2% of the value of the loan was covered by some type of collateral, 12.2% of the loans is non-performing after 12 months and 16.8% is non performing after 24 months. Loans to new borrowers are less collateralized and are more likely to default than loans to existing borrowers (borrowers with a pre-existing relationship with the bank). Existing borrowers have on average $58,550 of debt outstanding when received the loan and 14.1% of loan recipients hold some non-performing debt at the moment of receiving the loan.

5.2. Default Rate Results

The effect of the liquidity expansion on loan default risk can be characterized by estimating specification (5-1) using the default dummies as the dependent variable and the probability of participation as an instrument for the liquidity expansion dummy. The estimates of the first stage, the regression of the liquidity expansion dummy on the probability of participation, are shown in the bottom panel of Table 5. The 2SLS results for the 12 month and the 24 month default dummy and for various samples are shown in Table 8. The coefficient of interest can be interpreted as the change in the proportion of loans that default due to a liquidity expansion. The point estimates for the entire sample of loans are negative but insignificant for both the 12 and the 24 month measures (columns 1 and 2 of panel 1). This implies that the liquidity expansion do not change in a statistically significant way the default risk of bank loans, which suggests banks are lending at a point where the schedule of loan risk is constant on average.

To check whether the 12 to 24 month window is appropriate to measure changes in default i estimate the hazard rate function of default. The kernel estimation of the monthly hazard rate, probability a loan is defaulted t months after it is issued given that it has not defaulted at month t-1, is plotted in Figure 10. The kernel is estimated for the sample of loans issued between January and August 1998, for which I can observe at least three years and up to four years of repayment history. The plot shows that the hazard rate is initially increasing and peaks before 12 months and then decreases monotonically. Looking at the cumulative hazard, 45% of the loans that default in the sample period will have defaulted by month 12, and 85% will have done so by month 24. Looking at default in the 12 and 24 windows is likely to capture most of the defaults.

As suggested in the discussion in 2.3.2, the fact that banks can expand lending without facing an increase in the default rate of loans is consistent with banks being inefficiently constrained. In terms of that discussion, given the plausible assumption that the interest rate on the marginal loan does not change substantially when lending expands, banks are operating at a point where the expected return of the marginal loan is flat, which is consistent with lending below the optimal level. From the borrowers' perspective, these results also suggest that financing constraints at the bank level may result in credit rationing of viable projects, a topic I explore further in the next subsections.

5.3. Liquidity Constraints and the Composition of Lending

Before going ahead, I show evidence corroborating the claim made in Section 2.2 that the program targeting rule did not affect the investment decision of the banks. To do this I estimate specification (5-1) using a dummy equal to one if the loan is issued to an eligible borrower (less than \$200,000 in sales and 20 workers).[25] If the targeting rule was binding, the proportion of lending to eligible firms should increase when available program financing increases ($\beta>0$). The estimates in columns 1 of Table 9 show this is not the case. The 2SLS estimate of β is not significantly different from zero.

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[25] Loan recipient sales and workers are imputed using data from a sample of manufacturing firms collected by Unión Industrial Argentina. This database was used instead of the program database for imputation in order to avoid potential misreporting biases. The worker and sales data in the program database were self-reported by program banks and were not subject to verification by the program administrators. See a further discussion in Paravisini (2003).

The fact that financial constraints hinder the ability of banks to channel resources to potentially profitable projects brings up the question of which margins of lending are affected. In particular, constraints may affect the extensive margin of lending (access to bank financing) or the intensive one (amount of lending once access has been gained). I investigate this issue by looking at how the allocation of the flow of loans between borrowers with and without a previous debt with the bank ('existing' and 'new' borrowers) changes during liquidity expansion periods. I estimate specification (4-2) using the fraction of the amount of lending to new borrowers as the dependent variable and specification (5-1) using a dummy equal to one if the loan is issued to a new borrower. The results (shown in columns 1 and 2 of Table 9 respectively) indicate that neither the composition of the number of loans or the amount of lending change significantly during liquidity expansions. This implies that the marginal loan is allocated across new and existing borrowers as the infra marginal one is: according to Table 7, 87% of the lending expansion goes to know borrowers. When a bank receives a liquidity shock, it directs a large fraction of resources to increase the debt of firms that are already borrowing from the bank. This evidence is consistent with bank borrowers being credit constrained.

The results indicate that liquidity constraints affect both the extensive and the intensive margins of lending and that the loan allocation choice is not altered in the margin by the liquidity shocks. This cannot be extrapolated to imply that the portfolio composition of the bank will be unaffected by any shock, but it means that the source of shocks considered in this paper is small enough not to change the composition of the marginal investment of the bank. This is convenient for the purposes of this paper because the results can be interpreted as if the risk profile of the banks is not changing and allows focusing on the characteristics of the marginal loan, to which I turn next.

5.4. Marginal Loan Default Risk and Relationship Lending

Even if liquidity constrained banks are prevented from taking all profitable loan opportunities, unconstrained banks may step up and fill in the gap. The previous results suggest that there are frictions preventing borrowers from obtaining finance from other lenders when the bank they borrow from is constrained. These frictions may arise if banks obtain private information from their borrowers and have an advantage over uninformed banks (Sharpe 1990; Rajan

1992; Von Thadden 2001). In this case only the worse borrowers will substitute lenders and uninformed banks will face a 'winners curse'.

This subsection presents evidence consistent with banks holding private information about their borrowers and some of its consequences. I will show that the result obtained in section 5.2, that banks can expand lending without facing an increase in the default rate, is mostly driven by the fact that the default risk profile of the marginal loan to existing borrowers is flat. On the contrary, expanding lending to new borrowers involves an increase in default risk, in particular when lending to new borrowers that are switching from another bank.

The second panel of Table 8 shows the estimated parameters of specification (5-1) in subsection 5.2 but for the sample of existing borrowers. The results for this sub-sample follow are similar to those of the entire sample: the default rate on loans to existing borrowers remains unchanged during lending expansions. On the contrary, the results for the sample of new borrowers, shown in panel 3 of Table 8, indicate that the 12-month default rate for new borrowers increases by 3.8 percentage points when lending expands due to the liquidity shock. The 24-month default rate is also positive but statistically insignificant. Expanding lending to new borrowers does imply an important increase in loan risk. And the time profile of the default rate suggests that loans to new borrowers given during liquidity expansion also tend to default earlier.

The finding that the default rate of loans to new borrowers increases during lending expansions does not necessarily imply that expanding lending to new borrowers is inefficient. If banks have poor information about the quality of new borrowers but can obtain signals of this quality through a lending relationship, then lending to new borrowers can be interpreted as an investment in information. As in Petersen and Rajan (1995), banks will be willing to face a higher default rate in the short run in exchange of higher returns in the future.

Note also that the credit history of all borrowers is public information in Argentina. The entire history of past performance of all borrowers is available to all lenders through the Public Credit Registry in the Central bank. Private information of borrower quality revealed through the lending relationship is less likely to be important if observable past repayment performance is a good enough signal of quality. I examine whether this is the case by repeating the estimation of the change in the default rate during liquidity expansions for new borrowers, but restricting the sample to borrowers that have previous history with another bank. Expanding lending to these 'switching' borrowers should be less risky than lending to new borrowers if public Credit Registry information is a good signal for borrower quality.

The estimate for the sub-sample of switching borrowers is shown in panel 4 of Table 8. First note that the fraction of lending to switching borrowers is very low: 4% of the loans issued to new borrowers and 0.7% of total loans. Second, the estimated change in the default rate during liquidity expansions suggest that the default risk of the marginal loan to a switching borrower is four times that of the marginal loan to new borrowers. Both the reluctance of banks to lend to switching borrowers and the high default risk involved in doing so are consistent with the winners curse story. These results suggest that the private information banks have about their borrowers is still important in this environment of full credit history disclosure. This raises the question of whether the public signals of borrower quality available through the Credit Registry are relevant in the decision of banks to lend, and moreover, whether they are related at all with the probability of default of a firm. I address these issues next.

5.5. Observable Borrower Quality and Rationing

The interpretation of the results so far has been based on the presumption than banks ration borrowers according to default risk. However, borrower risk is unobservable and rationing must be based on observable borrower characteristics that are related to default risk. If borrowers are rationed according to observable borrower quality, then the average observable quality should drop during lending expansions. I test for this prediction by evaluating how two borrower characteristics available in the Public Credit Registry change during lending expansions. First, I look at the collateral to loan ratio of the loan. Higher collateral increases the contingency of the loan contract and should elicit a higher effort from the borrower, leading to a lower probability of default. Second, I use whether a loan recipient has any a non-performing debt outstanding at the moment of receiving the loan as a measure of past repayment performance. Better past performance is a positive signal of the ability of the entrepreneur and the quality of the project and should also predict a lower probability of default.

Specification (5-1) is estimated using the collateral to loan ratio as the dependent variable and the results are shown in column 1 of Table 10. The estimate using the entire sample of loans (panel 1) indicates that the collateral to loan ratio fell by one percentage point due to the liquidity expansion and this change is significant. The fact that the marginal borrower of the bank has a lower collateral than the average borrower is consistent with banks rationing borrowers according to collateral. The result supports the hypothesis that banks lend to lower observable quality borrowers when liquidity expands.

