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Local Bank Financial Constraints and Firm Access to External Finance

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ABSTRACT

I exploit the exogenous component of a formula-based allocation of government funds across banks in Argentina to test for financial constraints and underinvestment by local banks. Banks are found to expand lending by $0.66 in response to an additional dollar of external financing. Using novel data to measure risk and return on marginal lending, I show that the profitability of lending does not decline and total borrower debt increases during lending expansions, holding investment opportunities constant. Overall, financial shocks to constrained banks are found to have a quick, persistent, and amplified effect on the aggregate supply of credit.

THE QUESTION OF HOW FINANCING FRICTIONS in the banking sector affect lending behavior and economic activity has long been of concern to the literature on financial institutions. Recent empirical work on the lending channel and credit crunches has focused on two issues: whether financing frictions exist and, if so, whether shocks to the financial position of a bank have any real effect on investment.[1] The question of whether constrained financial intermediaries lead to underinvestment, however, has received little attention. This is fundamentally an empirical question since, as Allen and Gale (2004) point out, the effect of contracting imperfections in financial intermediation on the efficiency of investment is theoretically ambiguous.[2]

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[1] For examples of the first line of research see Calomiris and Mason (2003), Kashyap and Stein (2000), Khwaja and Mian (2008), and Peek and Rosengren (1997). Some examples of papers that look into the real effect of shocks to the financial system are Chava and Purnanandam (2006), Hubbard, Kuttner, and Palia (2002), Gan (forthcoming), Kashyap, Lamont, and Stein (1994), Kashyap, Stein, and Wilcox (1993), and Peek and Rosengren (2000).

[2] On the one hand, financial frictions may be incentive-efficient if they arise as a solution to an agency problem between the owners of capital and bank managers (Hart and Moore (1995), Jensen

To provide compelling empirical evidence that frictions in intermediation lead to underinvestment, three hypotheses must be tested. First, that banks face frictions in their access to external financing. Second, that these financing frictions prevent banks from undertaking profitable investment opportunities. And third, that the lending opportunities forgone by constrained banks are not arbitraged by other unconstrained financial intermediaries. This paper exploits a shock to the financial position of local banks by a government lending program in Argentina to show empirically that the three hypotheses hold true in an emerging market context.

Government lending programs that allocate resources based on predetermined formulas provide a useful laboratory to test the financial constraints and underinvestment hypotheses. Bureaucratic formulas usually result in resource allocations that are imperfectly correlated with other determinants of the supply or demand for credit. In this paper, I identify the exogenous components of the government program's allocation formula and show that the time-series and cross-sectional variations in the implied funding distribution are unrelated to the banks' marginal cost of capital or investment opportunities of the banks. Then, using the formula-based funding allocations as an instrument for external financing, I show that bank investment is responsive to exogenous changes in the financial position of the bank.

The results indicate that there is an immediate expansion of lending of \$0.66 for every dollar of additional external finance. The magnitude of the lending response is underestimated by a factor of two when the endogenous variation of external financing is not properly accounted for using the formula-based instrument. Exploiting the monthly panel structure of the data I assess the timing and duration of the lending response. The average cumulative expansion of lending is around \$1.2 per additional dollar of external finance. This expansion is achieved within 3 months and is significant after 2 years of the external financing shock induced by the program. The results indicate that the lending response to a shock to the financial position of a constrained bank is quick and persistent. It also involves a multiplier effect. These findings are not consistent with the Modigliani–Miller proposition for banks and suggest that banks were financially constrained before experiencing the external finance expansion.[3]

The empirical sensitivity of investment to external financing is potentially consistent with either underinvestment or free cash flows, since additional external finance allows managers to pursue wasteful lending opportunities (Hart and Moore (1995), Jensen (1986), Stulz (1990)). The underinvestment

(1986), Stulz (1990)). On the other hand, even if bank managers act in the best interest of current shareholders, frictions may lead to underinvestment when there is asymmetric information about the value of bank assets (Myers and Majluf (1984), Stein (1998)).

[3] The optimal response of an unconstrained bank to an expansion in external financing that doesn't affect the marginal cost of capital is to reduce market-priced liabilities or to distribute it among investors as dividends. A lending expansion 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 previous empirical work on the lending channel. See Stein (2003) for a recent survey on both.

and free cash flows hypotheses can be distinguished empirically by looking at the profitability of marginal investments when available finance increases. To test whether financing frictions prevent banks from making profitable loans, I look at the risk and return of bank marginal loans during lending expansions. I measure the actual default risk of loans issued during the external financing expansions using novel loan-level data from a public credit registry. The results show that loans financed during periods of increased available external finance are not more likely to default than loans issued in other periods. Also, bank interest rate revenues do not decline during lending expansions. The fact that proxies for the risk and return of the bank loan portfolio were unaltered during the lending expansion allows one to rule out the free cash flows interpretation of the results. The evidence supports the hypothesis that financial frictions lead to underinvestment by constrained local banks.

Finally, this paper addresses the question of whether underinvestment by constrained local banks affects the overall availability of credit to their borrowers. The hypothesis that firms are constrained and have limited access to other sources of financing has an empirical implication that is testable in the context of this paper. Specifically, the total amount of debt of the constrained bank's borrowers should increase when the external financing constraint of the bank is relaxed due to the program, holding constant both the borrower's investment opportunities and interest rates. This hypothesis is corroborated in the data, which indicates that borrowers from constrained banks were credit rationed before the lending expansion.

The results of this paper are relevant for several strands of the literature in finance. Since the work of Modigliani and Miller (1958), considerable research in corporate investment has been devoted to assess whether a substantial misallocation of resources results from agency problems between the owners of capital and firms.[4] This paper provides the first direct evidence that the resource misallocation can be exacerbated due to conflicts of interest between the owners of capital and financial intermediaries.

The lending channel literature has emphasized the role of financially constrained banks in amplifying the real effects of aggregate shocks.[5] This paper shows that the supply of credit by local banks is indeed sensitive to available external finance. It also shows that financial constraints of local banks affect the overall supply of credit in a context where close to 50% of the assets of the banking system is held by international banks. This suggests that the extent to which financial systems will propagate the real effects of aggregate shocks hinges crucially on the cross-sectional distribution of financial constraints in the banking sector.

[4] A wealth of empirical research has been devoted to providing evidence that firms engage in value-destroying acquisitions (Lang, Stulz, and Walking (1991), Morck, Shleifer, and Vishny (1990)), and that firms with excess cash do so more often (Blanchard, Lopez-de-Silanes, and Shleifer (1994), Harford (1999), Richardson (2006)).

[5] See the theoretical arguments in Bernanke and Blinder (1988), Holmstrom and Tirole (1997), and Stein (1998). For empirical evidence see Peek and Rosengren (1997), Kashyap and Stein (2000), and Calomiris and Mason (2003) among others.

From a banking perspective, this paper provides evidence that local bank finance is difficult to substitute. Spurred by the trend towards internationalization of the banking industry, recent research suggests foreign banks shy away from lending to informationally opaque firms.[6] This suggests that international bank entry may have a limited impact on the availability of capital in emerging markets. Overall, the results indicate that improved access to capital markets of local financial intermediaries can have a first-order effect on the efficiency of investment.

The paper proceeds as follows. Section I provides the institutional details on the government lending program and introduces the empirical strategy, emphasizing how the resource allocation rule of the program is exploited to create an exogenous instrument for bank external finance. Section II describes the data sources and variable definitions. Section III presents the results, Section IV provides tests for the identification assumptions, and Section V concludes.

I. Testing for Financially Constrained Banks

This section presents a description of the government lending program and the resource allocation formula, and discusses how the allocation formula is used to construct an exogenous source of variation in bank external financing to test for financing constraints.

A. *Source of External Finance Shocks: MYPES Program*

The Credit Program to Small and Medium Sized Firms (MYPES, for its acronym in Spanish) was implemented in Argentina between 1993 and 1999. MYPES provided financial intermediaries with limited amounts of 3-year financing at the average deposit rate in the banking system. The program was funded by the Inter-American Development Bank (IDB) and had the objective of encouraging formal intermediary institutions to expand lending to small businesses. MYPES belongs to a broad class of credit market interventions called *on-lending*. The common feature of on-lending programs is to make financing available to existing financial intermediaries with the requirement that a fraction of the funds be lent to a narrowly defined group of borrowers.

Using an on-lending program to test for financing constraints has the methodological advantage that it can be repeated in other institutional and economic contexts. On-lending programs are a widespread policy tool in both developed and emerging markets. For example, the World Bank alone allocates between 5% and 20% of its annual loan portfolio through local financial intermediaries, and has allocated more resources through this channel than through any other individual program (Barger (1998), Bratanovic (2002)).

MYPES required banks to lend \$1 to eligible borrowers for every \$0.75 of program financing received. Firms with less than 20 workers and less than

[6] See, for example, Berger, Klapper, and Udell (2001), Mian (2006), and Gormley (2006).

$200,000 in annual sales were eligible to receive program loans. Program financing was allocated in 12 waves between 1993 and 1999. A month prior to the beginning of each wave, the Central Bank announced publicly the amount to be distributed and banks submitted an application to participate. An administrative formula based on bank characteristics was used to allocate resources to participating banks in each wave. The formula assigned a higher fraction of the resources in a wave to banks with a smaller average loan size and a higher proportion of loans in poor provinces. Each participating bank was assigned a point score according to these characteristics and received financing in proportion to this score (*Zsize* and *Zregion*).[7] Banks had 3 months to use the allocated resources or pay a penalty proportional to the unused balance. In practice, all banks used all the allocated resources in every wave.

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 in the banking system and was unlikely to influence interest rates or the cost of capital. 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. Nevertheless, at all times banks held liabilities at the market price (e.g., subordinated debt). The fact that government finance was allocated in predetermined and limited amounts implies that the external financing was inframarginal. In other words, it is unlikely that the program affected the marginal financing cost of banks. This crucial identification assumption will be shown to hold true empirically in Section III.

