Firm Size and Bank Lending After a Liquidity Supply Shock

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Abstract

Using the inclusion of Mexican Government Bonds into Citibank's World Government Bond Index (WGBI) in 2010 as a source for an increase on the demand for these assets, and thus a potential positive liquidity shock for Mexican banks holding them, I explore the transmission of such a liquidity shock through bank lending using the methodology of Khwaja and Mian (2008). I extend the analysis by considering the possible effects of the size of firms, and the economic sector in which they operate, may have on this transmission. In general, I find that small firms did receive a greater increase in total credit after the liquidity shock, relative to larger firms. However the evidence is not irrefutable and more research would be needed to confirm these results.

1 Introduction

The understanding of monetary policy transmission is an important issue, both from a theoretical and an empirical point of view. Furthermore, the evidence of how real variables react to monetary policy decisions can be incorporated by policy makers, and thus lead to more opportune policy

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interventions. However, despite its importance, the empirical study of the channels through which monetary policy impacts real variables presents several difficulties. This paper is related to the credit channel of monetary policy transmission, and more specifically, to the bank-lending view of such mechanism. In particular, identifying the existence of the credit channel of monetary policy transmission requires disentangling the effects of the demand for credit, from those of its supply. The seminal work of (Bernanke & Gertler, 1995) found evidence that restrictive monetary policy causes changes in aggregate real variables such as GDP [1], however, given that this analysis uses only aggregate variables, it is not possible to conclude whether these changes respond uniquely to changes on the supply of credit. Trying to face this problem, (Kashyap & Stein, 2000) use the differentiated response of banks to monetary policy changes, according to each particular bank's characteristics. While this approach adds information to the results of (Bernanke & Gertler, 1995), it still cannot completely disentangle the effects of supply and demand for credit. This problem was addressed directly by (Khwaja & Mian, 2008), who proposed using on an exogenous liquidity supply shock, and focus on firms who have credit relationships with at least two banks. This way, and adding firm fixed effects, it is possible to isolate the effects of the supply and the demand of credit, in principle.

The methodology of (Khwaja & Mian, 2008) has become standard in the literature about the bank lending channel of monetary policy transmission. Similar exercises have been carried out for different countries and periods of time. The underlying common element between all of these is the use of an exogenous liquidity shock and a database that allows to identify a group of firms that receive loans from at least two banks. In this spirit, the work of (Levin-Konigsberg, López Castañón, & López-Gallo Dey, 2017) uses the methodology of (Khwaja & Mian, 2008) for Mexico. As the exogenous liquidity shock they propose the entrance of Mexican government bonds to Citibank's World Government Bond Index (WGBI) in the last quarter of 2010. The intuition being that this event would increase the demand for Mexican government bonds, which would allow banks operating in Mexico to sell some of these assets and acquire other types of assets, for example, commercial loans. Therefore, banks who held a higher proportion of their assets in the form of Mexican Government bonds would be at an advantage to sell some of those away and experience an

[1] The authors make the distinction between the two mechanisms at work behind their results. Namely, the bank-lending channel and the balance-sheet channel.

increase in their liquidity that can be in turn converted to new loans. On the other hand, Mexico has a comprehensive database of commercial loans offered by banks: the R04 report. This information allows to identify those firms obtaining credit from at least two banks [2].

For this paper I use the same liquidity shock proposed in (Levin-Konigsberg et al., 2017), while also using the R04C database, but I extend the analysis in two ways. First, I add three definitions of the size of firms, to explore whether the size of a firm gives rise to a different response from the credit they receive from banks. In particular, I use the definition of micro and small firms established on the "Competition Report on loans to Micro, Small and Medium firms" [3]. Said report finds that credit to small and micro firms tends to be less competitive, relative to the credit conditions offered to larger firms. Therefore, using these definitions can serve as a proxy variable of competition in the provision of credit. Secondly, I analyze separately the credit provided to firms in the service sector of the economy and the credit to firms in non-service sectors. This would, in principle, capture any differences that may exist in the provision of credit to these different types of firms.

The results of this empirical analysis show that, for the most part, there is an positive effect in bank lending to firms after an increase in liquidity (i.e. after the sale of Mexican Government bonds). However, these results are generally non-significant. Additionally, I also find evidence that lending to smaller firms increased more, relative to that of larger firms, which could be a sign of credit rationing to smaller firms. Finally, I find no significant difference between the response of credit to firms that operate in the retail and services sectors of the economy, vis-à-vis firms that operate in the non-services sectors of the economy.

2 Data

The data come from various sources. Data about the credit to firms comes from the R04-C report. This report is a comprehensive report on all the outstanding loans by Mexican banks to firms and entrepreneurs. The information for each credit includes information about the creditor [4], the identity

[2] In (Levin-Konigsberg et al., 2017) they also use credit card loans obtained from the Credit Bureau, in order to measure the transmission not only to commercial loans, but also to credit card loans.

[3] *Reporte sobre las condiciones de competencia en el otorgamiento de crédito a las pequeñas y medianas empresas (PYME)*, in Spanish. The link can be found (in Spanish) in the following link: `http://www.anterior.banxico.org.mx/publicaciones-y-discursos/publicaciones/informes-periodicos/reporte-sobre-las-condiciones-de-competencia-en-lo/reporte-condiciones-competenc.html`.

[4] Among them: the number of employees, the economic activity, the area in which it operates, whether it's a government institution or not. Additionally, it includes the amount of revenue the firm receives, however this variable

of the bank extending the credit, and information about the credit conditions [5]. Additionally, the information is presented in two main databases: the one for new credits (*altas*); and the one for outstanding credits formalized in the past (*seguimiento*).

I used a consolidated database which contains both outstanding credits and newly issued credits. The frequency of the data is quarterly, which means the database contains both loans that were issued in the last month of the quarter, as well as loans that were issued during the first two months of the quarter, but are included in the follow-up database (*seguimiento*). As will become clearer once the methodology I use in this paper is explained, this issue poses no problem for the analysis. In summary, the methodology requires to collapse all the observations into one pre-shock period and one post-shock period, both of equal length[6]. In that sense, the timing of the initiation of each loan is irrelevant as long as the loan balance does not fluctuate dramatically from quarter to quarter.

On the other hand, the data about bank characteristics comes from two sources: the publicly available information at the National Banking and Securities Commission's website (*Comisión Nacional Bancaria y de Valores*, CNBV); and the database with detailed bank information available in Banco de México called R01 or *Catálogo Mínimo*. From the first source, I obtained the capital ratio index for each bank in the sample. On the other hand, the data for bank's total assets, their profits, total deposits, total liabilities, and the proportion of delinquent loans per bank comes from the second non-publicly available database.

More importantly, this non-public database allows me to construct the variable that measures the exposure of each bank to the liquidity shock. This variable is defined as the proportion of government bonds to total assets that each bank held, prior and after the entrance of Mexican Government Bonds to the Citibank's World Government Bond Index (WGBI).