The estimates for the new and existing borrower samples (panels 2 and 3 respectively) suggest that the drop in collateral requirements comes entirely from lending to new borrowers. The collateral to loan ratio of loans to new borrowers drops by 3.4 percentage points during liquidity expansions. Thus, the result regarding collateral could potentially explain the observed patterns in the sensitivity of the default rate to liquidity. If loan collateralization is a good predictor of default and banks are able to expand lending to existing borrowers without relaxing collateral requirements, then it is to be expected that the default rate of existing borrowers does not react to liquidity expansions.

I turn next to past repayment performance and estimate specification (5-1) again using as the dependent variable a dummy equal to one if the loan recipient has some non-performing debt outstanding at the moment it receives the loan. The result in column 2 of Table 10, which uses the sub-sample of existing borrowers, shows that the fraction of loans issued to borrowers with non-performing debt increased by 4.7 percentage points during liquidity expansions. This result is again consistent with rationing according to observable characteristics and indicates banks relaxed their rationing criteria of existing borrowers as well.

Recalling the results from the previous subsection, the default rate of existing borrowers did not increase during lending expansions even though these borrowers are of a lower observable quality. This suggests banks are able to pick the best performing borrowers among a pool of existing borrowers of equivalent observable quality. This result supports the hypothesis that banks have private information about borrower quality and use it effectively to screen borrower risk.

An alternative interpretation of the previous results is that past performance is not a good predictor of borrower quality and only collateral matters. To test whether this is the case I estimate the following linear probability model of default using past performance and collateral as dependent variables:

$$DumDef_{ijt} = \alpha_i + \alpha_t + \alpha_s + \zeta_1 DumPast_{it} + \zeta_2 Collat_{it} + \nu_{it} \tag{5-2}$$

As before, each observation represents a loan j issued by bank i at month t. The dependent variable is a dummy equal to one if the loan defaults within 12 (24) months. On the right hand side are the past default dummy and the collateral to loan amount ratio. Also a full set of bank, month and sector dummies are included. The estimated parameters are shown in Table 11. The results show a significant relationship between both collateral and past performance with the probability of default of a loan. A 10 percentage point decrease in the collateral to loan ratio can be associated with 0.5 percentage point increase in the probability of default in the entire sample, a 1 percentage point increase in the new borrower sample and a 0.35 percentage point increase in the existing borrower sample. Also, a loan recipient that holds non-performing debt is 54% more likely to default than one with a clean slate.

These results corroborate the initial interpretation of the results: bank-borrower interactions elicit information about borrower quality that is observable only by the lender and is used effectively to screen default risk.

6. Conclusions

This paper provides evidence that banks are liquidity constrained and that these constraints lead to a high sensitivity of lending to changes in the financial position of the bank. The results also indicate that liquidity constraints hinder bank investment in potentially profitable loans. The paper addresses the difficulty of distinguishing changes in bank liquidity from changes in loan investment opportunities encountered in the previous literature by exploiting the exogenous variation in available finance produced by a government program in Argentina. The results in this paper vindicate previous findings by showing that the empirical strategy based on the cross sectional comparison of banks is biased against finding a substantial sensitivity to liquidity.

Bank liquidity constraints will affect investment only if borrowers cannot easily substitute bank credit with other sources of financing. The results of this paper suggest that specialized lenders like banks can produce information that outperforms observable hard information as a signal of borrower creditworthiness. Banks are able to distinguish the best investment prospects among existing borrowers that are observationally equivalent to outsiders. The findings also suggest collateral becomes less important in determining access to credit in the margin when this private information is available. I also provide evidence consistent with adverse selection in the bank credit market. Banks are reluctant to issue credit to borrowers that are switching from another lender and the default risk of the marginal loan to these borrowers is steeply increasing.

The relevance of soft data collected by sophisticated lenders raises a concern regarding the availability of noisy public data on borrower quality. The results indicated that past mistakes by some borrowers may have too much weight when estimating probabilities of default based on raw credit history data. Unsophisticated lenders that rely on this data to assess credit risk may punish past mistakes too harshly and precipitate the foreclosure of perfectly viable borrowers. The recent literature on the effects of credit information disclosure has generally emphasized the advantages due to increased availability of credit (see Miller 2003 for a recent survey). The results of this paper suggest there is a potential downside of disclosure, a point that has been raised in theoretical work (Morris and Shin 2001), although not without controversy (Angeletos and Pavan 2004).

Finally, the results of this paper shed some light on the nature of bank liquidity constraint and the potential welfare gains in loosening them. On the one hand, liquidity constraints may arise optimally as an incentive device to mitigate the propensity of bank owners to engage in risk shifting, or to keep in check the propensity empire-building managers to over-invest (Jensen 1986; Hart and Moore 1990; Stulz 1990; Aghion and Bolton 1992). In this scenario, relaxing liquidity constraints is likely to result in an inefficient increase in the risk profile of the bank portfolio and in lending. On the other hand, liquidity constraints may lead to under-investment when they arise from adverse selection in the financing market (Stiglitz and Weiss 1981; Myers 1984; Myers and Majluf 1984; Stein 1998) or are a consequence of tight capital requirements (Besanko and Kanatas 1996; Thakor 1996). The evidence presented in this paper is consistent with the second view of bank liquidity constraints.

7. References

Aghion, P. and P. Bolton (1992). "An Incomplete Contracts Approach to Financial Contracting." Review of Economic Studies **59**(200): 473.

Allen, F. (2001). "Presidential Address: Do Financial Institutions Matter?" Journal of Finance **56**(4): 1165-1175.

Allen, F. and D. Gale (2004). "Financial Intermediaries and Markets." Econometrica **72**(4): 1023-1061.

Alti, A. (2003). "How Sensitive Is Investment to Cash Flow When Financing Is Frictionless?" The Journal of Finance **58**(2).

Angeletos, M. and A. Pavan (2004). "Transarency of Information and Coordination in Economies with Investment Complementarities." Mimeo, MIT-Northwestern.

Angrist, J. and G. Imbens (1995). "Two-Stage Least Squares Estimation of Average Causal Effects in Models with Variable Treatment Intensity." Journal of the American Statistical Association **90**(430): 431-442.

Angrist, J., G. Imbens and D. Rubin (1996). "Identification of Causal Effects Using Instrumental Variables." Journal of the American Statistical Association **91**(434): 444-455.

Angrist, J. and V. Lavy (1999). "Using Maimonides' Rule to Estimate the Effect of Class Size on Scholastic Achievement." The Quarterly Journal of Economics **114**(2): 533-75.

Ashcraft, A. (2003). "New Evidence on the Lending Channel." Journal of Money, Credit and Banking(Forthcoming).

Banerjee, A. and E. Duflo (2004). Do Firms Want to Borrow More? Testing Credit Constraints Using a Directed Lending Program. Cambridge: MIT.

Barger, T. (1998). Financial Institutions. Lessons of Experience 6. Washington, International Finance Corporation - World Bank.

Berger, A., L. Klapper, M. Miller and G. Udell (2003). Relationship Lending in Argentine Small Business Credit Market. Credit Reporting Systems and the International Economy. M. Miller. Cambridge, Massachusetts, The MIT Press**:** 255-70.

Berger, A., L. Klapper and G. Udell (2001). "The Ability of Banks to Lend to Informationally Opaque Small Businesses." Journal of Banking and Finance **25**: 2127-67.

Berger, A., N. Miller, M. Petersen, R. Rajan and J. Stein (2003). Does Function Follow Organizational Form? Evidence From the Lending Practices of Large and Small Banks.

Berger, A. and G. Udell (1994). "Did Risk-Based Capital Allocate Bank Credit and Cause a "Credit Crunch" in the United States?" Journal of Money, Credit and Banking **26**(3-2): 585-628.

Bernanke, B. (1983). "Nonmonetary Effects of the Financial Crisis in the Propagation of the Great Depression." American Economic Review **73**(3): 257-76.

Bernanke, B. and A. Blinder (1988). "Credit, Money, and Aggregate Demand." American Economic Review **78**(2): 435-439.

Bernanke, B. and A. Blinder (1988). "Credit, Money, and Aggregate Demand." American Economic Review **78**(2): 435-9.

Bernanke, B. and A. Blinder (1992). "The Federal Funds Rate and the Channels of Monetary Transmission." American Economic Review **82**(4): 901-921.

Bernanke, B. and M. Gertler (1989). "Agency Costs, Net Worth, and Business Fluctuations." American Economic Review **79**(1): 14-31.

Bernanke, B. and M. Gertler (1995). "Inside the Black Box: The Credit Channel of Monetary Policy Transmission." The Journal of Economic Perspectives **9**(4): 27-48.

Bernanke, B. and C. Lown (1991). "The Credit Crunch." Brookings Papers on Economic Activity **1991**(2): 205-39.

Bertrand, M., E. Duflo and S. Mullainathan (2003). How Much Should we Trust Differences-in-Differences Estimates? MIT working paper. Cambridge.