B. Identification Strategy: Exogenous Component of Program Financing

To identify the effect of external finance on bank outcomes, the paper exploits the variation induced by the MYPES program. The relationship of interest between the total resources available to finance investment and bank lending is

$$\ln L_{it} - \ln L_{it-1} = \alpha_i + \alpha_t + \beta_0(\ln F_{it} - \ln F_{it-1}) + \boldsymbol{x}_{it}\gamma_1 + \varepsilon_{it}. \quad (1)$$

The explanatory variable of interest, F_{it}, represents all the sources of funds of bank i at month t, net of regulatory reserve requirements (from now on,

[7] Banks submitted in the application to the Central Bank the amount of financing required from the program. If the sum of the requested financing of all applicants exceeded the amount of resources in the wave (which it did in every wave), financing was distributed among applicants according to the formula based on loan size and regional loan allocation. The point score according to average loan size assigns a score of 100 for an average loan size between $0 and $3,000, a score of 97 for an average loan size of $3,000 to $6,000, and so on. Average loan sizes of $50,000 and above receive scores of 30 and below. The point score according to regional distribution allocated a weight of 30 to loans issued in the richest provinces (Capital Federal, La Pampa, and Santa Cruz) and 100 to loans issued in the poorest (Formosa, Catamarca, Santiago del Estero, Chaco, Jujuy, Misiones, Corrientes, Salta, Chubut, and Tucumán). Loans to other provinces received a weight of 70.

sources of capital).[8] The test for financial constraints consists of estimating the sensitivity of bank lending to changes in sources of capital, holding other determinants of the demand and supply of credit constant. The test is implemented by estimating β_0 through 2SLS using an exogenous source of variation in sources of capital. A positive estimate of this sensitivity, β_0, will contradict the null hypothesis of no financial constraints.

The fundamental identification assumption of this test is that the source of variation in sources of capital is not correlated with changes in the marginal cost of capital or investment opportunities of the bank. There are several reasons why the *actual* amounts of finance received from the MYPES program may not constitute an exogenous source of variation in sources of capital in this setting. I discuss in turn each of these reasons and the potential biases they may introduce, and then describe the empirical strategy used to address them.

B.1. The Targeting Rule

External financing received by banks was conditional on banks expanding lending to the target group of borrowers. This raises the concern that unconstrained banks may have expanded lending in order to comply with the allocation rule and gain access to a subsidized source of finance. However, the enforcement of targeting rules is commonly not attempted or ineffective in the practice of on-lending. The MYPES program was no exception to this.[9]

The government agency responsible for monitoring MYPES program execution examined target firms' debt only *after* these received program financing. This means banks could re-label the debt of existing eligible clients as *program loans* to comply with the targeting rule and, at the same time, retain freedom to allocate resources to their preferred use. Figure 1 shows preliminary evidence that re-labeling took place in the MYPES case. The figure shows the monthly evolution of total bank debt of a sample of firms that received program loans. The horizontal axis measures the time relative to the date each firm received the program loan. The graph shows that the amount of firm debt with the program bank did not change after the firm received a program loan. Instead, program loans substituted dollar for dollar the preexisting debt of existing bank clients. Section IV provides robust evidence that the lending expansion was systematically allocated to firms that did not meet the targeting criteria.

[8] Reserve requirements in Argentina vary according to the residual maturity of liabilities. For example, banks are required to hold reserves of 20% of the balance of checking accounts, 5% of 90-day deposits, and 0% of 1-year deposits.

[9] Enforcement is rarely attempted because monitoring is aimed at ensuring full budgetary execution, the main concern of program administrators (Barger (1998)), and it is ineffective because banks can exploit the fungibility of sources of financing. For example, Zia (2008) shows that 50% of the on-lending resources allocated through Pakistan's banking sector to exporting firms crowd out existing finance.

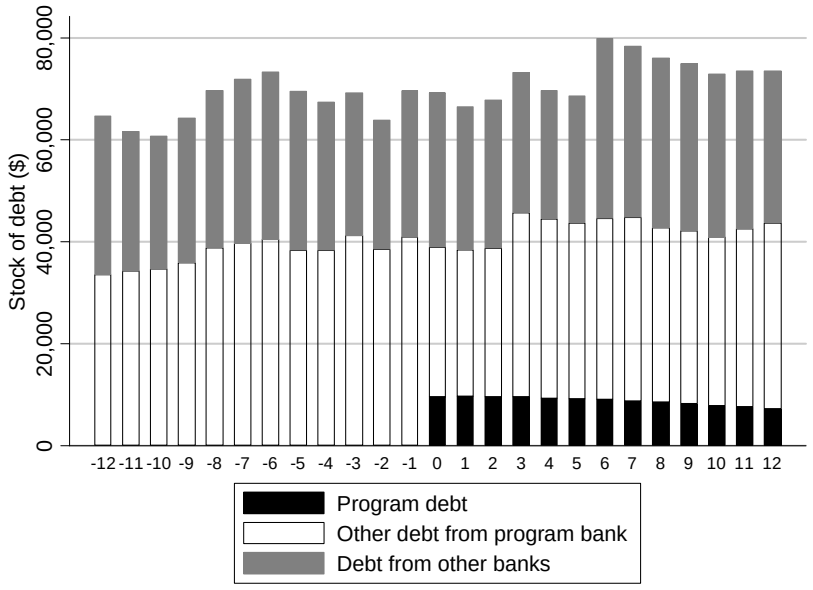

Figure 1. Evidence on loan re-labeling: monthly debt evolution of the firms that received program loans, by source. Monthly evolution of total bank debt of a sample of firms that received MYPES loans, classified by source. Calculations are based on a sample of 2,596 firms that received program loans after January 1996. The horizontal axis measures time in months relative to the date each firm received the MYPES loan.

B.2. Endogenous Timing and Size of Program Waves

Another concern is that MYPES may have been timed to provide financing when the banking sector was in need of additional liquidity, for example due to deposit shortages. This would lead to a downward bias in the estimate of β_0: The true effect of an additional dollar of external financing on bank lending is attenuated by the concurrent effect of the decline in deposits. In fact, the flow of program financing peaked once during 1995 and 1996, a period of massive deposit drains from the Argentine banking system during the aftermath of the Tequila Crisis (Figure 2, Panel A).

I deal with this concern by exploiting the surge in program financing in 1999 that was unrelated to banking sector liquidity. In mid-1998 IDB required that the remaining MYPES budget be spent by 1999 as a condition for providing additional aid in the future. As a result, the budgeted MYPES resources were lent in four waves from December 1998 through November 1999 (waves 9 through 12 in Panel B of Figure 2). The four waves in rapid succession during the 1-year period were required to accommodate a contractual clause in the MYPES program. The clause established that resources had to be allocated in 12 installments, and only 8 had been used by mid-1998.

Using MYPES financing provided during this "administrative rush" period to estimate β_0 has two advantages. First, the timing and amount of the financing

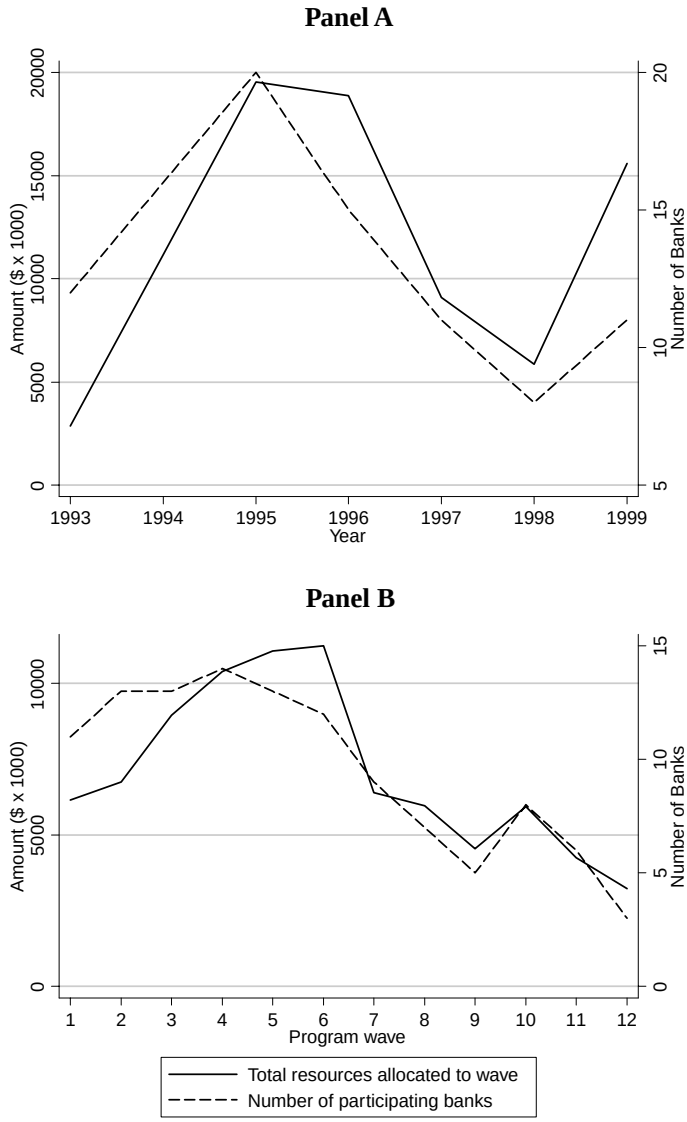

Figure 2. Panel A: Flow of program financing and number of participating banks, by year. The flow of financing during a year is the sum of the amount of resources allocated to all the waves that began during that year. The number of banks counts a bank once if it participated in two waves during the same year. Panel B: Flow of program financing and number of participating banks, by wave. Waves 9 through 12 occurred between December 1998 and November 1999.

waves were unrelated to liquidity needs of the banking system. In fact, total deposits grew steadily and outpaced output and lending through 2001. Second, the program provides four shocks to bank sources of capital within a short period of time during which macroeconomic and banking sector conditions did

not vary substantially. I show that the preferred estimates of β_0, obtained using the final four MYPES waves as a source of variation in bank external financing, are twice as large as those obtained using the full sample.[10]

B.3. Endogenous Bank Self-selection

A final concern is that banks with tighter cash positions or better investment opportunities may have applied for program financing. Self-selection into the program induces a correlation between external financing provided by the program and bank lending behavior. Such correlation would bias the estimate of the sensitivity of lending to external financing in specification (1). A downward bias would result if banks chose to participate as a consequence of deposit withdrawals. An upward bias would result if banks self-selected to participate as a result of improved returns to lending.