Finally, there is one last data series that I use, which is the price of *Unidades de Inversión* (UDIs)[7], which is reported on the publicly accessible website for Banco de México (Banxico). I convert all the outstanding loan balances into UDIs, in order to guarantee that the amounts are

seems to be subject to a high degree of measurement error.

[5]The maturity of the loan, the interest rate charged, the time to maturity, the outstanding balance, the total amount lent, the rating of the credit, among others.

[6]For the purposes of this paper, this is five quarters each.

[7]UDIs are indexed units of account in which many loans, particularly long-term ones, are denominated. The main idea is to maintain the purchasing parity of the amount on the outstanding loans, given that the price of UDIs adjusts according to CPI inflation.

expressed in real terms.

3 Empirical Analysis

3.1 The Khwaja and Mian Methodology

The study of the transmission of liquidity shocks, and specifically monetary policy shocks, into bank lending presents several problems arising from the simultaneity of these shocks on both demand and supply. For instance, a monetary policy intervention, affects liquidity in the banking system, but also affects nominal interest rates throughout the financial system. This in turn, will very likely also affect the demand for credit. Therefore, the findings of works such as (Bernanke & Blinder, 1988) and (Bernanke & Gertler, 1995), which focus mainly on aggregate outcomes, cannot properly disentangle the effects of both demand and supply for credit.

Moreover, when using micro-data to attempt to measure the effect of a change in bank characteristics on bank lending, it might seem natural to estimate by OLS a regression of the form:

$$\Delta L_{ij} = \beta_0 + \beta_1 * \Delta D_i + (\eta_j + \varepsilon_{ij})$$

Where ΔL_{ij} is the log-difference of the total amount of credit by bank i to firm j [8]; ΔD_i is the change that occurs for bank i's variable of interest (for example, deposits); ε_{ij} is a disturbance term; and η_j is an unobservable, firm-specific component.

The parameter of interest in this regression would be β_1, as it captures the response of the bank lending from bank i to firm j. However the OLS estimate for this parameter, $\hat{\beta}_1^{OLS}$ as long as $Corr(\eta_j, \Delta D_i) \neq 0$. That is, as long as the individual firm j's component is correlated to bank i's liquidity shock.

In this context, (Khwaja & Mian, 2008) propose a fixed effects (FE) approach on the data, *after taking first-differences*. This FE specification is the following:

$$\Delta L_{ij} = \beta_j + \beta_1 * \Delta D_i + \varepsilon_{ij} \tag{1}$$

They argue that this specification captures the firm-specific demand shocks (that is, the unob-

[8] In this literature, a loan is defined as a pair $(bank_i, firm_j)$

servable η_j component). The idea is to measure the effect that bank i's exposure to the liquidity shock (i.e. ΔD_i) has on bank i's credit to firm j. Put differently, the objective is to measure the differentiated effect of credit from different banks *to the same firm*. The only required assumption for this methodology is that credit demand needs to be firm-specific, and that it does not change *across* different banks. That is, that firms want to obtain credit, regardless of the source bank.

On the other hand, one downside of this methodology is the fact that it requires to use firms that receive loans from more than one bank. Not only is this *multi-relationship* sample naturally less numerous, which renders the estimation less accurate; but it also complicates any attempt at extrapolating the results to the full sample of firms. It could be argued that there is some sort of self-selection happening, and multi-relationship firms are different from single-bank firms. However, if these problems are not significant enough to be a source of concern, the FE estimation will provided consistent estimates of the parameter of interest β_1.

The final element required in this methodology is an exogenous liquidity supply shock [9]. The shock needs to be unanticipated and unrelated to the state of the aggregate economy [10], in order to further isolate the demand effects from the supply effects.

3.2 Liquidity Shock

Following (Levin-Konigsberg et al., 2017), I use the inclusion of Mexican Government Bonds into the World Government Bond Index (WGBI) of Citibank. This event was formalized in the fourth quarter of 2010 [11], but announced in April 2010. As argued in (Levin-Konigsberg et al., 2017), in principle, this would increase the demand for Mexican Government bonds and allow Mexican banks to sell off some of these assets and increase their liquidity. This increase in liquidity could then be allocated into loans and other assets, given the bank's liabilities. The following diagram shows the

[9] In (Khwaja & Mian, 2008) the shock comes from the nuclear tests in Pakistan and India during 1998. The international sanctions imposed on Pakistan forced the Pakistani government to stop the exchange rate insurance that they provided to dollar-denominated deposits on commercial banks in an attempt to avoid a balance of payments crisis. Some banks had a higher proportion of dollar-denominated deposits and therefore are considered to have been more exposed to the negative liquidity shock. Since these tests were unexpected, the liquidity shock is considered to be exogenous.

[10] These two conditions are evidently not satisfied by monetary policy interventions. And even in the case of unanticipated monetary policy shocks, it can easily be argued that not only it will be related to the state of the aggregate economy, but also that a change in monetary policy stance will affect nominal interest rates throughout the financial system and will therefore affect demand too.

[11] Specifically, inclusion of Mexican Government Bonds was formalized in October 2010, as can be read in the following link: `https://embamex.sre.gob.mx/canada/images/monitoreo/mexiabril1`

how such an event would cause a restructuring in a typical bank's balance sheet:

Table 1: Bank Balance Sheet After Selling Off Government Bonds

Assets	Liabilities
- Loans ↑	- Deposits
- Government Bonds ↓	- Other Liabilities
- Other Assets ↑	

Naturally, banks with a higher change in their holdings of Mexican Government Bonds would experience a higher increase in their liquidity, and would be in a better position to increase their loans. Therefore, both the total change – and the percent change – in the ratio of Mexican Government Bonds to total assets of each bank will measure its exposition to the positive liquidity shock.