Bertrand, M. and S. Mullainathan (2003). Cash Flow and Investment Project Outcomes: Evidence from Bidding on Oil and Gas Leases. MIT.

Besanko, D. and G. Kanatas (1993). "Credit Market Equilibrium with Bank Monitoring and Moral Hazard." Review of Financial Studies **6**(1): 213-32.

Besanko, D. and G. Kanatas (1996). "The Regulation of Bank Capital: Do Capital Standards Promote Bank Safety?" Journal of Financial Intermediation **5**: 160-83.

Blanchard, O., F. Lopez-de-Silanes and A. Shleifer (1994). "What do Firms do with Cash Windfalls?"" Journal of Financial Economics **36**: 337-360.

Boot, A., S. Greenbaum and A. Thakor (1993). "Reputation and Discretion in Financial Contracting." American Economic Review **83**(5): 1165-83.

Broecker, T. (1990). "Credit-Worthiness Tests and Interbank Competition." Econometrica **58**(2): 429-52.

Calomiris, C. and J. Mason (2003). "Consequences of Bank Distress During the Great Depression." American Economic Review **93**(3): 937-47.

Detragiache, E., P. Garella and L. Guiso (2000). "Multiple versus Single Banking Relationships: Theory and Evidence." Journal of Finance **55**(3): 1133-1161.

Diamond, D. (1984). "Financial Intermediation and Delegated Monitoring." Review of Economic Studies **51**(3): 393-414.

Diamond, D. (1991). "Monitoring and Reputation: The Choice between Bank Loans and Directly Placed Debt." The Journal of Political Economy **99**(4): 689-721.

Diamond, D. and P. Dybvig (1983). "Bank Runs, Deposit Insurance, and Liquidity." The Journal of Political Economy **91**(3): 401-19.

Diamond, D. and R. Rajan (2000). "A Theory of Bank Capital." The Journal of Finance **55**(6): 2431-65.

Driscoll, J. (2004). "Does Bank Lending Affect Output? Evidence from the U.S. States." Journal of Monetary Economics **51**: 451-471.

Erickson, T. and T. Whited (2000). "Measurement Error and the Relationship between Investment and "q"." The Journal of Political Economy **108**(5): 1027-57.

Falkenheim, M. and A. Powell (2003). The Use of Public Credit Registry Information in the Estimation of Appropriate Capital and Provisioning Requirements. Credit Reporting Systems and the International Economy. M. Miller. Cambridge, Massachusetts, The MIT Press.

Fazzari, S. M., G. Hubbard and B. C. Petersen (1988). "Financing Constraints and Corporate Investment." Brookings Papers on Economic Activity: 141-195.

Froot, K., D. Scharfstein and J. Stein (1993). "Risk Management: Coordinating Corporate Investment and Financing Policies." The Journal of Finance **48**(5): 1629-58.

Gorton, G. and G. Pennacchi (1990). "Financial Intermediaries and Liquidity Creation." Journal of Finance **45**(1): 49-71.

Gorton, G. and A. Winton (2002). Financial Intermediation. Handbook of the Economics of Finance. G. Constantinides, M. Harris and R. Stulz. Amsterdam, North Holland.

Gutiérrez-Girault, M. (2002). Estimación de un Modelo Estadístico de Default con l Central de Deudores del Sistema Financiero. Banco Central de la República Argentina. Buenos Aires.

Hart, O. and J. Moore (1990). "Property Rights and the Nature of the Firm." Journal of Political Economy.

Hart, O. and J. Moore (1995). "Debt and Seniority: An Analysis of the Role of Hard Claims in Constraining Management." American Economic Review **85**(3): 567-85.

Hart, O. and J. Moore (1996). "A Theory of Debt Based on the Inalienability of Human Capital." The Quarterly Journal of Economics **109**(4): 841.

Hart, O. and J. Moore (1998). "Default and Renegotiation: A Dynamic Model of Debt." The Quarterly Journal of Economics **113**(1): 1-41.

Heaton (2002). "Managerial Optimism and Corporate Finance." Financial Management **31**(2): 33.

Holmstrom, B. and J. Tirole (1997). "Financial Intermediation, Loanable Funds and the Real Sector." The Quarterly Journal of Economics **112**(3): 663-91.

Hubbard, G. (1995). "Is there a Credit Channel of Monetary Policy?" Federal Reserve Bank of St. Louis Review **77**(3): 63-77.

Hubbard, G., K. Kuttner and D. Palia (2002). "Are there Bank Effects in Borrowers' Cost of Funds? Evidence from a Matched Sample of Borrowers and Banks." Journal of Business **74**(4).

Jayaratne, J. and D. Morgan (2000). "Financial Market Frictions and Deposit Constraints at Banks." Journal of Money, Credit and Banking **32**(1): 74-92.

Jensen, M. (1986). "Agency Costs of Free Cash Flow, Corporate Finance, and Takeovers." American Economic Review **76**(2): 323-29.

Kaplan, S. and L. Zingales (1997). "Do Investment-Cash Flow Sensitivities Provide Useful Measures of Financing Constraints?" The Quarterly Journal of Economics **112**: 169-216.

Kaplan, S. and L. Zingales (2000). "Investment-cash Flow Sensitivity are not Valid Measures of Financial Constraints." The Quarterly Journal of Economics **115**: 707-712.

Kashyap, A., O. Lamont and J. Stein (1994). "Credit Conditions and the Cyclical Behavior of Inventories." The Quarterly Journal of Economics **109**(3): 565-592.

Kashyap, A., R. Rajan and J. Stein (2002). "Banks as Liquidity Providers: An Explanation for the Coexistence of Lending and Deposit-Taking." The Journal of Finance **57**(1).

Kashyap, A. and J. Stein (2000). "What do One Million Observations on Banks Have to Say About the Transmission of Monetary Policy." American Economic Review **90**(3): 407-428.

Kashyap, A., J. Stein and D. Wilcox (1993). "Monetary Policy and Credit Conditions: Evidence from the Composition of External Finance." American Economic Review **83**(1): 78-98.

Kishan, R. and T. Opiela (2000). "Bank Size, Bank Capital, and the Bank Lending Channel." Journal of Money, Credit and Banking **32**(1): 121.

Lamont, O. (1997). "Cash Flows and Investent: Evidence from Internal Capital Markets." Journal of Finance **51**(1): 83-109.
Miller, M. (2003). Credit Reporting Systems Around the Globe. Credit Reporting Systems and the International Economy. M. Miller, The MIT Press.
Morris, S. and H.-H. Shin (2001). Coordination Risk and the Price of Debt. mimeo - Yale.
Myers, S. (1984). "The Capital Structure Puzzle." Journal of Finance **39**: 575-92.
Myers, S. and N. Majluf (1984). "Corporate Financing and Investment Decisions when Firms have Information that Investors do not Have." Journal of Financial Economics **13**: 187-222.
Ostergaard, C. (2001). External Financing Costs and Bank's Loan Supply: Does the Structure of the Bank Sector Matter? Norwegian School of Management.
Paravisini, D. (2003). "Does targeting through banks work? An evaluation of the treatment effect of a directed credit government intervention in Argentina." MIT, mimeo.
Peek, J. and E. Rosengren (1997). "The International Transmission of Financial Shock." American Economic Review **87**(4): 495-505.
Peek, J. and E. Rosengren (2000). "Collateral Damage: Effects of the Japanese Bank Crisis on Real Activity in the United States." American Economic Review **90**(1): 30-45.
Petersen, M. and R. Rajan (1994). "The Benefits of Lending Relationships: Evidence from Small Business Data." The Journal of Finance **49**(1): 3-37.
Petersen, M. and R. Rajan (1995). "The Effect of Credit Market Competition on Lending Relationships." Quarterly Journal of Economics **110**(2): 407-443.
Poterba, J. (1988). "Comment: Financing Constraints and Corporate Investment." Brookings Papers on Economic Activity **1**: 200-6.
Rajan, R. (1992). "Insiders and Outsiders: The Choice between Informed and Arm's-Length Debt." Journal of Finance **47**(4): 1367-1400.
Rauh, J. (2004). Investment and Financing Constraints: Evidence from the Funding of Corporate Pension Plans. MIT.
Sharpe, S. (1990). "Asymmetric Information, Bank Lending and Implicit Contracts: A Stylized Model of Customer Relationships." The Journal of Finance **45**(4): 1069-87.
Sharpe, S. (1995). Bank Capitalization, Regulation, and the Credit Crunch: A Critical Review of the Research Findings. Board of Governors of the Federal Reserve System Finance and Economics Discussion Series.
Stein, J. (1997). "Internal Capital Markets and the Competition for Corporate Resources." The Journal of Finance **52**(1): 111-133.
Stein, J. (1998). "An Adverse Selection Model of Bank Asset and Liability Management with Implications for the Transmission of Monetary Policy." RAND Journal of Economics **29**(3): 466-86.
Stein, J. (2002). "Information Production and Capital Allocation: Decentralized Vs. Hierarchical Firms." Journal of Finance **57**.
Stein, J. (2003). Agency, Information and Corporate Investment. Handbook of the Economics of Finance. G. Constantinides, M. Harris and R. Stulz. Amsterdam, North Holland.
Stiglitz, J. and A. Weiss (1981). "Credit Rationing in Markets with Imperfect Information." American Economic Review **71**(3): 393-410.
Stulz, R. (1990). "Managerial discretion and optimal financing policies." Journal of Financial Economics **26**(1): 3-27.