The time-series variation in the amount of resources allocated to different waves of the program (wave size variation) provides a plausible exogenous determinant of bank participation in the program. If program participation involves a fixed cost, an increase in the amount of resources in a wave will induce higher program participation rates. Moreover, the increase in the probability of participation will be larger for banks that are allocated a higher share of the wave resources by the administrative formula (e.g., higher *Zregion* and *Zsize*). The time-series variation in wave size together with the cross-sectional allocation formula induce time-series and cross-sectional variation in the participation decision of banks.

These predictions are consistent with the participation patterns observed in the data. Figure 2 shows a substantial and positive time-series correlation between the number of participating banks and the amount of resources in a wave. Also, the average participating bank allocated more than twice its loan portfolio in poor regions than nonparticipating banks, 15.4% versus 6.3%, and has an average loan size that is just 25% the average loan size of nonparticipating banks, $76,000 versus $318,000.

C. Implementation and Comparison to Other Studies

The previous argument provides the rationale for the following identification strategy to estimate β_0: controlling for unobserved bank heterogeneity (bank fixed effects) and all period-specific shocks to the banking system (month

[10] The sample period of the preferred estimates immediately precedes the Argentine financial crisis of December 2001. One potential concern is that the results are particular to distressed bank loan portfolios. However, recent analysis suggests that the crisis occurred despite the high regulatory standards in the banking system (Krueger (2002)). More likely, the crisis ensued as a result of government expropriation of bank assets (IMF (2005)). Mishkin (2006, p 106) points out that the balance sheet of Argentine banks remained relatively healthy in 2000: "The amount of bank capital relative to assets, even after loan write-offs, remained in excess of 10% (high by international standards), and bank capital relative to risk-weighted assets was well in excess of requirements under the Basel Accord."

dummies), the nonlinear interaction between wave size, pre-program bank average loan size, and fraction of lending in poor areas provides a valid instrument for bank sources of capital. This interaction constitutes a valid instrument for sources of capital in (1) as long as it is uncorrelated with the time-series variation of bank-specific funding requirements, an assumption that is corroborated in Section IV.

The intuition behind the identification strategy can be conveyed through an analogy with a differences-in-differences estimation. A given increase in wave size induces a larger increase in the probability of participation among banks that receive a larger share of the wave. The effect of the expansion of available external finance can be estimated comparing the amount of lending across banks that receive high and low wave shares. Since the cross-sectional variation in shares is driven by predetermined bank characteristics, the direct effect on outcomes is captured in bank fixed effects. And the month dummies control for all cyclical determinants of loan supply or demand correlated with the time-series variation in wave size. The coefficient of interest is estimated solely from the variation that results from banks switching in and out of the program due to changes in wave size.

Any nonlinear interaction between wave size, *Zregion*, and *Zsize* would provide a valid instrument for external financing. However, a two-step procedure that first estimates the expected amount of financing and then uses the estimated expected finance as an instrument produces more precise estimates for β_0 (Wooldridge (2002)). All the results in the paper are shown using the two-step procedure, and in unreported results they are found to be robust to alternate functional form specifications.

The expected amount of financing in each wave is obtained by first estimating a probability model of participation (probit). The probability bank i participates in wave w of the program, p_{iw}, is a function of wave size (A_w), the region and loan size scores of bank i ($Zregion_i$, $Zsize_i$), and the scores of all other potential participants ($Zregion_{-i}$, $Zsize_{-i}$).[11] Next, I calculate the expected amounts of financing using the estimated probabilities of participation, $\hat{p}_{iw}$, and an *expected* cross-sectional allocation formula. The *actual* amount of resources allocated to bank i in wave w depended on the point scores of the banks that participated in that wave according to

$$C_{iw} = A_w \left[\frac{Zregion_i}{2 \cdot \sum_j^{n_w} Zregion_j} + \frac{Zsize_i}{2 \cdot \sum_j^{n_w} Zsize_j} \right], \tag{2}$$

where A_w represents the amount of resources and n_w is the number of banks in wave w. The actual participation formula cannot be used to generate the instrument because it is a function of the scores of the self-selected group of banks

[11] The probability is given by $p_{iw} = \Pr[\eta_{iw} < A_w G(Zregion_i, Zsize_i, Zregion_{-i}, Zsize_{-i})]$, where η is normally distributed, and G(.) is a second degree polynomial of the region and size scores, normalized by the sum of the scores of all participating banks. Again, the empirical strategy is robust to these particular distributional and functional form assumptions.

that participated in wave w. Instead I calculate an expected proportional allocation whereby the score of every bank—participating and nonparticipating—is weighted by the (exogenous) predicted probability of participation. The final instrument for external financing, expected financing by wave $\hat{C}_{iw}$, is given by[12]

$$\hat{C}_{iw} = A_w \left[\frac{\hat{p}_{iw} Zregion_i}{2 \cdot \sum_j^N \hat{p}_{jw} Zregion_j} + \frac{\hat{p}_{iw} Zsize_i}{2 \cdot \sum_j^N \hat{p}_{jw} Zsize_j} \right]. \tag{3}$$

This empirical approach departs from the standard literature on the lending channel by exploiting the plausibly exogenous variation to external financing provided by the government lending program. In this sense, the methodology is akin to the *natural experiment* approach of the more recent investment-cash flow and credit constraints literatures (Banerjee and Duflo (2004), Blanchard et al. (1994), Lamont (1997), Rauh (2006)). Previous studies on the lending channel use changes in monetary policy, deposit growth, internal cash, and stock prices as an instrument for sources of capital (see, for example, Bernanke and Gertler (1995), Hubbard (1995), Jayaratne and Morgan (2000), Ostergaard (2001), and Peek and Rosengren (1997)). These sources of variation are potentially correlated with other factors affecting either the supply or the demand of credit and render the estimated β_0 from specification (1) difficult to interpret.

Subsequent empirical work has approached this difficult identification issue by: (1) controlling explicitly for bank investment opportunities (Tobin's q, or GDP growth); (2) looking for larger sensitivities of lending among banks that are more likely to be constrained according to observable bank characteristics such as size or capitalization (Ashcraft (2006), Kashyap and Stein (2000), Kishan and Opiela (2000)); and (3) looking at changes in the composition of bank finance within firms when banks experience shocks (Gan (2007), Kashyap et al. (1994), Kashyap et al. (1993), Khwaja and Mian (2008)). Even with these refinements, the link between the observed lending sensitivities and financial constraints is not straightforward. Measurement errors in q and bank-specific changes in investment opportunities may induce a correlation between investment and cash flows (Erickson and Whited (2000), Gomes (2001), Poterba (1988)). The cross-sectional predictions are also consistent with models without financing frictions (Alti (2003), Kaplan and Zingales (1997, 2000), Moyen (2004)). And large shocks to deposits or asset prices may affect both bank sources of capital and the cost of capital, which renders it difficult to disentangle the source of the change in lending behavior. The principal advantage of the empirical approach

[12] The expected financing by month, $\hat{C}_{it}$, is calculated assuming, first, that banks drew the allocated program finance in equal parts during the 3 months following the date a wave begins, and second, that the principal was repaid in 36 equal monthly payments. The first assumption follows from the fact that banks had 3 months to draw the resources from the credit line in the Central Bank without penalty. The repayment period corresponds to the repayment schedule of the median program loan issued by the bank.

in the present paper is that it obtains the causal impact of a change in available external financing on lending, holding the banks' investment opportunities and cost of capital constant.

II. Data Sources and Variable Definitions

The data for this paper come from three sources. The first source comprises monthly balance sheets and earnings reports for nongovernment banks in the Argentine financial system between January 1995 and December 2001. Each observation in this database consists of fully detailed financial statements for bank i at month t. The descriptive statistics of selected variables from the financial statements are shown in column 1 of Table I. The average bank holds \$1.1 billion in assets during the sample period. The cross-sectional asset distribution is skewed due to the presence of large foreign-owned banks. Local banks hold more than half of the total assets in the banking system and the average local bank has \$0.7 billion in assets (column 2 of Table I).

The second source of data is the MYPES database, collected and managed by the Ministry of the Economy in Argentina. This database is used to obtain information on the timing and size of the program waves used to estimate the expected financing instrument described in the empirical strategy section. The last two rows of Table I present the descriptive statistics of the expected financing variable in levels and as a proportion of loans outstanding. Expected external financing represents about 7.6% of the stock of loans of participating banks during the sample period.[13]

The third source of data is the public credit registry (CDSF for its acronym in Spanish). Each observation in this database represents a loan j, issued to firm k by bank i at month t. Both firms and banks have unique tax code identifiers that allow for the construction of a panel data set, and also the linking of CDSF data with bank financial statements. The CDSF contains monthly data on all firms or individuals with more than \$50 of debt with a financial institution in Argentina. For every loan, the database includes debtor ID number, the issuing bank ID number, the principal outstanding, the amount and type of collateral posted, and a code describing the repayment situation. The repayment situation code ranges from 1 to 6, where 1 represents a loan in good standing and 5 and 6 represent defaulted loans. The categories are precisely defined in terms of days delinquent, debt refinancing, and bankruptcy filings.[14]

[13] An unreported regression of actual program financing on expected program financing, and bank and month fixed effects indicates that the coefficient on expected program financing is close to one and statistically significant. This indicates that the expected financing instrument is a good proxy for actual financing both in the time series and the cross-section, and that the cross-sectional allocation rule was strictly enforced.