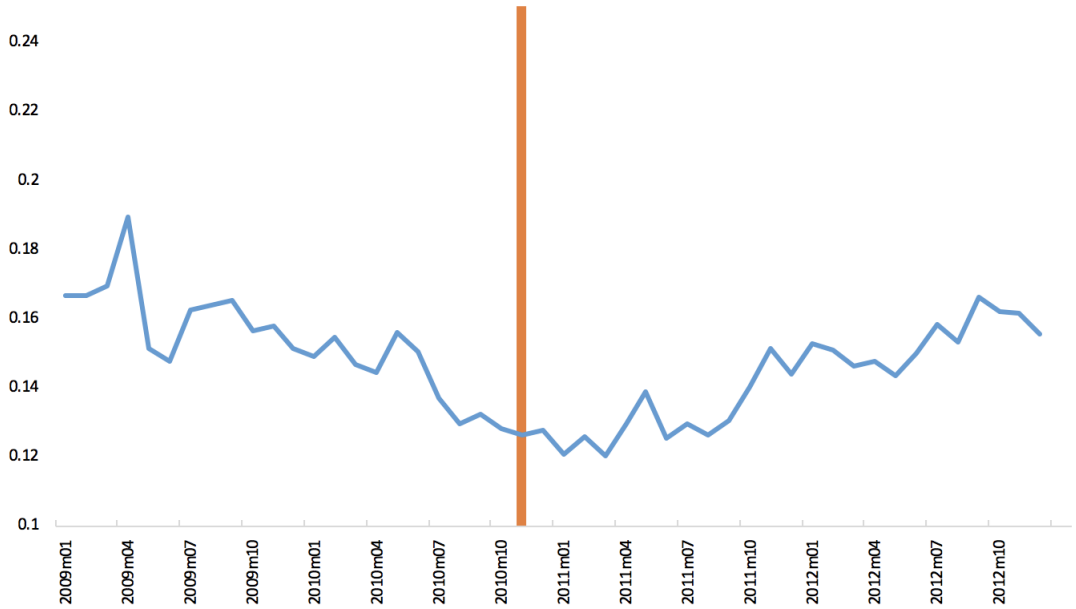
Figure 1 shows the evolution of the average ratio of Mexican Government Bonds to total assets, for all banks. There is a decline that started around June of 2010. While this is a general trend, some banks had a higher proportion of Mexican Government banks to total assets than others. It is this variation that I exploit to attempt to identify the response of bank lending to liquidity shocks. In terms of the notation presented before, this is the ΔD_i variable.

On the other hand, as has been explained in other sections of this paper, the methodology of (Khwaja & Mian, 2008) collapses all the information into a single pre-shock and a post-shock period. Given my data availability, I define my pre-shock period as the five quarters going from 2009Q3 (the first available data period under the previous R04 methodology) to 2010Q3. Since the inclusion of Mexican Government bonds became effective in October 2010, I consider 2010Q4 as the shock window. Finally, in order to maintain symmetry between the pre-shock and the post-shock periods, I also consider five quarters starting from 2011Q1 as the post-shock period. This is shown graphically in Figure 2.

3.3 Firm Size

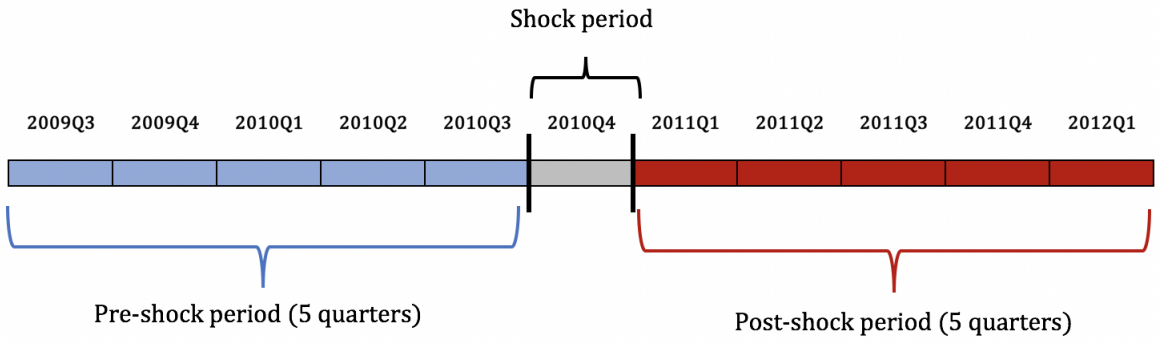
The analysis I carry out in this paper builds on the work of (Levin-Konigsberg et al., 2017). However, I extend their analysis in two main dimensions. First, I include firm size, to study its effect on bank-lending. This variable provides an additional control on the lending dynamics from banks to firms. Furthermore, the original work of (Khwaja & Mian, 2008) uses the size of the firms, as described

Figure 1: Ratio of Bank Bonds to Total Assets for All Banks



Notes: The graph shows the average ratio of all the Mexican Government bonds to total assets for all banks during the period of interest (2009-2012). The data comes from the R01 database (or *Catálogo Mínimo*). The vertical line marks the date when the inclusion of Mexican Government Bonds became official (October 2010). While the graph shows a general downward trend, some banks experienced larger drops than others in their holdings of Government bonds. This is the variation that is exploited to identify the effect of the liquidity shock on bank lending to particular firms.

Figure 2: Diagram Depicting the choice of Pre and Post-shock periods



by their level of indebtedness. Second, I divide the original sample between loans given to firms operating in the services sector, and loans given to firms in the non-service sector[12]. I do this in an attempt measure the differential effect that may occur between service and non-service firms in terms of their access to credit, if such a difference indeed exists.

In order to determine the size of a firm I use different approaches. First, based on the definition of micro, and small and medium establishments (SMEs) proposed in the "Competition Report on Loans to Micro, Small and Medium firms"[13], elaborated by the Financial System Affairs Directorate (DGASF) at Banxico. This report concludes that credit to non-large firms is considerably less competitive than credit to large firms in Mexico. This implies that using these definitions to determine the size of a firm serves as a proxy for the level of competitiveness in the access to credit that each firms receives. Table 2 shows the way each firm is classified in the Report, according to its number of workers, total amount of indebtedness, and revenue.

While all of these variables are readily available in the R04 database, one caveat that emerged when speaking to the personnel at the DGASF is that the gross revenue variable contains considerable measurement error in the previous version of the R04 database. It is for this reason that I do not include it in the definition of firm size.

A third definition of firm size, which is more similar in spirit to the original work of (Khwaja & Mian, 2008), is defining a firm as "small" in terms of its total indebtedness. More specifically, if its total indebtedness falls below 1 million UDIs.

[12] Mainly manufacturing, agriculture, and other extracting activities.

[13] "Reporte sobre las Condiciones de Competencia en el Otorgamiento de Crédito a las Pequeñas y Medianas Empresas (PYME)", in Spanish.

Table 2: Definition of Micro, Small, Medium and Large Firms in the Competition Report by the DGASF.

	No. of Workers	Level of Indebtedness	Revenue
Large:	Retail and Services $>$ 100	$>$3m UDIS	$>$ 250m (MXN)
	Manufacturing and Industry $>$ 250		
SMEs:	Retail and Services $\leq$ 100	$\leq$3m UDIS	$\leq$ 250m (MXN)
	Manufacturing and Industry $\leq$ 250		
	Within SMEs:		
	Medium, if **indebtedness**	$>$ 1m UDIS	
	Small and Micro, if	$\leq$ 1m UDIS	

3.4 Economic Sector

The data available on the R04 database allows to determine the economic activity of the firm demanding the credit; and, more generally, the economic sector in which the firm will be using the loans. This is identified via the 5-digit North American Industry Classification System (NAICS). I use this information to determine whether or not a firm uses the loan on the Service and Retail sector. To do so, I focus exclusively on the first digit of the NAICS codes. Given that Services and Retail begin when this first digit is equal to "4", I consider a firm operates in the non-services sector whenever the first digit of its NAICS code is equal to "1","2", or "3" [14].