Thakor, A. (1996). "Capital Requirements, Monetary Policy, and Aggregate Bank Lending: Theory and Empirical Evidence." Journal of Finance **51**(1): 279-324.
Von Thadden, E.-L. (2001). Assymetric Information, Bank Lending and Implicit Contracts: The Winner's Curse. mimeo.

8. Tables

Table 1

Allocation Formula Score Point According to the Average Size of Loan

Average size of loan		
From ($)	To ($)	Points
0	3000	100
3000	6000	97
6000	9000	94
9000	12000	91
12000	15000	88
15000	18000	85
18000	21000	82
21000	24000	79
24000	27000	76
27000	30000	73
30000	33000	70
33000	36000	67
36000	39000	64
39000	42000	61
42000	45000	58
45000	48000	55
48000	50000	52
50000	100000	30
100000	200000	20
200000	∞	10

Table 2

Bank Descriptive Statistics, by Program Participation (Thousands of $)

	All banks	Program banks	Non-program banks
Assets	1,095,287	543,985	1,244,598
	[2,396,431]	[599,719]	[2,667,256]
Loans	536,344	283,790	604,744
	[1,241,008]	[332,044]	[1,382,174]
Liabilities	979,350	488,200	1,112,370
	[2,168,293]	[539,852]	[2,414,047]
Deposits	569,590	361,719	625,888
	[1,331,549]	[407,961]	[1,483,052]
Loanable funds	616,099	382,853	680,614
	[1,348,276]	[418,375]	[1,503,195]
Loans/Assets	0.500	0.500	0.485
	[0.146]	[0.109]	[0.199]
Deposits/Assets	0.515	0.626	0.485
	[0.194]	[0.124]	[0.199]
Equity/Assets	0.133	0.133	0.133
	[0.135]	[0.130]	[0.137]
ROA	0.31%	0.14%	0.35%
	[1.22]	[1.12]	[1.24]
Financial Rev./Loans (%)	13.6%	12.8%	13.9%
	[7.2]	[2.4]	[8.0]
Predicted financing	1,547.5	1,598.7	1,532.9
	[494.9]	[429.2]	[513.1]
Exp. financing/Loans	0.068	0.076	0.065
	[0.166]	[0.196]	[0.159]

Means and standard deviations (in brackets) are reported. The statistics are calculated for a universe of 122 banks (26 program, 96 non-program) between 1998 and 2000. Loanable funds: the sum of equity, deposits and other liabilities minus the reserve requirements for each type of liability (for example 20% for checking accounts and 5% for 90 day deposits, 0% for one year deposits and so on). Program banks hold on average 10.2% of total assets, 11.2% of total loans and 12.1% of total deposits of the banking system.

Table 3

Program Firm Loans' Descriptive Statistics

Variable	Mean	Std. Dev.	Min	Max	Median
Amount of loan ($)	9,438.4	4,322.2	500	26,666	10,000
Value of collateral posted	10,527.5	9,751.9	0	350,000	10,000
Interest rate (%)	13.74	1.302	11.5	16	13.5
Grace period (months)	2.15	4.32	0	47	0
Frequency of payments (months)	1.30	1.10	1	6	1
Number of payments	33.19	13.38	0	48	36
Duration (months)	35.60	11.72	1	48	36

* Source: Program database, Secretaría de la Pequeña y Mediana Industria, Ministry of Economy, Government of Argentina. The table is based on 12,192 observations where each observation corresponds to a program loan. Duration is the number of months that results when multiplying the frequency of payment times the number of payments.

Table 4

Regression of Actual and Predicted Financing Expansion Growth on Past Deposit Growth, Past Cash Flow and Bank/Month Fixed Effects

	Actual Financing (growth)	Predicted Financing (growth) Program banks	Predicted Financing (growth) All banks
	(1)	(2)	(3)
$DepositGrowth_{t-1}$	-0.028	0.02	0.002
	[0.049]	[0.018]	[0.002]
$DepositGrowth_{t-2}$	-0.162***	-0.015	-0.001
	[0.058]	[0.011]	[0.003]
$DepositGrowth_{t-3}$	-0.094	-0.021	0
	[0.086]	[0.016]	[0.004]
$DepositGrowth_{t-4}$	-0.111*	-0.027	-0.002
	[0.055]	[0.019]	[0.003]
$CashFlow_{t-1}$	0.00078	0.00074	0.00076
	[0.0035]	[0.00071]	[0.00073]
$CashFlow_{t-2}$	0.0033	0.00070	0.00055
	[0.0035]	[0.00074]	[0.00040]
$CashFlow_{t-3}$	0.0058	0.00096	0.00027
	[0.0056]	[0.00098]	[0.00044]
$CashFlow_{t-4}$	0.0049	0.00071	0.00019
	[0.0071]	[0.00074]	[0.00044]
Observations	1001	1003	5818
R-squared	0.31	0.85	0.88

* significant at 10%; ** significant at 5%; *** significant at 1%. Robust standard errors in brackets, clustered at the bank level. All specifications include a full set of bank and month dummies.

Table 5

First Stage: Regression of Liquidity (Liquidity Expansion Dummy) on Predicted Credit Expansion Growth (Predicted Probability of Participation) and Bank/Month Fixed Effects

	All Waves			Final Waves
	All banks	High-probability of participation banks	Low-probability of participation banks	All banks
Liquidity	(1)	(2)	(3)	(4)
1. Dependent Variable: Liquidity				
Predicted Financing	0.033**	0.074***	0.011	0.068***
Expansion Growth	[0.012]	[0.021]	[0.040]	[0.021]
Observations	6,746	2,015	4,731	4,654
R-squared	0.08	0.15	0.10	0.07
2. Dependent Variable: Liquidity Expansion Dummy				
Predicted Probability				0.057***
of Participation				[0.011]
Bank/Month/Industry FE				Yes
Observations				750,533
R-squared				0.59

* significant at 10%; ** significant at 5%; *** significant at 1%. Robust standard errors in brackets, clustered at the bank level. Banks with a high probability of participation are banks in the top quartile of the distribution of predicted probability of participation. All specifications include a full set of bank and month dummies. Liquidity is defined as the loanable fund growth, where loanable funds are equity plus deposits plus other liabilities minus reserve requirements. The liquidity expansion dummy is equal to one during the three following month after a bank participated in a program wave. The predicted probability of participation is estimated using (4-8).

Table 6

OLS/2SLS Estimates of the Sensitivity of Lending to Liquidity by Bank Size and Capitalization (Bank/Month Fixed Effects)

	OLS	2SLS	2SLS			
Sample	All waves	All waves	Final waves			
Loan growth	(1)	(2)	(3)	(4)	(5)	(6)
Instrument: Predicted Financing Expansion						
Liquidity	0.307***	0.481***	0.745***	0.745***	0.692***	0.627***
	[0.074]	[0.170]	[0.139]	[0.139]	[0.145]	[0.147]
Liquidity x Small					0.012	
					[0.221]	
Liquidity x LowCap						0.063
						[0.190]
# Banks	117	117	113	113	113	113
Observations	6,671	6,436	4,654	4,654	4,654	4,654
R-squared	0.15					

* significant at 10%; ** significant at 5%; *** significant at 1%. Robust standard errors in brackets, clustered at the bank level. All specifications include full set of bank/month dummies. Liquidity is loanable fund growth, where loanable funds are equity plus deposits plus other liabilities minus reserve requirements. Of the program banks in the reduced sample, 40.7% are classified as small and 25.9% as low capitalized. Of the non-program banks, 51.0% are classified as small and 14.9% as low capitalized.

Table 7

Loan and Loan Recipient Summary Statistics, by Borrower Type

	All	Existing Borrowers	New Borrowers - All	New Borrowers - Switching
Number	750,526	620,325	130,201	5,488
Loan Characteristics				
Loan amount ($)	16,691	17,722	11,776	15,602
	[226,660]	[218,790]	[260,858]	[326,867]
Collateral/Loan	0.123	0.124	0.118	0.129
	[0.301]	[0.299]	[0.312]	[0.324]
Loan Performance				
Default after 12 months (yes=1)	0.122	0.104	0.191	0.206
	[0.328]	[0.306]	[0.393]	[0.404]
Default after 24 months (yes=1)	0.168	0.153	0.228	0.254
	[0.374]	[0.359]	[0.420]	[0.435]
Borrower History				
Total bank debt		58,551		6,444
		[601,468]		[258,200]
Past non-performing loan (yes=1)		0.141		0.057
		[0.348]		[0.231]

Means and standard deviations (in brackets) are reported. Statistics are estimated from the post-1998 sub-sample. Each observation corresponds to a new loan issued during the sample period. Default after 12 (24) months is a dummy equal to one if the loan is non performing 12 (24) months after the loan is issued. Past non-performing loan is a dummy equal to one in the loan recipient has any non-performing debt during the 12 months previous to the loan issuance. A loan recipient is classified as *new* if it has no previous credit with the issuing bank, and *existing* otherwise.