[14] 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 forgiveness, some collateral has been seized. Situation 5 (unrecoverable): bankruptcy declared. Situation 6 (unrecoverable by technical disposition): late repayments of more than 180 days with intervened financial institutions.

Table I

Bank Descriptive Statistics (Nongovernment Banks), by Ownership and Program Participation (Thousands of $)

Means and standard deviations (in brackets) are reported. The statistics are calculated for a sample of 111 banks (83 locally owned, 26 of which received external financing from the program at some time between 1993 and 1999), first averaging each variable across all monthly observations between January 1998 and December 2000 (the preferred sample period) and then across banks. The reported standard errors are calculated from the cross-sectional variation, calculated after averaging each variable across monthly observations between January 1998 and December 2000. Sources of capital: the sum of equity, deposits, and other liabilities minus the reserve requirements for each type of liability (for example, 20% for checking accounts, 5% for 90-day deposits, 0% for 1-year deposits, and so on). Expected External Financing is the amount of financing a bank expects to receive from the MYPES program, and is calculated using the estimation of a participation model and the cross-sectional formula. Program banks hold on average 10.2%, and local banks 51% of the total assets of the banking system.

	All Banks (1)	Locally Owned Banks (2)	Program Banks (3)
Assets	1,095,287	693,538	543,985
	[2,396,431]	[1,880,620]	[599,719]
Loans	536,344	362,000	283,790
	[1,241,008]	[1,043,741]	[332,044]
Loans and commitments	636,382	584,056	345,905
	[1,541,574]	[1,751,396]	[394,131]
Liabilities	979,350	605,314	488,200
	[2,168,293]	[1,674,728]	[539,852]
Deposits	569,590	384,378	361,719
	[1,331,549]	[1,122,679]	[407,961]
Sources of capital	616,099	399,500	382,853
	[1,348,276]	[1,151,055]	[418,375]
Loans/assets	0.500	0.517	0.500
	[0.146]	[0.140]	[0.109]
Deposits/assets	0.515	0.538	0.626
	[0.194]	[0.189]	[0.124]
Equity/assets	0.133	0.144	0.133
	[0.135]	[0.141]	[0.130]
ROA	0.31%	0.26%	0.14%
	[1.22]	[1.23]	[1.12]
Financial rev./loans (%)	13.6%	14%	12.8%
	[7.2]	[7.6]	[2.4]
Exp. external financing	1,547.5	1,630.4	1,598.7
	[494.9]	[482.4]	[429.2]
Exp. ext. financing/loans	0.068	0.068	0.076
	[0.166]	[0.154]	[0.196]

The CDSF data are used to construct measures of the actual performance of all loans issued during the sample period. A loan originated at time t can be observed at time $t + T$ and its repayment status assessed. This assures that the performance measures are linked to the incremental (marginal) investments of banks during the external finance shocks. Column 1 of Table II reports the

Table II

Loan and Loan Recipient Summary Statistics, by Borrower Type

Means and standard deviations (in brackets) are reported. Statistics are estimated using the January 1998 to December 2000 preferred subsample. Each observation corresponds to a new loan, loan commitment, or increase in credit limit extended during the sample period. Loan amount represents the amount of the loan or credit availability expansion. Default after 12 (24) months is a dummy equal to one if the loan is nonperforming 12 (24) months after the loan is issued. Total bank debt is the sum of the bank debt held by the loan recipient across all financial institutions. Past nonperforming loan is a dummy equal to one if the loan recipient has any non-performing debt at the time of receiving the new loan. A loan recipient is classified as *new* if it has no previous credit with the issuing bank, and *existing* otherwise.

	All (1)	Existing Borrowers (2)	New Borrowers (3)
Number of Loans	750,526	620,325	130,201
1. Loan characteristics			
Loan amount ($)	16,691	17,722	11,776
	[226,660]	[218,790]	[260,858]
Collateral/loan	0.123	0.124	0.118
	[0.301]	[0.299]	[0.312]
2. Loan performance			
Default after 12 months (yes = 1)	0.122	0.104	0.191
	[0.328]	[0.306]	[0.393]
Default after 24 months (yes = 1)	0.168	0.153	0.228
	[0.374]	[0.359]	[0.420]
3. Borrower history			
Total bank debt		58,551	
		[601,468]	
Past non-performing loan (yes = 1)		0.141	
		[0.348]	

descriptive statistics of all the loans issued between January 1998 and December 1999. There were 750,526 loans issued to 222,146 firms and individuals. The average loan principal was $16,691 and 12.3% of this principal was secured with collateral. Turning to loan performance, 16.8% of all the loans defaulted within 24 months.

Data censoring in 2002, when the CDSF was not publicly available, limits the measurement of default rates to 24 months after the loan has been issued. I verify whether this introduces substantial measurement error in default rates by estimating the monthly hazard function of defaults—the probability that a loan issued at month t defaults at month $t + T$, conditional on not having defaulted at $t + T - 1$. Figure 3 plots the hazard function estimated over the subsample of loans issued between January and August 1998, with at least 3 years of observable repayment history. The default hazard peaks before 12 months, and the cumulative hazards (not shown) indicate that 85% of the loans that default do so within 24 months of being issued. This indicates that the 24-month window allows measuring the default rate without substantial measurement error.

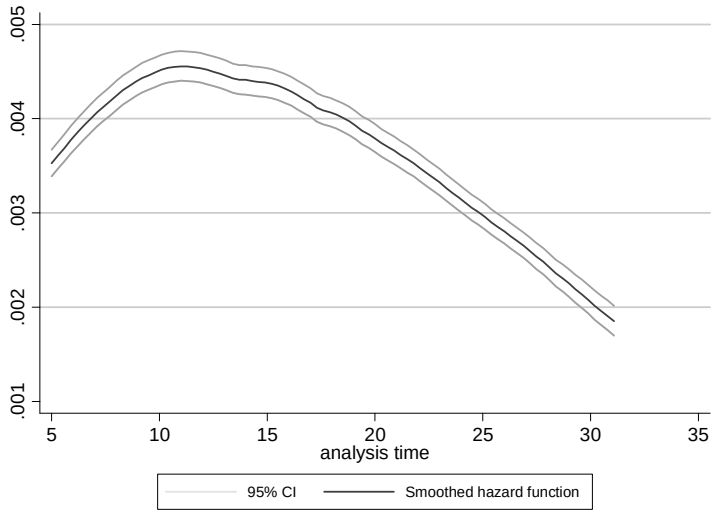

Figure 3. Kernel estimation of the monthly hazard rate of default. The vertical axis plots the weighted kernel density estimate (smoothed) of the monthly hazard function of defaults—the probability that a loan issued at month t defaults at month $t+T$, conditional on not having defaulted at $t+T-1$. The horizontal axis measures months elapsed after the loan was issued. The kernel is estimated over the subsample of loans issued between January and August 1998, with at least 3 years of observable repayment history.

I further corroborate this in the results section by showing that the estimated parameters are robust to alternate definitions of the default window.

III. Results

A. Effect of Expected Program Financing on Sources of Capital (First Stage)

The first empirical test of interest is one that shows that the expected external financing instrument has a significant and direct impact on bank sources of capital. This is a necessary condition for the 2SLS estimation of β_0 in specification (1), the main relationship of interest, and the basis for the proposed test of financing frictions.

I estimate a regression of bank sources of capital on the expected external finance instrument, bank and month dummies, and other controls. This regression corresponds to the first stage of the 2SLS estimation of (1) and is given by

$$\ln F_{it} - \ln F_{it-1} = \alpha_i + \alpha_t + \varphi(\ln \hat{C}_{it} - \ln \hat{C}_{it-1}) + \boldsymbol{x}_{it}\boldsymbol{\gamma}_2 + \eta_{it}. \tag{4}$$

All specifications are in first differences to account for the trends in loans and sources of capital variables. The remaining potential serial correlation is accounted for estimating standard errors clustered at the bank level (Bertrand, Duflo, and Mullainathan (2004), Petersen (2007)). All standard error estimation is robust to heteroskedasticity. Month dummies (α_t) control

Table III
First Stage: Regression of Sources of Capital on Expected External Financing and Bank/Month Fixed Effects

The table presents the estimated coefficients of the following specification:

$$\ln F_{it} - \ln F_{it-1} = \alpha_i + \alpha_t + \varphi(\ln \hat{C}_{it} - \ln \hat{C}_{it-1}) + \boldsymbol{x}_{it}\gamma_2 + \eta_{it},$$

where F_{it} represents sources of capital (sum of equity, deposits, and other liabilities minus the reserve requirements for each type of liability) of bank i at time t, $\hat{C}_{it}$ is the expected external financing, α_i and α_t are bank and month fixed effects, and $\boldsymbol{x}_{it}$ is a set of bank-level controls (lagged log of assets, deposits, cash flows, and net income). All estimates are based on the sample months between January 1998 and December 2000, which includes the final four waves of the program. The subsample partition in columns 2 and 3 is based on the predicted probability of participation in MYPES. Banks are defined as having a high average probability of participation if they are in the top quartile of the distribution estimated participation probabilities. Heteroskedasticity-robust standard errors are in brackets, clustered at the bank level. *, **, and *** stand for statistical significance at the 10%, 5%, and 1% level.

	All		High Probability of Participation	Low Probability of Participation
Bank Subsample	(1)	(2)	(3)	(4)
Dependent Variable: Bank Sources of Capital (logs, first differences)				
Expected external financing	0.068***	0.076***	0.067**	0.016
(logs, first differences)	[0.021]	[0.025]	[0.030]	[0.024]
Additional controls	No	Yes	No	No
Bank/month FE	Yes	Yes	Yes	Yes
Observations	4,654	4,654	1,405	3,493
R-squared	0.07	0.08	0.06	0.04

for varying macroeconomic conditions and bank fixed effects (α_i) account for differential bank-specific trends in all variables.