By splitting the data in this form I find that some firms seem to receive loans in more than one economic activity as classified by their NAICS code. Furthermore, about 70% of firms of the final multi-relationship sample operate in the Retail and Service sector.

With this information, I collapse the outstanding loans according to the firm receiving the loan, the bank providing said loan, and the economic activity in which that loan is used. I then run the same regressions of the baseline case on both subsamples. The baseline econometric exercise only collapses the outstanding loans according to the firm receiving credit and the bank supplying it.

3.5 Econometric Specifications

In order to test the effect of the liquidity shock on bank lending I run a more general version of Eq. (1) that includes various bank-level controls and other possible firm-level controls. Among the bank-level controls I include: the log of total assets (as a measure of bank size), an alternative

[14] These digits correspond to Agriculture, Mining, and Manufacturing activities, respectively.

measure of bank liquidity defined as the ratio of core deposits to total liabilities, [15]; the capital ratio of banks; bank ROA; the delinquency ratio for commercial loans [16]. For the firm-level controls I follow (Khwaja & Mian, 2008) directly and include dummies for the state in which the firm operates and dummies for what is coded in the R04C database as "economic sector" [17] which comprises a list of 12 possible classifications for the entity receiving the loan [18].

Furthermore, I add various definitions of the size of the firm. Both as an interaction with the liquidity shock (i.e. the change in the proportion of government bonds to total bank assets) and as a standalone dummy. This, in principle, would allow to measure if bank lending behaves differently for small firms. There are multiple reasons for why bank lending to small firms may react in a different manner to lending to big firms. Firstly, as has already been discussed in this paper, there is evidence of decreased competition on the provision of credit to small and medium firms [19]. On the other hand, even in a more competitive setting, there is extensive work on credit rationing and financial constraints. If small firms face higher financial constraints than small firms, those constraints might be relaxed after banks experience a positive liquidity shock. To explore this idea more thoroughly, ideally I would need to have information on loan applications that were rejected prior to the positive liquidity shock, but were accepted after it [20]. However, this information is not available in the R04 database. Therefore, this interaction term could provide evidence of a differential effect of loans to small firms vis-à-vis larger firms. Although this evidence would not be conclusive, given the available information.

The generalized version of (1) that I run is therefore:

$$\Delta L_{ij} = \beta_j + \beta_1 * \Delta D_i + \boldsymbol{X}'_{ij}\gamma + \varepsilon_{ij} \tag{2}$$

Where $\boldsymbol{X}_{ij}$ is a vector containing firm and bank controls.

Additionally, given the properties of the OLS estimator and its potential bias, running an OLS

[15] This same measure is included in (Levin-Konigsberg et al., 2017)

[16] All of these variables are collapsed to a pre-shock average. Therefore, there is a single observation per bank.

[17] *Sector Económico*, in Spanish. This is not to be confused with the definition of Economic Sector based on the NAICS that I use to identify service and non-service firms.

[18] The classification distinguishes between Federal and Subnational Governments, Publicly owned firms, Standard Deposit Banks, Development Banks, Firms, People with Entrepreneurial Activities, and Foreign Firms.

[19] See the Competition Report on the Provision of Credit to Small and Medium Firms, by the DGASF at Banco de México, which has been discussed elsewhere in this document.

[20] This is exactly the setting used by (Jiménez, Ongena, Peydró, & Saurina, 2012), who have access to such information using the Spanish credit registry.

regression can also be informative about the direction of said bias. Related to this point, performing the OLS regressions also allows to obtain some indication of the magnitude of the bias. In that sense, I include various OLS regressions, both on the full sample and the sample containing multi-relationship firms. In the different OLS specifications, I add bank-level controls and some of the same firm-level controls, among which, the size of the firm, and its interaction with the change in the bank holdings of government bonds, is the main characteristic of interest in this paper.

The OLS specification is very similar to the FE specification (2). Specifically, the OLS equation to estimate is given by:

$$\Delta L_{ij} = \beta_0 + \beta_1 * \Delta D_i + \hat{\boldsymbol{X}}'_{ij}\theta + \epsilon_{ij} \tag{3}$$

Where once again, the parameter of interest is the one associated to the change in the holdings of government bonds, as proportion of total assets (i.e. the parameter β_1), and we allow for a set of possibly different bank-level and firm-level controls, $\hat{\boldsymbol{X}}_{\boldsymbol{ij}}$. In principle, both the OLS and the FE estimator try to estimate the same parameter, however the OLS estimator is inconsistent. On the other hand, the OLS estimation of (3) allows to add different types of firm-controls, without it being collinear with the firm-fixed-effects.

4 Results

4.1 Small (PYME) Firms

The first set of regressions uses the definition of "small or medium firm" that is proposed on the Competition Report for the Credit to Small and Medium Firms. It comprises firms that that have less than 100 workers (if they operate in retail and services), or less than 250 workers (if they operate in manufacturing and industry)[21]; have a level of indebtedness that is lower than 3 million UDIS; and have less than 250 million (MXN) as yearly gross revenues. Once again, this last variable contains considerable measurement error and is therefore omitted from the definition for the size of each firm. The regressions are repeated three times. Once for the baseline case, which does not distinguish between the economic sector in which the firm operates. Another one for those firms

[21] Given the definitions I used for this paper, I considered firms whose first digit from the NAICS was 1,2, or 3.

operating in the services and retail sector of the economy. And a final one, with the same regressions for the firms operating in the non-services sector of the economy [22]. In general, the three sets of regressions show similar results. The point estimates of the parameter measuring the response have the appropriate sign (negative)[23]

4.1.1 Baseline

The baseline regressions are presented in table 6.1. It can be seen that the coefficient associated with the liquidity shock (i.e. the percent change in government bonds as a proportion of total assets) [24]. For the FE estimation none of the point estimates are significant. Furthermore, comparing the OLS estimate from the multi-relationship sample (Column 3), we see that the estimate is marginally higher than the point-estimate use FE. However, this latter is not significant and therefore poses problems in terms of this interpretation. Despite this, at face value this would seem to indicate that the correlation between the firms' unobserved demand component and the bank's exposure to the liquidity shock is negative [25]. Additionally, the results for the simple OLS specification, without bank-level controls and firm-level controls, on the full sample seem to suggest that there is not a response in total lending from banks after the liquidity shock. However, the story changes when considering the interaction between the size dummies and the liquidity shock faced by banks (columns 6 and 7), for which the estimated coefficient becomes significant and seems to capture most of the change observed on lending to each firm. This effect is unsurprisingly dampened when introducing bank-level and firm-level controls (column 7), but it remains significant. A priori, this would indicate that indeed smaller firms observe a significant increase in the amount of credit they received after the shock.