Table 8

Bank Liquidity and Loan Risk – IV Estimates of Loan Default Rate on Liquidity Expansion Dummy including Bank/Month/Industry Fixed Effects

	Loan with problems after:	
	12 months	24 months
	(1)	(2)
1. All Loans		
Liquidity expansion bank-month	-0.004	-0.009
	[0.028]	[0.020]
Observations	750,563	750,563
2. Existing Borrowers		
Liquidity expansion bank-month	-0.002	-0.012
	[0.022]	[0.018]
Observations	620,325	620,325
3. New Borrowers		
Liquidity expansion bank-month	0.038**	0.017
	[0.018]	[0.016]
Observations	130,201	130,201
4. New Borrowers w/history		
Liquidity expansion bank-month	0.176**	0.161**
	[0.062]	[0.067]
Observations	5,488	5,488

Robust standard errors in brackets, clustered at the bank level. All specifications include bank and month fixed effects. * significant at 10%; ** significant at 5%; *** significant at 1%. Each observation corresponds to a loan made by bank i to firm j at month t. The dependent variable in columns 1 and 2 (3 and 4) is a dummy equal to one if the loan repayment is at least six months late, the loan is defaulted or the loan recipient has filed for bankruptcy 12 (24) months after issued. All specifications include bank, industry and month dummies. The liquidity expansion dummy is instrumented with the predicted probability of participation of bank i in a wave that begins at month t.

Table 9

Bank Liquidity and Composition of Lending: 2SLS Estimation of the Effect of Liquidity Expansion on Proportion of Number of Loans to Small and New Borrowers

Fraction of Loans to	Small Borrowers	New Borrowers
	(1)	(3)
Liquidity	-0.011	
	[.034]	
Liquidity Expansion		-0.010
Bank-Month		[.050]
Bank/Month FE	Yes	Yes
Observations	4,654	4,654

* significant at 10%; ** significant at 5%; *** significant at 1%. Robust standard errors in brackets, clustered at the bank level. Each observation in the specification in column 1 is a loanj given by bank i at month t. Each observation in the specification of column 2 is lending by bank i at month t. Liquidity is defined as the loanable fund growth, where loanable funds are equity plus deposits plus other liabilities minus reserve requirements. Liquidity is instrumented with the predicted available finance. The liquidity expansion dummy is equal to one during the three following month after a bank participated in a program wave. The predicted probability of participation is estimated using (4-8). New borrowers are loan recipients with no previous relationship with the bank. Small borrowers are borrowers with less than $200,000 in sales and 20 workers.

Table 10

Bank Liquidity, Collateral and Borrower Past Performance: IV Estimates of Loan Collateral to Debt Ratio and Default History on Liquidity Expansion Dummy including Bank/Month/Industry Fixed Effects

	Collateral/Loan (1)	Bad Past Performance (2)
1. All Loans		
Liquidity expansion bank-month	-0.010**	
	[0.004]	
Observations	750,526	
R-squared	0.09	
2. New Borrowers		
Liquidity expansion bank-month	-0.034*	
	[0.019]	
Observations	130,201	
R-squared	0.05	
3. Existing Borrowers		
Liquidity expansion bank-month	0.002	0.047*
	[0.008]	[0.025]
Observations	620,325	620,325
R-squared	0.14	0.07
4. New Borrowers w/history		
Liquidity expansion bank-month	-0.068*	0.039***
	[0.037]	[0.013]
Observations	5,488	5,488
R-squared	0.20	0.02

Robust standard errors in brackets, clustered at the bank level. All specifications include bank, industry and month dummies. * significant at 10%; ** significant at 5%; *** significant at 1%. Each observation corresponds to a loan made by bank i to firm j at month t. The dependent variable in columns 1 and 2 is the proportion of the value of the loan covered with collateral. The dependent variable in column 3 is a dummy equal to one if the loan recipient has some non-performing debt outstanding (non-performing is defined as at least six months late in repayment). The liquidity expansion dummy is instrumented with the predicted probability of participation of bank i in a wave that begins at month t. The small loans dummy is equal to one if the amount of the loan is in the lowest quintile of the loan amount distribution.

Table 11

Collateral and Past Performance as Predictors of Default: Probit Estimation of the Probability of Default as a Function of the Collateral to Debt Ratio and Past Defaults including Bank/Month/Industry Fixed Effects

	Probability of Default	
	OLS	Probit [a]
	(1)	(2)
1. All Loans		
Collateral/Debt	-0.052***	-0.052***
	[0.004]	[0.004]
Observations	750,526	750,526
R-squared (pseudo)	0.04	0.04
2. New Borrowers		
Collateral/Debt	-0.104***	-0.109***
	[0.005]	[0.005]
Observations	130,238	129,804
R-squared (pseudo)	0.08	0.08
3. Existing Borrowers		
Collateral/Debt	-0.035***	-0.038***
	[0.004]	[0.005]
Past Default Dummy	0.544***	0.554***
	[0.002]	[0.003]
Observations	620,325	617,863
R-squared (pseudo)	0.21	0.17
4. New Borrowers w/history		
Collateral/Debt	-0.096***	-0.104***
	[0.019]	[0.022]
Past Default Dummy	0.339***	0.367***
	[0.065]	[0.069]
Observations	5,488	5,488
R-squared (pseudo)	0.08	0.07

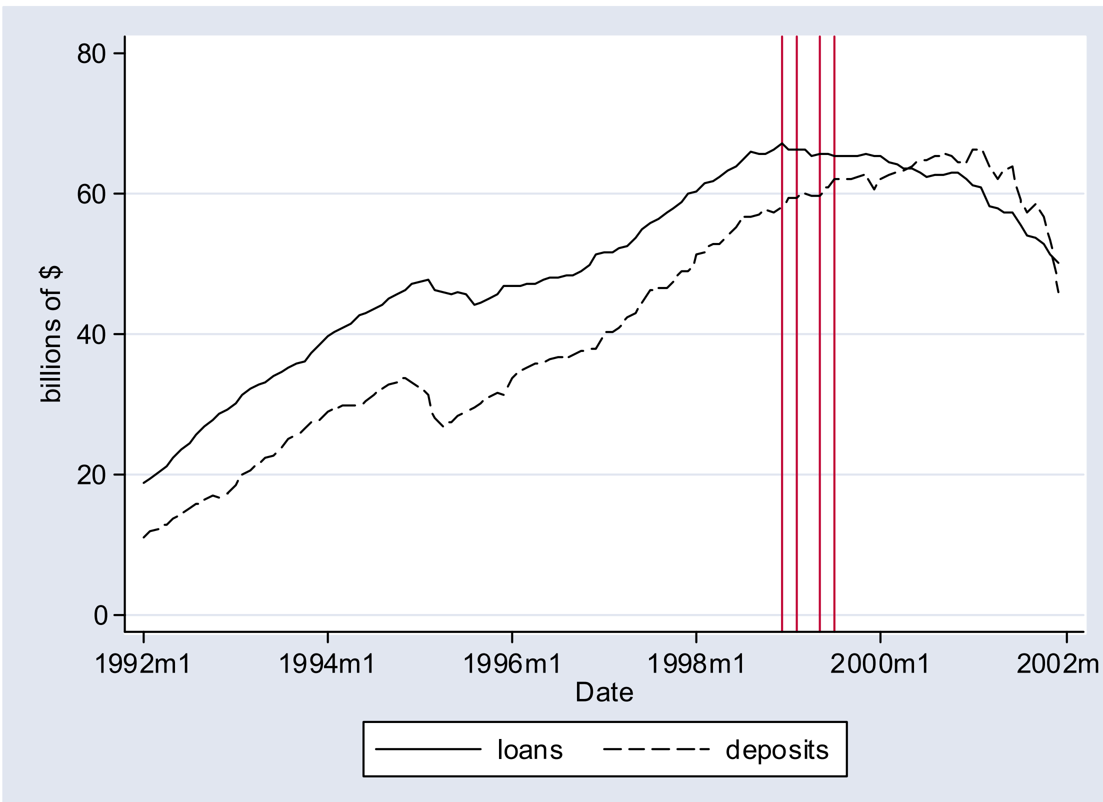
Robust standard errors in brackets, clustered at the firm level (222,146 clusters in the entire sample). All specifications include bank, industry and month dummies. * significant at 10%; ** significant at 5%; *** significant at 1%. Each observation corresponds to a loan made by bank i to firm j at month t. The small loans dummy is equal to one if the amount of the loan is in the lowest quintile of the loan amount distribution.

(a) Marginal effects evaluated at the sample mean are reported.