The explanatory variable of interest, $\hat{C}$, is the estimated expected MYPES program financing. The parameter φ represents the sensitivity of bank sources of capital to changes in external financing provided by the program. Since the variation in expected financing is plausibly exogenous, all the variation in bank capital sources can be solely attributed to changes in the availability of external financing.

The estimated φ is 0.068 ($SD = 0.021$), indicating there is a positive and significant relationship between expected external financing and bank sources of capital (Table III, column 1). Given the average sources of capital, expected external finance, and predicted probability of participation of banks in the sample, the point estimate implies that bank sources of capital increased by \$1 for every dollar of program financing received. In other words, banks did not use the MYPES financing to substitute for other sources of external financing. This observation is consistent with the hypothesis that MYPES financing was inframarginal.

The only determinants of bank sources of capital that are not accounted for in (4) are time-varying bank-specific shocks. These bank-specific shocks can be

due to, for example, the exposure of individual bank loan portfolios to industry or regional shocks. The inclusion of a wide range of time-varying bank controls to the first-stage regression—lagged log of assets, deposits, cash flows, and net income ($\boldsymbol{x}_{it}$)—does not affect either the significance or the magnitude of the point estimate of φ (column 2). This implies that the expected financing instrument is uncorrelated with the excluded and potentially endogenous variables.

I finally verify that the expected financing instrument is a good predictor of changes in sources of capital *only for banks that are likely to receive program financing*. Columns 3 and 4 of Table III report the estimated φ in the subsamples of banks that have high and low average predicted probability of participation in the program, $\hat{p}$. Changes in expected external financing have a positive and significant effect on the sources of capital of banks with a high probability of participation in the program, and no effect on low probability of participation banks. This confirms that the correlation observed in column 1 is not driven by aggregate factors and is specific to the banks that received MYPES financing.

The first-stage results taken together indicate that changes in expected external financing had an exogenous and strong influence on the financial position of banks. I exploit this fact to test for financing constraints in the next subsection.

B. *Financing Frictions Test: Sensitivity of Lending to Available External Finance*

B.1. Baseline Results

Under the null hypothesis of no financial constraints, β_0 in specification (1) is equal to zero: When finance is frictionless optimal bank investment is independent of the financial position of the bank. Table IV shows the OLS and 2SLS estimates of β_0 for different samples and specifications. The first two columns present the estimates using the entire sample period between 1995 and 2000, and estimates in columns 3 and 4 use the sample period reduced to include only the final four waves of the program (1998 to 2000). The 2SLS estimate of β_0 is positive and significant in both samples. The positive estimate implies that changes in the availability of external financing to banks affect lending, and that the null hypothesis of no financing frictions is rejected.[15]

The estimate of β_0 using the last four waves of the program (0.745, with *SD* 0.139) is significantly larger than the estimate using the entire sample (0.474, with *SD* 0.260). As indicated in Section I.B, the availability of program finance during the initial waves of the program was potentially correlated with negative

[15] In contrast, the OLS estimate of β_0 cannot be interpreted causally as the effect of changes in sources of capital on lending. The correlation may result, for example, from the fact that the variation in bank sources of capital is driven by changes in deposits, which are potentially correlated with the demand for credit (Bernanke and Gertler (1989), Kashyap, Rajan, and Stein (2002), Gatev and Strahan (2006)). I repeat the estimations of Table IV using deposits as an instrument for sources of capital, and obtain estimates for β_0 that are statistically indistinguishable from the OLS ones (0.314).

Table IV

OLS/2SLS Estimates of the Instantaneous Effect of an Expansion in Bank External Financing on Loans, by Bank Size and Capitalization

Each column presents estimated coefficients from a specification of the form:

$$\ln L_{it} - \ln L_{it-1} = \alpha_i + \alpha_t + \beta_0(\ln F_{it} - \ln F_{it-1}) + \beta_0^c(\ln F_{it} - \ln F_{it-1})\, Constrained\, Bank_i + \varepsilon_{it},$$

where L_{it} are loans of bank i at month t, F_{it} are sources of capital (total capital minus regulatory reserve requirements), $ConstrainedBank_i$ is a dummy equal to one if bank i is likely to be financially constrained according to an ex ante observable characteristic, and α_i and α_t are bank and month fixed effects. As constrained banks indicators, specification (3) uses $Small_i$, a dummy equal to one if the bank is in the lowest quartile of the asset distribution, and specification (4) uses $LowCap_i$, a dummy equal to one if the bank is in the lowest quartile of the equity to assets ratio distribution. Both variables are predetermined, calculated at the time the banks first appear in the sample. Of the program banks in the 1998–2000 sample, 40.7% are classified as small and 25.9% as low capitalized. Of the nonprogram banks, 51.0% are classified as small and 14.9% as low capitalized. The 2SLS estimates are obtained using the change in expected external financing as an instrument for the change in bank sources of capital, and expected external financing interacted with $Small_i$ and $LowCap_i$ as an instrument for the interaction term between sources of capital and the dummy variables. The first stage for all estimates is shown in Table III. The reduced sample of specifications 3 through 6 covers years 1998 and 1999, which include the last four waves of the program. Heteroskedasticity-robust standard errors are in brackets, clustered at the bank level. *, **, and *** stand for statistical significance at the 10%, 5%, and 1% level.

	All Waves		Final Four Waves			
Estimation Method	OLS (1)	2SLS (2)	OLS (3)	2SLS (4)	2SLS (5)	2SLS (6)
Dependent Variable: Loans (logs, first differences)						
Sources of capital	0.309***	0.474*	0.314***	0.745***	0.618***	0.708***
(logs, first differences)	[0.074]	[0.260]	[0.090]	[0.139]	[0.171]	[0.174]
Sources of capital					0.065	
× Small					[0.211]	
Sources of capital						0.105
× LowCap						[0.204]
Bank/month FE	Yes	Yes	Yes	Yes	Yes	Yes
# Banks	119	119	113	113	113	113
Observations	6,330	6,330	4,654	4,654	4,654	4,654
R-squared	0.14		0.17			

shocks to deposits to the banking system. Such a correlation induces the observed downward bias of the 2SLS estimate in the full sample. The sensitivity estimate using the final four waves is unbiased because the timing of these waves was driven by the "administrative rush" and hence plausibly uncorrelated with bank liquidity needs. In what follows I report the unbiased estimates based on the 1998 through 2000 subsample.[16]

[16] The 2SLS estimates of the sensitivity of lending to external finance are robust to bank selection. In an unreported estimation restricting the sample to banks that participated at least once in the program and excluding all banks that participated in every wave, I find an estimated elasticity of 0.66 with a standard error of 0.29. This estimate is statistically indistinguishable from the

The preferred estimate of β_0 using the reduced sample implies a substantial lending response to an exogenous change in external financing: An elasticity of 0.745 suggests that loans increase by \$0.66 for every dollar of additional external financing, calculated at the sample averages.

Columns 5 and 6 of Table IV show how the lending sensitivity varies across banks of different size and capitalization, two variables that have been used in previous literature to proxy for banks' financial constraints. The variable $Small_i$ ($LowCap_i$) is a dummy equal to one if a bank is in the lowest quartile of the asset (equity to capital ratio) distribution. The parameter of the interaction term represents the difference in the sensitivity of lending to external finance of the subset of small (low capitalization) banks relative to the large (high capitalization) ones. The estimated coefficient is positive in both specifications, which indicates that smaller and less capitalized banks exhibit a larger sensitivity of lending to an expansion in external finance as expected. The measured interaction coefficient is not significant, which implies that within the group of constrained banks, size and capitalization are not good predictors of the sensitivity of lending to external financing.

B.2. Lagged Effects on the Supply of Credit

The baseline results suggest that changes in the availability of external finance will have a strong immediate impact on constrained banks' ability to supply credit. The estimated coefficient β_0 measures the elasticity of bank loans to contemporaneous changes in sources of capital due to the expansion in external financing. This measurement may underestimate the total effect on the supply of credit if an expansion in available finance has a lagged impact on lending. A lagged effect may occur, for example, if the process of finding suitable lending projects and screening loan applications is time consuming, or if contemporaneous expansions in lending induce an expansion in future bank deposits from banks' clients.

This hypothesis can be tested by estimating specification (1) including lagged changes in sources of capital:

$$\begin{aligned}\ln L_{it} - \ln L_{it-1} = \alpha_i + \alpha_t + \beta_0(\ln F_{it} - \ln F_{it-1}) + \beta_1(\ln F_{it-1} - \ln F_{it-2}) \\ + \beta_2(\ln F_{it-2} - \ln F_{it-3}) + \cdots + \beta_{24}(\ln F_{it-24} - \ln F_{it-25}) + \varepsilon_{it}.\end{aligned} \tag{5}$$

A coefficient for the sensitivity of lending s months after the change in sources of capital, β_s, can be estimated using as an instrument the expected external financing variable lagged s months, $\hat{C}_{it-s}$. Intuitively, this elasticity measures the marginal sensitivity of bank loans at time t induced by an expansion in external financing at $t - s$. The cumulative percentage impact on lending of a 1% change in capital after s periods can be estimated by adding the lagged elasticities β_1 through β_s. Table V shows the estimated marginal and cumulative

estimate using the entire bank sample. This robustness suggests the validity of the identification assumptions of the 2SLS strategy and the exogeneity of the expected external finance instrument.