[22] For the full sample, 21.45% of the firms receiving bank loans operate in the non-services sector of the economy. For the multi-bank sample, this number increases marginally to 25.46%, or around one fourth.

[23] The reason why we would expect the sign of this coefficient to be negative is because the interpretation is that banks that sold-off a higher amount of their government bonds (i.e. who started the shock period with a higher proportion of government bonds and finished it with a lower proportion) would be able to transform that liquidity into a higher amount of loans.

[24] In the table, this covariate is labeled as $\Delta Gov.\,Bonds$.

[25] See (Khwaja & Mian, 2008), where they show that $\hat{\beta}_1^{OLS} = \beta_1 + \frac{Cov(\Delta D_i, \eta_j)}{Var(\Delta D_i)}$. In words, this means that banks that experience a higher decline in their holdings of government bonds, as proportion of their total assets, tend to lend to firms that either demand less credit or do not face credit rationing.

4.1.2 Services

The results for the regressions using only firms operating in the retail and services sector of the economy are presented in Table 6.1. They show a similar story to the baseline case, both in qualitative and quantitative terms. The main departure from the previous case is that the difference between the FE and the OLS estimators would suggest that the correlation between the banks' exposure to the liquidity shock (i.e. the change in their holdings of government bonds) and the firms' unobserved demand component would seem to be positive. Also, as in the baseline case, for the full sample of firms, the OLS estimator of the interaction between the change in the liquidity of banks and the size of the firm seems to be the most significant covariate in this specification.

4.1.3 Non-Services

The results for this set of regressions are presented in Table 6.1. While, in general, the results for firms operating in the non-services sectors of the economy are similar to the previous two cases, some differences arise. First, the FE estimate of the simplest specification (column 1) is positive, albeit non-significantly. Second, the size dummy is significant in the FE estimation (column 3). However, this result should be interpreted with caution, given that the sample size is relatively small and there might be some issues arising from the fact that the firm-FE already capture similar variation from the size dummy. Finally, from looking at the OLS estimate with bank-level and firm-level controls (column 7), it would seem that the effect of firm size is more important for firms in the non-services sectors of the economy, as can be seen from the magnitude of the coefficient associated with the interaction between the size dummy and the change in bank holdings of government bonds. This estimate is larger to the one found for the baseline case, and for firms operating in the services sector of the economy. This would imply that firms in the non-services sector of the economy might face a higher amount of credit-rationing, vis-à-vis firms in the retail and services sector.

4.2 Micro Firms

This second set of regressions uses the definition of "micro firm" included in the same Competition Report previously referenced. A firm is defined as a micro firm if it qualifies as a small or medium firm (PYME) and it has a total indebtedness of less than one million UDIS. Once more, the different

specifications are run on the baseline sample, which doesn't distinguish the economic activity sector of the firm; on the sample composed of firms operating in the retail and service sector of the economy; and, finally, on the firms operating on the non-services sector of the economy. Two differences, relative to the PYME case, arise. First, when introducing the size dummy into the FE regression, the issue of collinearity emerges, and thus the coefficient measuring the response of loans to the change in banks' holdings of government bonds (i.e. the Δ Gov. Bonds variable) cannot be estimated, as it drops from the estimation. Second, for the same FE estimation, the coefficient associated with the interaction between the change in banks' holdings of government bonds and the size dummy becomes significant for both the baseline specification and for the sample composed of firms operating in the retail and services sector. Aside from this, the results do not diverge considerably from those obtained when using the PYME definition.

4.2.1 Baseline

The results are shown in Table 6.2. Attention should be focused on column 3. This corresponds to the FE specification including the regression of the log change in total loans from bank i to firm j against the change in bank i's holdings of government bonds, and this same variable interacted with the size dummy. As evidenced by the results in column 3, the change in government bonds held by bank i becomes collinear and is thus omitted from the regression, however the estimate of coefficient for that same variable interacted with the size dummy becomes significant under this specification. For the other regressions, the result look very similar to those of the first regressions previously presented.

4.2.2 Services

The results for firms operating in the services sector are shown in Table 6.2. They look very similar to the results of the regressions that do not distinguish between the sector in which the firm operates. While the point estimate is larger, in absolute value, its significance is reduced slightly. However, the results are virtually the same for firms in the services sector of the economy.

4.2.3 Non-Services

The results for firms in the non-services sectors of the economy are shown in Table 6.2. Apart from the fact that the regressions omit the coefficient of the variable measuring the change in banks' holdings of government bonds, the results do not vary considerably from those found when using small and medium firms as the definition of small firms.

4.3 Level of Indebtedness

The final definition of small firm is exclusively established by its total level of indebtedness. This definition is more in line with the original work of (Khwaja & Mian, 2008). A firm will be considered small if its total pre-shock level of indebtedness is below one million UDIS. This definition is closely related to the definition of "micro firms" described above, by construction. However, it could be argued that it is marginally broader, and therefore worth exploring. Despite this, its close relationship to the definition of micro firms makes the results from this definition of small firms very similar to the former.

4.3.1 Baseline

The results for the baseline case are reported in Table 6.3. These results do not differ substantially from those obtained by using the definition of micro firms. On column 3, it is possible to see that the change in the holdings of government bonds by bank i is also omitted due to collinearity. The regressions also seem to indicate that the interaction between this former variable and the size dummy is significant.

4.3.2 Services

Table 6.3 shows the results from running the same specifications on the sample of firms operating only in the service sector of the economy. Once again, the results are virtually identical to the ones found when defining a firm as "small" when it satisfies the definition of a micro firm.

4.3.3 Non-Services

The results for firms operating in the non-services sector are reported in Table 6.3. Similarly to the results found for micro firms, and small and medium firms, none of the FE specification are significant.

5 Concluding Remarks

Using the inclusion of Mexican Government Bonds to Citibank's World Government Bonds Index (WGBI) as a positive liquidity shock [26], I use the methodology introduced by (Khwaja & Mian, 2008) to measure the response of bank lending to this liquidity shock. This methodology attempts to find the response of bank lending by observing the change in total lending from bank i to firm j after the shock. The estimation is done first, using a fixed-effects (FE) approach in order to obtain an unbiased estimate of the parameter that measures the response of bank lending to the bank's exposure to the shock. This FE approach is carried out considering a multi-bank sample of firms (i.e. firms that receive loans from at least two banks). The methodology also considers OLS regressions using the entire sample of firms, while adding firm-level and bank-level controls.

This methodology, along with the R04 database that I use in this paper, has already been implemented by other works for the case of Mexico. In particular, I use the same shock introduced by (Levin-Konigsberg et al., 2017), in which the authors perform a highly similar exercise. However, my approach departs from previous works in two aspects. First, I include as firm-level controls the size of the firm. To this purpose, I use various definitions of what constitutes a small firm; among which, two of them come from the Competition Report on the Provision of Credit to Small and Medium Firms, written by the DGASF at Banco de México; and a third one, which is based solely on the pre-shock level of indebtedness of the firm. Second, I run the econometric specifications for the total sample of available firms, and I subsequently partition this sample into firms operating in the retail and services sector of the economy, and firms in the non-services sector of the economy. I then repeat the original econometric specifications for both sub-samples.