9. Figures

Figure 1

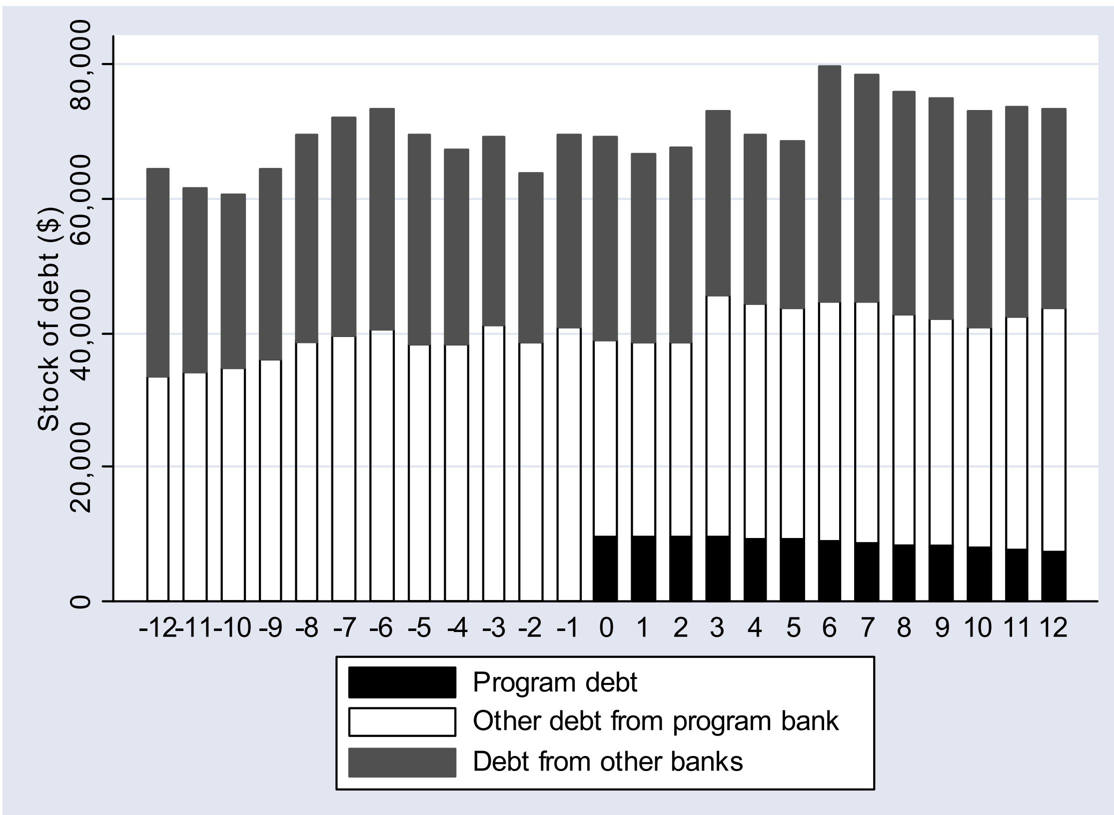
Time Series Evolution of Loans and Deposits in the Banking System, monthly data from 1992 to 2001



Source: Central Bank of Argentina. The vertical lines represent the start date of the final four waves of the program.

Figure 2

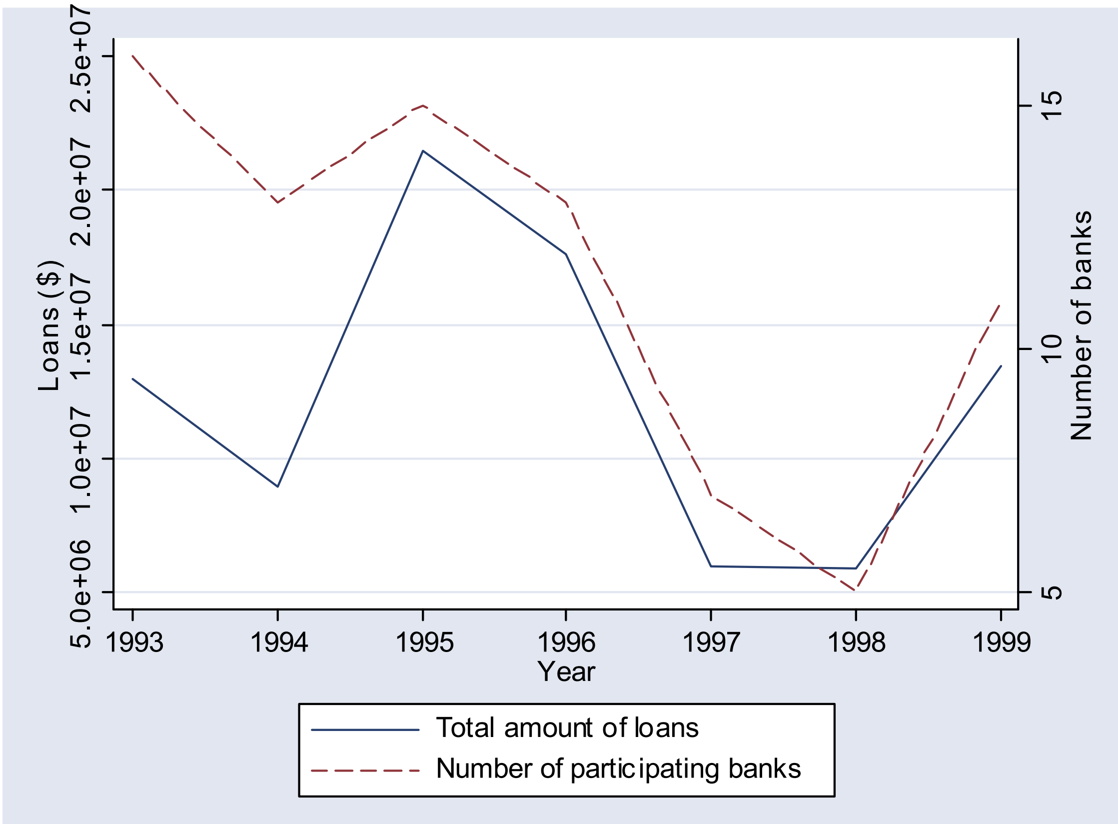
Evidence on Loan Re-Labeling: Monthly Debt Evolution of the Firms that Received Program Loans, by Source



Source: own calculations using MYPES program database and CDSF credit bureau data. Based on a sample of 2,596 firms that received program loans after January 1996. The horizontal axis measures time in months relative to the moment of reception of the program loan (0 is the month the program loan was received by the firm).

Figure 3

Flow of Program Financing and Number of Participating Banks, by Year



Source: own calculations using MYPES program data. The flow of financing during a year is the sum of the amount of resources allocated to all the waves that began during that year. The number of banks counts a bank only once even if it participated in two waves during a year.

Figure 4

No Financing Frictions: Profit Maximizing Choice of Loans when Subsidized Financing Increases

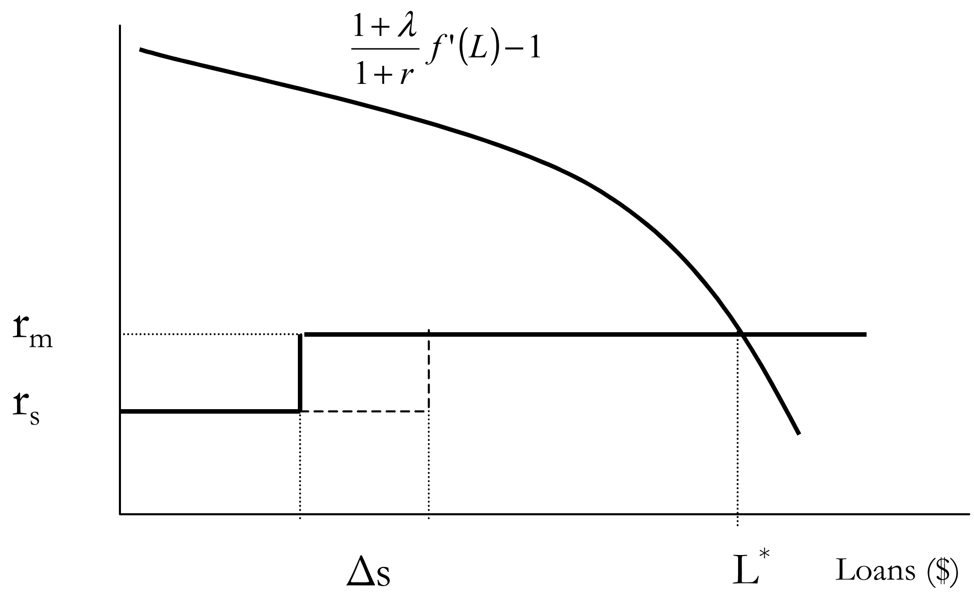


Figure 5

Financing Frictions: Profit Maximizing Choice of Loans when Subsidized Financing Increases