Table V

2SLS Estimates of the Lagged Effects of an Expansion in Bank External Financing on Loans

The marginal lagged effects are the 2SLS estimation results of the coefficients of the following specification:

$$\ln L_{it} - \ln L_{it-1} = \alpha_i + \alpha_t + \beta_0(\ln F_{it} - \ln F_{it-1}) + \beta_1(\ln F_{it-1} - \ln F_{it-2}) + \beta_2(\ln F_{it-2} - \ln F_{it-3}) + \cdots + \beta_T(\ln F_{it-24} - \ln F_{it-25}) + \varepsilon_{it},$$

where L_{it} are loans of bank i at month t, F_{it} are sources of capital (total capital minus regulatory reserve requirements), and α_i and α_t are bank and month fixed effects. The specification is estimated including all lags, but only the coefficients for every quarter are reported for conciseness. The 2SLS estimates are obtained using the change in expected external financing and its lags as an instrument for the change in bank sources of capital. The cumulative lagged effects up to time s are the sum of the marginal coefficients β_0 through β_s. The estimations are obtained from the reduced sample that includes the last four waves of the program. Heteroskedasticity-robust standard errors, clustered at the bank level, are reported. Both specifications include a full set of bank and month dummies. *, **, and *** stand for statistical significance at the 10%, 5%, and 1% level.

	Marginal Lagged Effect		Cumulative Lagged Effect	
Lags in Months	Point Estimate (1)	*SE* (2)	Point Estimate (3)	*SE* (4)
0	0.887*	0.476	0.887*	0.476
3	0.475	0.309	1.303*	0.690
6	−0.270	0.306	0.747	0.634
9	−0.265	0.470	1.434*	0.845
12	0.178	0.282	0.935	0.610
15	0.226	0.489	0.954*	0.557
18	0.319	0.509	1.996*	1.156
21	0.198	0.515	2.376*	1.429
24	−0.200	0.263	1.300	1.865

effects, standard errors, and significance levels for up to 24 months (shown only for each quarter for conciseness).

The estimates confirm that an expansion in external financing has a positive and significant instantaneous effect on lending (zero lags). There is an additional incremental effect up to 3 months after the expansion. The point estimate of β_3 in column 1 (0.48, significant at the 17% level of confidence) implies that lending expands by an additional \$0.42 at month $t + 3$ for each dollar of external financing received at t. The estimated cumulative effects are all positive and remain significant up to 21 months after the expansion in available financing (columns 3 and 4). The average cumulative elasticity throughout the 2-year period is 1.3, which implies that total lending expanded on average by more than \$1.2 per dollar of additional external finance.

The expansion in available external finance had a substantial positive effect on the supply of credit of constrained banks. The lending response is quick: The bulk of the credit supply response occurs within one quarter of the shock to available finance. The lending response is also persistent and involves a

multiplier effect, in the sense that total lending increases more than dollar for dollar with the expansion of available funds.[17]

C. Underinvestment or Free Cash Flows?

The effects of financing frictions faced by banks on the efficiency of investment are theoretically ambiguous. Limited financing may prevent empire-building bank managers from overinvesting, in which case an exogenous expansion in external financing would lead banks to pursue unprofitable investments (Hart and Moore (1995), Jensen (1986), Stulz (1990)). On the other hand, financial constraints may be inefficient in the sense that they prevent banks from investing in profitable loans (Fazzari, Hubbard, and Petersen (1988), Myers and Majluf (1984), Stein (1998)). The *underinvestment* and *free cash flows* views have distinct predictions about the profitability of marginal investments when available finance increases (Harford (1999), Richardson (2006)). According to the underinvestment view, marginal investment is always profitable. The free cash flows view, in contrast, predicts that there will be overinvestment ex post in states of the world "when the level of free cash flow relative to investment opportunities is higher than expected" (Stein (2003, p 121)).

I distinguish between the two hypotheses by measuring the profitability of marginal loans during credit expansions. I focus on two components of loan profitability: probability of default and interest revenue. The loan-level data allows one to look at whether loans issued during the lending expansion are more likely to default than loans issued in other periods by the same banks. Using detailed bank income statement data I measure changes in bank interest revenue during the lending expansions. Under the free cash flow interpretation, marginal loans should be riskier and/or have lower returns when banks expand the supply of credit.[18]

The effect of the lending expansion on default rates is measured using the following loan-level specification:

$$\text{Default } T_{ijt} = \alpha_i + \alpha_t + \alpha_s + \psi_T(\ln F_{it} - \ln F_{it-1}) + \omega_{ijt}. \tag{6}$$

Each observation represents a loan j issued by bank i at time t. The variable Default T_{ijt} is a dummy equal to one if loan j defaults between t and $t+T$, where

[17] The magnitude of the lending response is likely to be related to the maturity of the additional financing provided by the program, in this case 3 years. The lending response to an increase in callable deposits is likely to be lower if banks optimally hold buffer stocks to insure against liquidity shocks.

[18] The profitability of marginal investments can be below the inframarginal one in the absence of agency problems when banks have market power and face a sharply declining schedule of marginal revenues from lending as in Stein (1998). The two theories will be empirically distinct only when the banking sector is relatively competitive or this schedule is relatively flat in equilibrium. The results confirm this is the case in the empirical context of this paper. Also, marginal loans by unconstrained government-owned banks may not be zero NPV because they do not maximize profits (Banerjee and Duflo (2004)). This is not a concern here because government-owned banks have been excluded from the sample.

Table VI

Constraints or Free Cash Flows? 2SLS Estimates of the Effect of an Expansion in Bank External Financing on Loan Default Rates and Interest Revenues

Columns 1 and 2 present the estimated coefficients from a specification of the form:

$$DefaultT_{ijt} = \alpha_i + \alpha_t + \alpha_s + \psi_T(\ln F_{it} - \ln F_{it-1}) + \omega_{ijt},$$

where each observation corresponds to a loan j issued by bank i at month t. $DefaultT_{ijt}$ is a dummy equal to one if loan j is nonperforming (at least 6 months late, defaulted, or the loan recipient has filed for bankruptcy) at some time between time t and time $t + T$, where T can be 12 or 24 months (specifications (1) and (2), respectively). F_{it} are sources of capital (total capital minus regulatory reserve requirements). Finally, α_i, α_t, and α_s are bank, month, and loan recipient sector (three-digit industry sector) fixed effects.

Columns 3 and 4 present the estimated coefficients from a bank-level specification of the form:

$$Interest\ Revenue_{it}/Loans_{it} = \alpha_i + \alpha_t + \gamma(\ln F_{it} - \ln F_{it-1}) + \omega_{it}.$$

The 2SLS estimates are obtained using the change in expected external financing as an instrument for the change in bank sources of capital. Heteroskedasticity-robust standard errors are in brackets, clustered at the bank level. *, **, and *** stand for statistical significance at the 10%, 5%, and 1% level.

	Loan Non-Performing After		Interest	Net Interest
	12 Months (1)	24 Months (2)	Revenue/Loans (3)	Revenue/Loans (4)
1. Sample: all loans				
Sources of capital	0.0007	−0.0005	0.004	0.033*
(logs, first differences)	[0.0015]	[0.0011]	[0.032]	[0.018]
Bank/month fixed effects	Yes	Yes	Yes	Yes
Industry Fixed effects	Yes	Yes	No	No
Observations	750,563	750,563	4,654	4,654
2. Sample: existing borrowers				
Sources of capital	−0.0001	−0.0013		
(logs, first differences)	[0.0012]	[0.0009]		
Bank/month fixed effects	Yes	Yes		
Industry fixed effects	Yes	Yes		
Observations	620,325	620,325		

T is set to 12 or 24 months. As before, F_{it} represents sources of capital and the coefficient of interest, ψ_T, is estimated through 2SLS using expected external finance, $\hat{C}_{it}$, as an instrument. The parameter ψ_T measures the change in the average default rate of loans issued during lending expansions. The estimated effects of a loan expansion on loan default rates (Table VI, Panel A) are not statistically different from zero ($\psi_{12} = 0.0007$ and $\psi_{24} = -0.0005$). Loans issued during external finance expansions are neither more likely to default nor more likely to default *earlier* than loans issued in other periods.[19]

[19] The fact that the results using the 12- and 24-month default windows are statistically indistinguishable from each other suggests that measurement error in default rates is not driving

I measure the change in interest revenue per dollar of lending during credit supply expansions by estimating specification (1) using bank interest revenues scaled by the amount of loans outstanding of bank i at month t as the dependent variable. The estimated coefficient is small and statistically indistinguishable from zero (column 3 of Table VI), which indicates that there is no change in interest revenue per dollar of loan during credit expansions. Together with the result on default rates, the evidence indicates that the marginal profitability of loans did not decline during credit expansions. This is inconsistent with the free cash flows hypothesis, which posits that constraints are in place to prevent bank management from undertaking unprofitable investments.

Focusing on risk and interest revenue proxies can potentially underestimate the true effect of the lending expansion on profitability, especially for new borrowers. In Petersen and Rajan (1995) banks may accept short-term losses when lending to new borrowers in order to obtain informational rents later in the relationship. This reinforces the argument furthered in this paper that the profitability of lending did not decline during lending expansions. Nonetheless, I verify that the above results hold in the subsample of borrowers with a preexisting relationship with the bank, among which the bias is less likely (Panel B of Table VI). The results are confirmed: Marginal loans to existing borrowers issued during lending expansions are not more likely to default.

Ex post default rates may be misleading about the ex ante profitability of the marginal loans.[20] The ex post default rates may be low if the additional lending was allocated unintentionally to an industry that received a positive shock. Industry fixed effects in the default specification address this concern because estimates are obtained from differences in default of loans to firms in the same industry. It is also possible that loans issued to an industry *during* the period of external financing expansion did exceptionally well. For example, it could be the case that loans issued to an industry during November 1999, when an external financing shocks occurred, experienced a positive shock, while loans issued by the *same bank* and to the *same industry* during October 1999 and January 2000 did not experience the shock. Although such a scenario cannot be ruled out, the monthly frequency of the analysis renders it unlikely.