While the FE estimations are non-significant, in general, for most of the regressions the coefficient

[26] The reason why this event can be interpreted as a positive liquidity shock is that this event would, in principle, increase the demand for this type of assets.

associated with the change in bank holdings of government bonds is negative, as would be expected. Furthermore, this coefficient is significant for several of the OLS specifications. Indicating that there was indeed a response from banks to this liquidity shock, and that the response is in accordance to what theory would imply, even though the response might not have been enough. Additionally, the size dummies, when interacted with the change in holdings of government bonds by each bank, also produce significant results in many of the specifications. Moreover, when it's significant, it tends to reduce the magnitude of the estimate of the coefficient associated with banks' exposure to the shock [27]. This would suggest that credit to smaller firms reacted more intensely, relative to larger firms. Put different, this evidence could be the result of smaller firms being more credit-rationed, or not receiving as much credit as they would like to, previous to the liquidity shock.

The above hypothesis, however, cannot be comprehensively tested out with the available information. In an ideal setting, it would be desirable to have access to information about whether or not a firm who applied for a loan with a particular bank received it [28] Given that this information is not yet available on the R04C database, – and less so in the previous version, which is the one used for this paper – it is not possible to rule out alternative explanations for these findings. Additionally, and given that the results are not uniform, this evidence is not incontrovertible. Furthermore, the choice of the liquidity shock might be subject to debate on itself. Given that the increase in demand for Mexican Government bonds might have increased since the announcement was made. Also, there is no guarantee that the additional liquidity from the sale of government bonds by banks was used to increase the amount of loans that banks offered. It could be the case that banks decided to invest primarily in other types of assets. Finally, looking at the evolution of the ratio of government bonds to total assets across the system, we see that since the middle of 2009, there seems to be a general downward trend in this ratio, which reverses into a positive trend at the middle of 2011. This means that this change in the ratio of government bonds to total assets might not be an exogenous shock, but could be responding to other aggregate trends in the economy that could, in principle, also be affecting the demand for credit.

Finally, and in terms of future research, the Khwaja and Mian methodology seems to only have been used thus far to test the response of bank lending to firms at the *intensive margin* [29], however

[27] i.e. The coefficient associated to the change in holdings of government bonds as proportion of total bank assets.
[28] See (Jiménez et al., 2012).
[29] i.e. changes in bank lending to the same firms.

no analysis on the effects of its response at the *extensive margin* [30] have been done, to my knowledge. Doing so, would require to use an alternative database, such as the *Buró de Crédito*. The former should be done having in mind the caveat of the *Buró* not representing a full account of the totality of credits given by all Mexican financial institutions to private firms, but only a snapshot of the total volume of credit supplied to private firms in the last seven years at any given point in time.

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[30] i.e. changes across firms and different types of lending.

6 Appendix – Tables

6.1 Small (PYME) Firms

Table 3: Small Firm – Baseline

Dependent variable: Δ log Loan size							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	FE	FE, bank controls	FE	OLS, multi	OLS, full	OLS, size	OLS, bank controls
Δ Gov. Bonds	-0.166	-0.214	-0.106	-0.180*	-0.252	-0.0169	-0.130
	(0.275)	(0.309)	(0.258)	(0.0806)	(0.158)	(0.0143)	(0.0842)
Bank ROA		72.39*					36.64*
		(30.32)					(16.14)
log(Bank Size)		0.0208					0.0318
		(0.0911)					(0.0266)
Capital Ratio		-0.00945					-0.00132
		(0.0593)					(0.0193)
Delinq. Ratio.		-4.611					1.798
		(9.243)					(2.583)
Deposits/Liabilities		-0.828					-0.290
		(0.700)					(0.413)
Δ Gov. Bonds×Size			-0.0875			-0.500***	-0.340***
			(0.251)			(0.0706)	(0.0535)
Size Dummy			-0.457			0.000944	-0.0271
			(0.672)			(0.0387)	(0.0348)
Constant	1.388***	1.212	1.778**	1.388***	1.400***	1.416***	1.138
	(0.0505)	(2.878)	(0.589)	(0.0346)	(0.0457)	(0.0250)	(0.861)
N	868	867	868	868	244,650	244,650	244,581
R^2	0.678	0.691	0.680	0.003	0.007	0.015	0.023

Standard errors in parentheses. "*"=p <0.05 "**"= p <0.01 "***"= p < 0.001

The first column is a regression of the log change in total loans from bank i to firm j, against percent change in the holding of banks' government bonds (with firm-fixed-effects). The second column adds bank controls to this specification, while the third column adds size dummies. The fourth column runs the same specification as column one, but using OLS instead of FE on the sample of multi-relationship firms. The fifth column does the same on the full sample of firms. Column 6 and 7 also use the full sample of firms. In column 6 I add the size dummies; whereas in column 7 I add the bank-level and firm-level controls. For the latter, I include a dummy for each one of the 32 states where the firm might be located, dummies for whether or not the firm has multiple bank relationships, and dummies for whether the firm is a government-firm or private-firm. The total sample of firms is those firms with outstanding and active loans before and after the shock period (i.e. 2010Q4). Standard errors are clustered at the bank level. The firm size dummy takes a value of one if the firm satisfies the definition for a small or medium firm (PYME) found on the "Competition report on the provision of credit to small and medium firms".

Table 4: Small Firm – Services

Dependent variable: Δ log Loan size							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	FE	FE, bank controls	FE	OLS, multi	OLS, full	OLS, size	OLS, bank controls
Δ Gov. Bonds	-0.265	0.00743	-0.108	-0.240	-0.242	-0.0171	-0.211*
	(0.394)	(0.862)	(0.916)	(0.146)	(0.162)	(0.0146)	(0.0886)
Bank ROA		80.34					34.19*
		(57.43)					(15.53)
log(Bank Size)		0.00332					0.0451
		(0.164)					(0.0287)
Capital Ratio		-0.0246					0.00897
		(0.124)					(0.0214)
Delinq. Ratio		-12.62					2.742
		(20.80)					(2.767)
Deposits/Liabilities		-1.681					-0.324
		(1.476)					(0.428)
Δ Gov. Bonds×Size			-0.191			-0.512***	-0.287***
			(0.854)			(0.0629)	(0.0424)
Size Dummy			-0.0340			-0.00907	-0.0607
			(0.898)			(0.0402)	(0.0309)
Constant	-0.125	0.691	-0.0952	-0.125*	-0.132*	-0.101*	-0.795
	(0.0699)	(5.663)	(0.814)	(0.0439)	(0.0496)	(0.0376)	(0.913)
N	642	641	642	642	191996	191996	191968
R^2	0.780	0.801	0.780	0.005	0.008	0.017	0.026