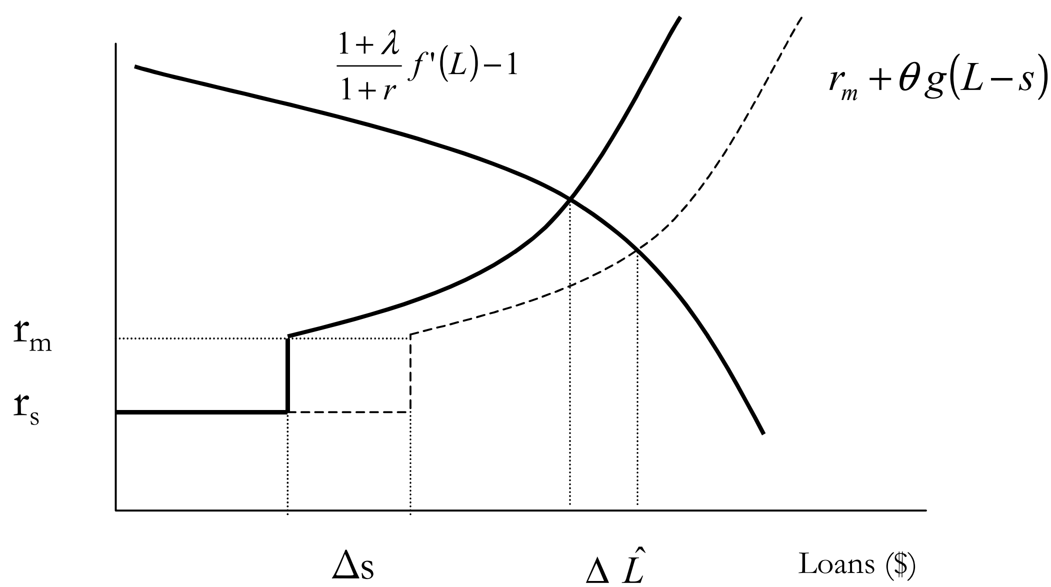
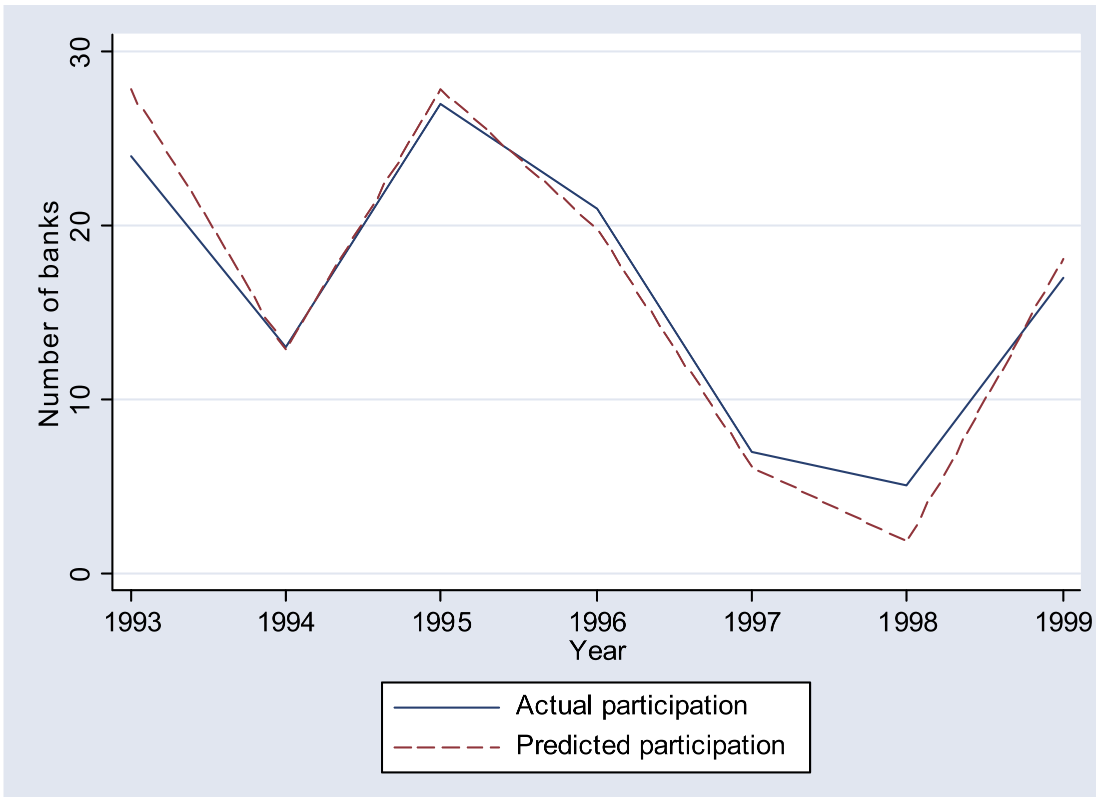


Figure 6

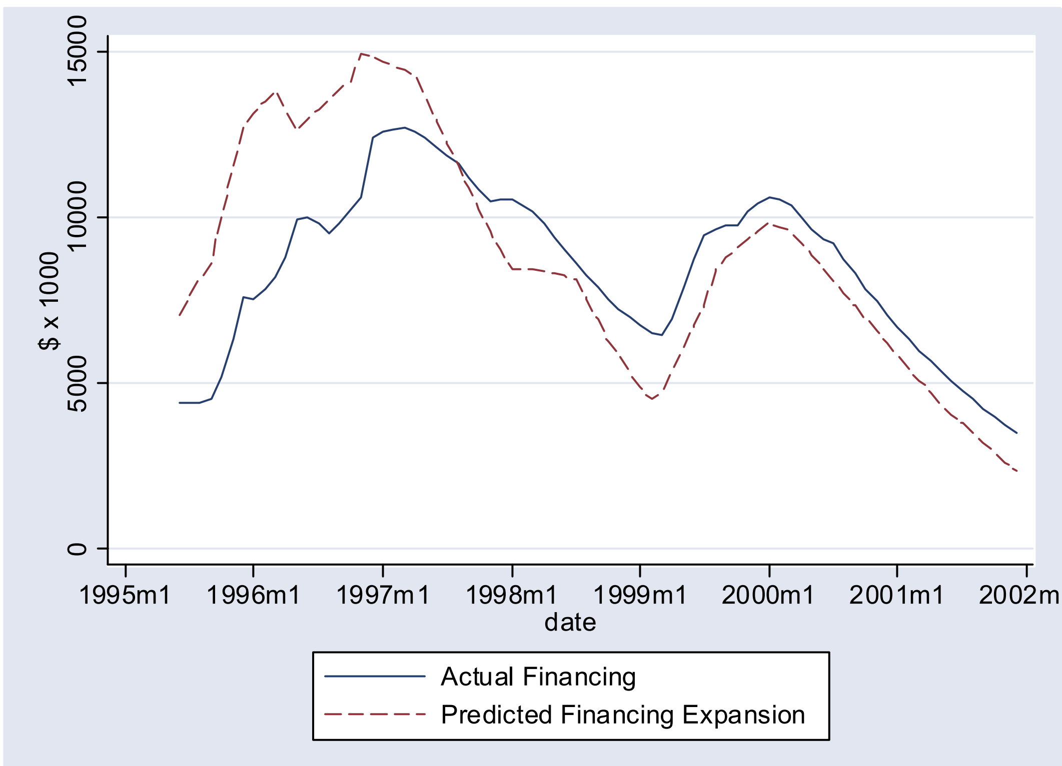
Actual and Predicted Number of Bank Participations in a Wave, by Year



Source: Own calculations using MYPES program data and bank balance sheet data and monthly income reports. The predicted participation is the result of the estimation of a probit model of the probability of participation of bank i in wave w, on a third degree polynomial of wave size, and the point scores of each bank. Participations in a wave are higher that participating banks per year (last graph) when the same bank participated in more than one wave during a year