Another potential concern is that the power of the tests is insufficient to find a significant effect on defaults rates or interest revenue. However, the estimated standard error of 0.0015 in the default equation allows one to detect an increase in the probability of default of 0.1 percentage points at a 1% level of confidence. Further, I verify that the interest revenue test obtains significant estimates in specifications in which the predictions are theoretically unambiguous. In particular, an increase in inframarginal subsidized financing increases the profitability of lending regardless of whether banks are constrained or not. Consistent with this prediction, I show that interest rate revenue net of financial expenses increases during lending expansions (column 4 of Table VI).

the results. I further corroborate that the results remain unchanged when the default window is expanded to 30 months (requires reducing the sample loans issued prior to June 1999).

[20] I thank an anonymous referee for pointing out this possibility.

Considering that the MYPES program induced an average external financing increase of 7% of loans, the empirical tests can rule out a substantial range of plausible interest rate and default probability increases during the lending expansion.

One caveat remains regarding the interpretation of the results in this section. The default rates of marginal loans are calculated during normal times. While stress periods are useful to learn about the creditworthiness of borrowers, data limitations prevent extending the analysis to the post-2001 period, during which time macroeconomic turmoil in Argentina induced a sharp increase in default rates. It remains an open question whether the quality of marginal loans issued by constrained and unconstrained banks remains indistinct during times of aggregate negative shocks.

D. Financially Constrained Borrowers?

The results so far indicate that shocks to the ability of banks to raise external finance can have a substantial impact on the supply of credit by local constrained banks. I now address the empirical question of whether these shocks affect the aggregate supply of credit. The answer depends on the ability of borrowers from local banks to tap alternate sources of capital when their main lenders are constrained. This is indeed a possibility in a financial system characterized by the presence of large, foreign, and plausibly unconstrained banks that can supply capital. This question is addressed by testing the following empirical prediction: If borrowers are unconstrained, their total debt should not respond to an increase in external finance available to their lenders. I test this prediction using the following firm-level specification:

$$\ln(Debt_{kt}) - \ln(Debt_{kt-1}) = \alpha_k + \alpha_t + \varrho^F(\ln F_{kt} - \ln F_{kt-1}) + \upsilon_{kt}. \qquad (7)$$

Each observation corresponds to a firm k at time t and $Debt_{kt}$ is the total bank debt of firm k aggregated across all banks at t. The independent variable of interest is the change in bank sources of capital averaged across all lenders of firm k at time t. It is instrumented with the change in log expected external finance, $\hat{C}_{kt}$, also averaged across all lenders. The terms α_k and α_t are firm and month fixed effects. The parameter ϱ^F represents the sensitivity of firm k's total bank debt to a shock to the external finance of any of firm k's lenders, controlling for all time-invariant firm characteristics. The estimated sensitivity of the amount of bank finance of a firm to an increase in available external finance to a lender is positive and significant (column 1 of Table VII). The estimated coefficient indicates that a 1% increase in bank external finance leads to an average expansion of debt across borrowers of 0.3%. The point estimate is consistent with previous results: It implies that an increase in $1 of external finance leads to an expansion of $0.73 in aggregate bank credits to firms.[21]

[21] This number is obtained by multiplying the elasticity of 0.0028 times the average expected external finance (1.2 million), times the average number of borrowers per bank (10,900), and dividing by the average bank debt per borrower ($29,200).

Table VII

Effect of Bank External Financing Expansion on Borrower Debt: Firm Level and Within-Firm Estimations of the Reduced Form of Change in Firm Debt on Changes in Expected External Finance

Columns 2 through 7 present estimated coefficients from a specification of the form:

$$\ln(Debt_{ikt}) - \ln(Debt_{ikt-1}) = \alpha_k + \alpha_i + \alpha_t + \varrho(\ln F_{ikt} - \ln F_{ikt-1}) + \chi(\ln(Debt_{-ikt}) - \ln(Debt_{-ikt-1})) + \upsilon_{ikt},$$

where the left-hand side variable is the debt growth of firm k with bank i at month t. On the right-hand side, F_{ikt} are sources of capital net of reserve requirements (instrumented with expected external finance, $\hat{p}_{ikt}\ \hat{C}_{ikt}$); α_k , α_i , and α_t are firm, bank and, month fixed effects, respectively; and $Debt_{-ikt-1}$ represents the sum of all the bank debt held by firm k, excluding bank i. Column 1 presents the coefficients of the same specification but with the information aggregated at the firm-month level. Thus, the estimations of column 1 do not allow for error clustering at the bank level, bank fixed effects, or the inclusion of $Debt_{-ikt-1}$ as a control. Columns 1 and 2 show the estimates obtained using the entire sample of firms. Columns 3 and 4 show the estimates obtained using the subsample of firms that borrow from more than one bank in the sample, which is required for the inclusion of of $Debt_{-ikt-1}$ as a control. Columns 5 and 6 are estimates of the subsamples of firms that are not eligible and eligible to the MYPES program, where only firms with less than $200,000 in annual sales and 20 workers are eligible. *, **, and *** stand for statistical significance at the 10%, 5%, and 1% level.

Unit of Observation		Loan				
Borrower Sample	Firm		With Two or More Lenders		Noneligible to the MYPES	Eligible to the MYPES
Dependent Variable: Debt (logs, first differences)	All (1)	All (2)	(3)	(4)	(5)	(6)
Sources of capital (logs, first differences)	0.0025*** [0.0001]	0.0026** [.0012]	0.0034** [.0015]	0.0034** [.0015]	0.0037*** [.0003]	0.0012 [.0014]
Debt with other banks (logs, first differences)				−0.0009 [0.0175]		
Borrower FE	Yes	Yes	Yes	Yes	Yes	Yes
Bank FE	No	Yes	Yes	Yes	Yes	Yes
Month FE	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.11	0.12	0.06	0.06	0.12	0.08
Observations	3,098,481	3,275,779	371,512	358,741	3,226,602	49,171
Error clustering	Firm	Bank	Bank	Bank	Bank	Bank

The firm-level specification has two potential caveats. First, the magnitude of the standard errors is potentially underestimated because the firm-level specification does not allow for clustering at the bank level. And second, if firm investment opportunities are time varying and banks lend to firms with better investment opportunities, the estimated ϱ^F will have an upward bias. To address these issues I look in the loan-level specification at whether the amount of debt of firm k from bank i that receives an external financing shock increases relative to the amount borrowed by the *same* firm k from other financial institutions:

$$\ln(Debt_{ikt}) - \ln(Debt_{ikt-1}) = \alpha_k + \alpha_i + \alpha_t + \varrho^L(\ln F_{ikt} - \ln F_{ikt-1}) + \chi(\ln(Debt_{-ikt}) - \ln(Debt_{-ikt-1})) + v_{ikt}. \quad (8)$$

Each observation in this specification is a bank-borrower-month cell (subindexes i, k, and t). The dependent variable is the change in log debt of firm k with bank i at month t, and the independent variable of interest is the change in sources of capital of bank i (instrumented with the log change in expected finance of bank i). The added control is the total debt of the same firm k at time t with all banks other than i (denoted by the subindex–i). Standard errors are calculated allowing for clustering at the bank level. Controlling for the growth of debt with other banks requires reducing the sample of firms to those that borrow from more than one bank. The parameter of interest, labeled ϱ^L to denote the loan-level specification, represents the sensitivity of the amount of debt of borrower k from lender i to changes in lender i's external finance. The estimated sensitivity is positive and not statistically distinguishable from the firm-level sensitivity (column 4 of Table VII). The point estimate is slightly larger, but this is entirely driven by the fact that the estimation is performed over a different sample of firms, with multiple bank relationships (columns 2 and 3 report the loan-level estimates for the full and reduced samples without the other bank debt control). The results corroborate the finding that shocks to a bank's financial position affect the available credit to its borrowers even after controlling for firm investment opportunities.

Overall, these results suggest that borrowers from constrained banks were also constrained before the lending expansion. Holding firm investment opportunities and interest rates constant, borrowers expanded the amount of bank debt when their lenders' external financing increased. This behavior violates the Modigliani–Miller proposition for firms, and is consistent with borrowers being credit-rationed before the external finance shock to the banks. The overall evidence suggests that financial constraints at the bank level can result in financing constraints at the firm level, and that shocks to the financial position of banks will affect the aggregate availability of credit and the financial position of their borrowers.

IV. Testing the Identifying Assumptions

The interpretation of the results in this paper rests upon the assumption that the external financing provided by the program was uncorrelated with

Table VIII

Testing for Changes in Bank Risk Profile: Regression of Changes in Inter-bank Rate and Subordinated Debt Rate on Changes in Actual and Expected External Financing

Each column presents estimated coefficients from a specification of the following form:

$$R_{it} - R_{it-1} = \alpha_i + \alpha_t + \beta \ln(C_{it}/C_{it-1}) + \varepsilon_{it},$$

where R_{it} is either the interbank rate (columns 1 and 2) or the subordinated debt rate (columns 3 and 4) faced by bank i at time t. The rate for each type of debt is calculated dividing the interest rate accrued (from the earnings report at month t) by the stock of debt (from the balance sheet at time $t-1$). C_{it} is either actual (columns 1 and 3) or expected (columns 2 and 4) program financing of bank i at time t, and α_i and α_t are bank and month fixed effects. All estimations are performed on the reduced sample of banks that received program financing at some time between 1993 and 1999. Heteroskedasticity-robust standard errors are in brackets, clustered at the bank level. *, **, and *** stand for statistical significance at the 10%, 5%, and 1% level.

	Interbank Debt Rate		Subordinated Debt Rate	
Dependent Variable	(1)	(2)	(3)	(4)
Actual program financing	−0.074		−0.001	
(logs, first differences)	[0.358]		[0.003]	
Expected program financing		1.748		0.173
(logs, first differences)		[17.42]		[0.321]
Bank/month FE	Yes	Yes	Yes	Yes
Observations	991	984	993	922
R-squared	0.15	0.07	0.43	0.42

changes in the marginal cost of financing or the investment opportunities of the bank. The interpretation also assumes that the targeting restrictions imposed by the program did not have a direct effect on the banks' lending behavior. This final section provides additional evidence that corroborates these assumptions.