Standard errors in parentheses. "*"=p <0.05 "**"= p <0.01 "***"= p < 0.001

The first column is a regression of the log change in total loans from bank i to firm j, against percent change in the holding of banks' government bonds (with firm-fixed-effects). The second column adds bank controls to this specification, while the third column adds size dummies. The fourth column runs the same specification as column one, but using OLS instead of FE on the sample of multi-relationship firms. The fifth column does the same on the full sample of firms. Column 6 and 7 also use the full sample of firms. In column 6 I add the size dummies; whereas in column 7 I add the bank-level and firm-level controls. For the latter, I include a dummy for each one of the 32 states where the firm might be located, dummies for whether or not the firm has multiple bank relationships, and dummies for whether the firm is a government-firm or private-firm. The total sample of firms is those firms with outstanding and active loans before and after the shock period (i.e. 2010Q4). Standard errors are clustered at the bank level. The firm size dummy takes a value of one if the firm satisfies the definition for a small or medium firm (PYME) found on the "Competition report on the provision of credit to small and medium firms".

Table 5: Small Firm – Non-Services

Dependent variable:	Δ log Loan size						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	FE	FE, bank controls	FE	OLS, multi	OLS, full	OLS, size	OLS, bank controls
Δ Gov. Bonds	0.0416	-0.694	-0.872	-0.0473	-0.346**	-0.0196	0.0114
	(2.369)	(1.607)	(3.302)	(0.242)	(0.112)	(0.0547)	(0.0782)
Bank ROA		105.2					37.18
		(327.8)					(18.52)
log(Bank Size)		-0.358					0.00495
		(0.496)					(0.0230)
Capital Ratio		0.420					-0.0172
		(0.350)					(0.0160)
Delinq. Ratio		-55.18					0.297
		(43.52)					(2.369)
Deposits/Liabilities		3.639					-0.237
		(7.362)					(0.355)
Δ Gov. Bonds×Size			1.569			-0.398***	-0.411***
			(3.463)			(0.103)	(0.1000)
Size Dummy			-4.802***			0.0153	0.0196
			(0.289)			(0.0460)	(0.0450)
Constant	-0.172	-0.0551	3.797***	-0.173*	-0.114**	-0.128***	0.449
	(0.123)	(10.26)	(0.212)	(0.0674)	(0.0330)	(0.0170)	(1.036)
N	223	223	223	223	52,392	52,392	52,351
R^2	0.828	0.901	0.878	0.000	0.005	0.006	0.011

Standard errors in parentheses. "*"=p <0.05 "**"= p <0.01 "***"= p < 0.001

The first column is a regression of the log change in total loans from bank i to firm j, against percent change in the holding of banks' government bonds (with firm-fixed-effects). The second column adds bank controls to this specification, while the third column adds size dummies. The fourth column runs the same specification as column one, but using OLS instead of FE on the sample of multi-relationship firms. The fifth column does the same on the full sample of firms. Column 6 and 7 also use the full sample of firms. In column 6 I add the size dummies; whereas in column 7 I add the bank-level and firm-level controls. For the latter, I include a dummy for each one of the 32 states where the firm might be located, dummies for whether or not the firm has multiple bank relationships, and dummies for whether the firm is a government-firm or private-firm. The total sample of firms is those firms with outstanding and active loans before and after the shock period (i.e. 2010Q4). Standard errors are clustered at the bank level. The firm size dummy takes a value of one if the firm satisfies the definition for a small or medium firm (PYME) found on the "Competition report on the provision of credit to small and medium firms".

6.2 Micro Firms

Table 6: Micro Firm – Baseline

Dependent variable: Δ log Loan size							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	FE	FE, bank controls	FE	OLS, multi	OLS, full	OLS, size	OLS, bank controls
Δ Gov. Bonds	-0.166	-0.214	0	-0.180*	-0.252	-0.00332	0.0404
	(0.275)	(0.309)	(.)	(0.0806)	(0.158)	(0.00365)	(0.0916)
Bank ROA		72.39*					35.97*
		(30.32)					(15.94)
log(Bank Size)		0.0208					0.0303
		(0.0911)					(0.0273)
Capital Ratio		-0.00945					0.00225
		(0.0593)					(0.0200)
Delinq. Ratio		-4.611					2.067
		(9.243)					(2.601)
Deposits/Liabilities		-0.828					-0.328
		(0.700)					(0.409)
Δ Gov. Bonds×Size			-0.417***			-0.511***	-0.522***
			(0.103)			(0.0668)	(0.102)
Size Dummy			-0.0530			0.0530	0.0486
			(0.0572)			(0.0451)	(0.0471)
Constant	1.388***	1.212	1.433***	1.388***	1.400***	1.368***	1.084
	(0.0505)	(2.878)	(0.0466)	(0.0346)	(0.0457)	(0.0166)	(0.882)
N	868	867	868	868	244,650	244,650	24,4581
R^2	0.678	0.691	0.033	0.003	0.007	0.015	0.023

Standard errors in parentheses. "*"=p <0.05 "**"= p <0.01 "***"= $p < 0.001$

The first column is a regression of the log change in total loans from bank i to firm j, against percent change in the holding of banks' government bonds (with firm-fixed-effects). The second column adds bank controls to this specification, while the third column adds size dummies. The fourth column runs the same specification as column one, but using OLS instead of FE on the sample of multi-relationship firms. The fifth column does the same on the full sample of firms. Column 6 and 7 also use the full sample of firms. In column 6 I add the size dummies; whereas in column 7 I add the bank-level and firm-level controls. For the latter, I include a dummy for each one of the 32 states where the firm might be located, dummies for whether or not the firm has multiple bank relationships, and dummies for whether the firm is a government-firm or private-firm. The total sample of firms is those firms with outstanding and active loans before and after the shock period (i.e. 2010Q4). Standard errors are clustered at the bank level. The firm size dummy takes a value of one if the firm satisfies the definition for a micro firm found on the "Competition report on the provision of credit to small and medium firms".