Figure 7

Stock of Actual Program Financing and Predicted Program Disbursement, by Month

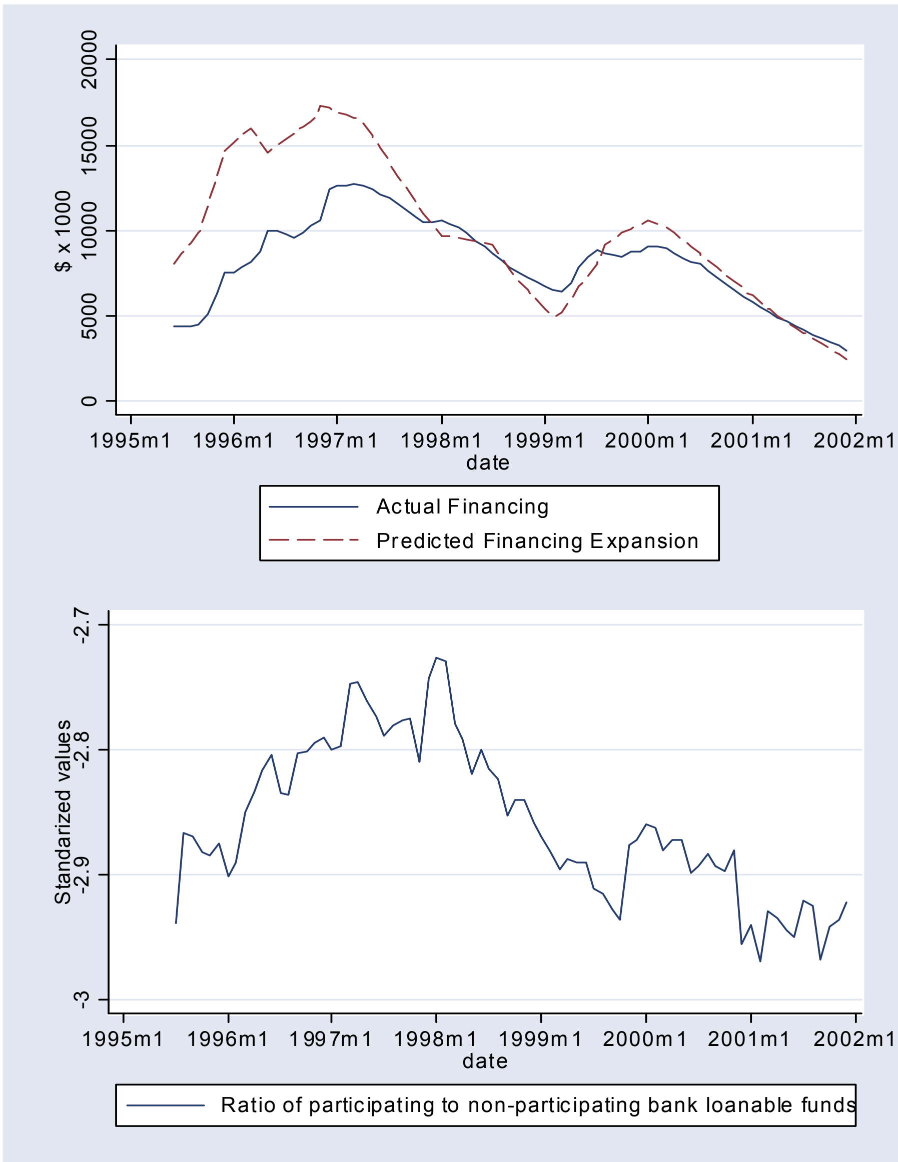


Source: Own calculations using MYPES program data and bank balance sheet data and monthly income reports. Actual program financing is the stock of program debt outstanding. The predicted program disbursement is the predicted financing expansion using (4-10) times the probability of participation of each bank, summed across all banks.

Figure 8

Top Panel: Stock of Actual Program Financing and Predicted Disbursement to Banks with High Probability of Participation, by month

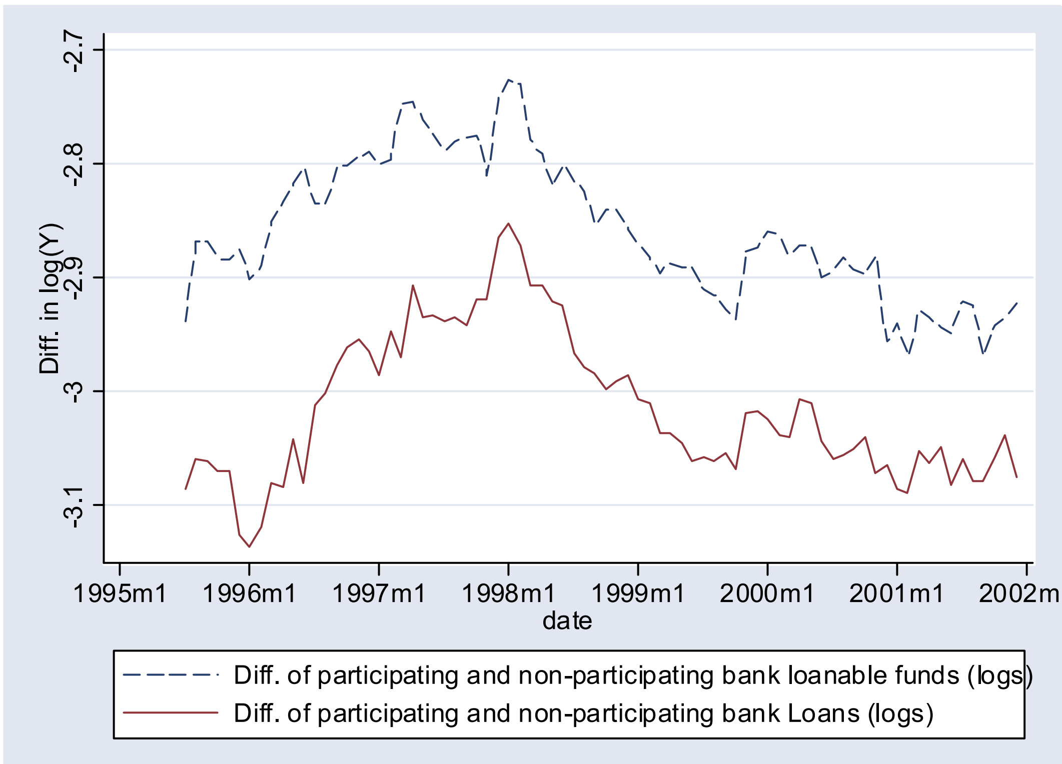
Bottom Panel: Ratio of High Probability to Low-Probability of Participation Bank Loanable Funds, by month (normalized)



Source: Own calculations using MYPES program data and bank balance sheet data and monthly income reports. Loanable Funds are the sum of Equity, Deposits, and other liabilities, minus reserve requirements. Actual program financing is the stock of program debt outstanding. The predicted program disbursement is the predicted financing expansion using (4-10) times the probability of participation of each bank, summed across all banks. Banks with a high probability of participation are banks in the top quartile of the distribution of predicted probability of participation.

Figure 9

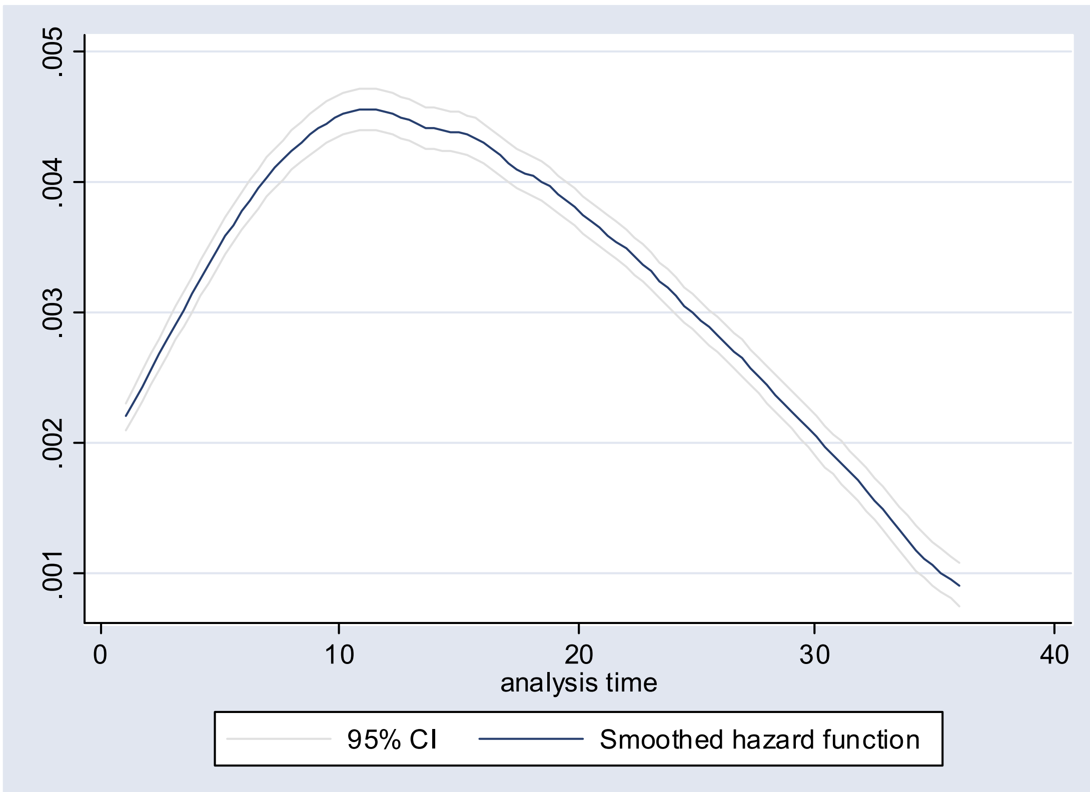
Difference in the log Average Loanable Funds and Loans of High-Probability vs. Low-Probability of Participation Banks



Source: Own calculations using MYPES program data and bank balance sheet data and monthly income reports. Loanable Funds are the sum of Equity, Deposits, and other liabilities, minus reserve requirements. Banks with a high probability of participation are banks in the top quartile of the distribution of predicted probability of participation.

Figure 10

Kernel Estimation of the Monthly Hazard Rate of Default



Source: Own calculations using Public Credit Bureau database from the sample of loans issued between January and August 1998. The vertical axis plots the weighted kernel density estimate utilizing the estimated monthly default hazard. The horizontal axis measures months elapsed after the loan was issued. Loan performance is observed until August 2001 where the sample is truncated to avoid the period of high default rates that preceded the December 2001 crisis in Argentina.