A. Changes in the Risk Profile of Banks

I assume in the analysis above that the external financing provided by the program was inframarginal, in the sense that the marginal cost of finance of the banks was unaffected by the program. This is a necessary condition for the validity of the financing frictions test. This assumption can be tested empirically by looking at how proxies for the risk profile of the bank and its marginal cost of capital change when banks receive program financing. Two such proxies are the overnight interbank interest rate and the interest rate on subordinated debt.[22]

The estimated coefficients of a regression of changes in interest rates on changes in external financing (actual and expected), bank fixed effects, and month dummies are shown in Table VIII. None of the estimates is significant,

[22] See Ashcraft and Bleakley (2006) for evidence that federal funds' market rates reflect bank creditworthiness.

which suggests that program financing did not significantly affect the risk profile of banks. Thus, the observed sensitivity of lending to program financing is unlikely to be driven by changes in the marginal cost of capital.

B. Liquidity Shocks and Investment Opportunities

Another identifying assumption underlying the financial constraints test is that expected program financing was uncorrelated with other sources of changes in bank liquidity or with changes in bank investment opportunities. The previous section shows that there is an expansion in firm borrowing holding constant firm investment opportunities. Additional evidence can be drawn from looking at the correlation between expected external financing and proxies for bank liquidity needs and investment opportunities. I use lagged changes in bank deposits and lagged bank cash flows, respectively. A decline in bank deposits or cash flows will reduce bank liquidity and can be correlated with expectations of the banks' investment prospects (Alti (2003), Kaplan and Zingales (1997), Moyen (2004)).[23]

Table IX shows the estimated coefficients of a regression of program finance, actual and expected, on lagged changes in deposits, lagged cash flows, and bank and month fixed effects. One would expect actual program financing to be negatively (positively) correlated with past deposits and cash flows if bank participation in the program responded, at least in part, to short-term liquidity shortages (investment opportunities). Consistent with this interpretation, column 1 shows that actual program financing was negatively and significantly correlated with lagged shocks to deposits. However, expected financing is not significantly related to the proxies of either liquidity shocks or changes in investment opportunities. These results corroborate the view that the expected program financing variable is a suitable candidate as an instrument for bank sources of capital.

C. Targeting Requirements of the Program

The program rules required banks to use the program resources in extending new loans to small enterprises. A potential alternative interpretation of the results of the paper is that banks expanded lending in order to comply with the program rules and secure access to cheap funding from future waves of the program. I provide here additional evidence that the allocation rule was not binding.

First, the lending expansion that resulted from the increase in available external finance was mostly allocated to firms that were not eligible for participating in the program. This can be shown by estimating the within-firm specification (8) over two subsamples of firms: eligible and noneligible to the

[23] Other usual measures of investment opportunities, like Tobin's q, are not available because small locally owned banks in Argentina are not publicly traded.

Table IX

Testing for Changes in Liquidity and Investment Opportunities: Regression of Actual and Expected Financing Expansion on Lagged Deposit Growth and Cash Flows

Each column presents estimated coefficients from a specification of the following form:

$$\ln(C_{it}/C_{it-1}) = \alpha_i + \alpha_t + \beta_0 \ln(D_{it}/D_{it-1}) + \beta_1 \ln(D_{it-1}/D_{it-2}) + \beta_2 \ln(D_{it-2}/D_{it-3}) + \beta_3 \ln(D_{it-3}/D_{it-4}) + \beta_4 \ln(D_{it-4}/D_{it-5}) + \gamma_0 \ln(CF_{it-1}) + \gamma_1 \ln(CF_{it-2}) + \gamma_2 \ln(CF_{it-3}) + \gamma_3 \ln(CF_{it-4}) + \gamma_4 \ln(CF_{it-5}) + \varepsilon_{it},$$

where C_{it} is either actual (column 1) or expected (columns 2 and 3) external financing from the program of bank i at time t, D_{it} represents deposits, CF_{it} denotes cash flows (income plus depreciation), and α_i and α_t are bank and month fixed effects. Column 2 presents the estimates using the reduced sample of banks that received program financing at some time between 1993 and 1999. Heteroskedasticity-robust standard errors are in brackets, clustered at the bank level. *, **, and *** stand for statistical significance at the 10%, 5%, and 1% level.

	Actual Program Financing (logs, first differences)	Expected Program Financing (logs, first differences)	
	(1)	Program Banks (2)	All Banks (3)
Deposits_{t-1}	−0.028	0.02	0.002
(logs, first differences)	[0.049]	[0.018]	[0.002]
Deposits_{t-2}	−0.162***	−0.015	−0.001
(logs, first differences)	[0.058]	[0.011]	[0.003]
Deposits_{t-3}	−0.094	−0.021	0
(logs, first differences)	[0.086]	[0.016]	[0.004]
Deposits_{t-4}	−0.111*	−0.027	−0.002
(logs, first differences)	[0.055]	[0.019]	[0.003]
CashFlow_{t-1}	0.00078	0.00074	0.00076
(logs)	[0.0035]	[0.00071]	[0.00073]
CashFlow_{t-2}	0.0033	0.00070	0.00055
(logs)	[0.0035]	[0.00074]	[0.00040]
CashFlow_{t-3}	0.0058	0.00096	0.00027
(logs)	[0.0056]	[0.00098]	[0.00044]
CashFlow_{t-4}	0.0049	0.00071	0.00019
(logs)	[0.0071]	[0.00074]	[0.00044]
Bank/month FE	Yes	Yes	Yes
Observations	1001	1003	5818
R-squared	0.31	0.85	0.88

MYPES program.[24] One would expect the external financing shock to affect the amount of borrowing of eligible firms if the targeting rule were binding, and

[24] Sales and worker data are not available in the CDSF. I use the database of manufacturing firms collected by Unión Industrial Argentina (UIA) that contains sales and number of workers data for 1,048 of firms in 1998 that can be matched to the CDSF database. The UIA database is used to impute sales and number of workers to the CDSF database. The UIA database is collected by a not-for-profit organization through questionnaires and site visits, and chosen to be statistically representative by size and region of manufacturing firms. Using the 1998 data from the UIA

to be zero otherwise. The results in Table VII (columns 5 and 6) show that the observed total expansion in borrower bank debt comes solely from firms that are not eligible for participating in the program. The impact on eligible firms is not statistically significant.

Finally, I test whether the time-series pattern of lending expansions is consistent with the potential incentives provided by regulatory oversight. The incentives to expand lending to secure future finance should decline as the program nears an end. As a result, the magnitude of the lending expansion should decline during the last waves of the program. I test this prediction by estimating specification (8) over two periods, before and after July 1999. The first period includes waves 9 and 10 of the program, and the second one includes waves 11 and 12. The estimated coefficients in each period, not included in the tables for succinctness, are 0.0025 and 0.0028 and are statistically indistinguishable at the 1% level of confidence. The fact that the magnitude of the lending response did not vary as the program drew to an end is inconsistent with the hypothesis that the lending expansion was driven by regulatory oversight.

V. Conclusions

This paper measures the extent of financial constraints among locally owned banks in the context of the Argentine financial system. It shows that financial constraints prevent banks from undertaking profitable lending opportunities. These lending opportunities are not arbitraged by other competing lenders, which implies that financing frictions of local financial intermediaries affect the aggregate supply of credit and investment. This is true even in an environment where close to 50% of the assets of the banking system are held by large multinational banks. This percentage is high relative to other emerging markets, where 19% of the total banking assets are foreign owned.

Measuring the extent and consequences of financing frictions among local banks is particularly relevant in emerging markets. First, financial constraints are more likely to be prevalent among local banks, since unlike large foreign banks, these do not have large internal capital markets from which to draw funding (Berger et al. (2003), Stein (1997)). Second, recent evidence suggests that borrowers of local banks may have little access to other sources of funding even when banking markets are open to foreign investment (Mian (2006)). As a consequence, shocks to the banking sector can have a disproportionate effect on investment by local bank borrowers in emerging markets.

A natural question that arises from the results in this paper is what prevents borrowers of constrained banks from seeking funding from unconstrained institutions. Theory suggests that switching sources of finance is costly due to the private information that lenders hold about their borrowers' creditworthiness.

and the CDSF databases, I estimate an OLS regression of firm workers and sales over past debt performance, past debt growth, collateral, and number of bank relationships. The estimated model is used to predict the sales and workers of the rest of the firms in the CDSF in 1998, which I use to impute program eligibility.

Such private information creates a hold-up problem that makes competing banks reluctant to lend to borrowers that are switching lenders, and when they do, these borrowers tend to be lemons. Consistent with these predictions, additional results not shown in the paper indicate that less than 6% of the loans issued to new borrowers during 1999 went to borrowers that were switching from another financial institution. And the loans issued to these switching borrowers were more likely to default than other new loans, even after controlling for borrower characteristics.

Another important question is whether the results generalize to other empirical contexts. The Argentine banking sector regulatory and supervisory system during the second half of the 1990s became an archetype for regulation design in emerging markets in the following decade. The banking regulation pioneered the adoption of Basel II recommendations in 1995, and by 1998 the overall regulatory environment was ranked second behind Singapore among emerging market economies (Calomiris and Powell (2000), Mishkin (2000, 2001), World Bank (1998)). Thus, the exploration of empirical banking market issues in the Argentine setting during this period provides insights into the working of the financial sectors in emerging markets under the new Basel Accord rules. Moreover, the empirical strategy employed in the paper exploits a source of variation in the supply of bank credit that is widely available in other settings. Thus, replicating the methodology to learn about the extent of bank financing constraints and their effects on investment in other contexts should be a feasible and fruitful area for future research.

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