Table 7: Micro Firm – Services

Dependent variable: Δ log Loan size							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	FE	FE, bank controls	FE	OLS, multi	OLS, full	OLS, size	OLS, bank controls
Δ Gov. Bonds	-0.265	0.00743	0	-0.240	-0.242	-0.0152	-0.158
	(0.394)	(0.862)	(.)	(0.146)	(0.162)	(0.0124)	(0.0903)
Bank ROA		80.34					33.39*
		(57.43)					(15.40)
log(Bank Size)		0.00332					0.0457
		(0.164)					(0.0292)
Capital Ratio		-0.0246					0.0113
		(0.124)					(0.0216)
Delinq. Ratio		-12.62					2.822
		(20.80)					(2.776)
Deposits/Liabilities		-1.681					-0.331
		(1.476)					(0.425)
Δ Gov. Bonds×Size			-0.585**			-0.525***	-0.360***
			(0.170)			(0.0617)	(0.0606)
Size Dummy			-0.0802			0.0125	-0.0336
			(0.0701)			(0.0378)	(0.0341)
Constant	-0.125	0.691	-0.0559	-0.125*	-0.132*	-0.121***	-0.853
	(0.0699)	(5.663)	(0.0568)	(0.0439)	(0.0496)	(0.0271)	(0.927)
N	642	641	642	642	191996	191996	191968
R^2	0.780	0.801	0.049	0.005	0.008	0.017	0.027

Standard errors in parentheses. "*"=p <0.05 "**"= p <0.01 "***"= p < 0.001

The first column is a regression of the log change in total loans from bank i to firm j, against percent change in the holding of banks' government bonds (with firm-fixed-effects). The second column adds bank controls to this specification, while the third column adds size dummies. The fourth column runs the same specification as column one, but using OLS instead of FE on the sample of multi-relationship firms. The fifth column does the same on the full sample of firms. Column 6 and 7 also use the full sample of firms. In column 6 I add the size dummies; whereas in column 7 I add the bank-level and firm-level controls. For the latter, I include a dummy for each one of the 32 states where the firm might be located, dummies for whether or not the firm has multiple bank relationships, and dummies for whether the firm is a government-firm or private-firm. The total sample of firms is those firms with outstanding and active loans before and after the shock period (i.e. 2010Q4). Standard errors are clustered at the bank level. The firm size dummy takes a value of one if the firm satisfies the definition for a micro firm found on the "Competition report on the provision of credit to small and medium firms".

Table 8: Micro Firm – Non-Services

Dependent variable: Δ log Loan size							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	FE	FE, bank controls	FE	OLS, multi	OLS, full	OLS, size	OLS, bank controls
Δ Gov. Bonds	0.0416	-0.694	0	-0.0473	-0.346**	0.00922	0.0342
	(2.369)	(1.607)	(.)	(0.242)	(0.112)	(0.0464)	(0.0753)
Bank ROA		105.2					37.19
		(327.8)					(18.57)
log(Bank Size)		-0.358					0.00498
		(0.496)					(0.0231)
Capital Ratio		0.420					-0.0158
		(0.350)					(0.0161)
Delinq. Ratio		-55.18					0.398
		(43.52)					(2.340)
Deposits/Liabilities		3.639					-0.249
		(7.362)					(0.346)
Δ Gov. Bonds×Size			-0.0219			-0.464***	-0.472***
			(0.185)			(0.111)	(0.105)
Size Dummy			-0.294			0.0287	0.0348
			(0.199)			(0.0460)	(0.0458)
Constant	-0.172	-0.0551	0.0512	-0.173*	-0.114**	-0.140***	0.424
	(0.123)	(10.26)	(0.149)	(0.0674)	(0.0330)	(0.0167)	(1.026)
N	223	223	223	223	52392	52392	52351
R^2	0.828	0.901	0.091	0.000	0.005	0.006	0.011

Standard errors in parentheses. "*"=p <0.05 "**"= p <0.01 "***"= p < 0.001

The first column is a regression of the log change in total loans from bank i to firm j, against percent change in the holding of banks' government bonds (with firm-fixed-effects). The second column adds bank controls to this specification, while the third column adds size dummies. The fourth column runs the same specification as column one, but using OLS instead of FE on the sample of multi-relationship firms. The fifth column does the same on the full sample of firms. Column 6 and 7 also use the full sample of firms. In column 6 I add the size dummies; whereas in column 7 I add the bank-level and firm-level controls. For the latter, I include a dummy for each one of the 32 states where the firm might be located, dummies for whether or not the firm has multiple bank relationships, and dummies for whether the firm is a government-firm or private-firm. The total sample of firms is those firms with outstanding and active loans before and after the shock period (i.e. 2010Q4). Standard errors are clustered at the bank level. The firm size dummy takes a value of one if the firm satisfies the definition for a micro firm found on the "Competition report on the provision of credit to small and medium firms".

6.3 Level of Indebtedness

Table 9: Level of Indebtedness – Baseline

Dependent variable: Δ log Loan size							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	FE	FE, bank controls	FE	OLS, multi	OLS, full	OLS, size	OLS, bank controls
Δ Gov. Bonds	-0.166	-0.214	0	-0.180*	-0.252	-0.00481*	0.0331
	(0.275)	(0.309)	(.)	(0.0806)	(0.158)	(0.00224)	(0.0950)
Bank ROA		72.39*					36.71*
		(30.32)					(16.13)
log(Bank Size)		0.0208					0.0304
		(0.0911)					(0.0267)
Capital Ratio		-0.00945					-0.000606
		(0.0593)					(0.0194)
Delinq. Ratio		-4.611					1.924
		(9.243)					(2.587)
Deposits/Liabilities		-0.828					-0.308
		(0.700)					(0.415)
Δ Gov. Bonds×Size			-0.248**			-0.494***	-0.489***
			(0.0855)			(0.0694)	(0.0926)
Size Dummy			-0.130			0.0632	0.0734
			(0.0625)			(0.0525)	(0.0539)
Constant	1.388***	1.212	1.504***	1.388***	1.400***	1.356***	1.109
	(0.0505)	(2.878)	(0.0560)	(0.0346)	(0.0457)	(0.0210)	(0.865)
N	868	867	868	868	244,650	244,650	244,581
R^2	0.678	0.691	0.032	0.003	0.007	0.014	0.022

Standard errors in parentheses. "*"=p <0.05 "**"= p <0.01 "***"= p < 0.001

The first column is a regression of the log change in total loans from bank i to firm j, against percent change in the holding of banks' government bonds (with firm-fixed-effects). The second column adds bank controls to this specification, while the third column adds size dummies. The fourth column runs the same specification as column one, but using OLS instead of FE on the sample of multi-relationship firms. The fifth column does the same on the full sample of firms. Column 6 and 7 also use the full sample of firms. In column 6 I add the size dummies; whereas in column 7 I add the bank-level and firm-level controls. For the latter, I include a dummy for each one of the 32 states where the firm might be located, dummies for whether or not the firm has multiple bank relationships, and dummies for whether the firm is a government-firm or private-firm. The total sample of firms is those firms with outstanding and active loans before and after the shock period (i.e. 2010Q4). Standard errors are clustered at the bank level. The firm size dummy takes a value of one if the firm has a total indebtedness level of less than 1m UDIS.

Table 10: Level of Indebtedness – Services

Dependent variable: Δ log Loan size							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	FE	FE, bank controls	FE	OLS, multi	OLS, full	OLS, size	OLS, bank controls
Δ Gov. Bonds	-0.265	0.00743	0	-0.240	-0.242	-0.00537*	-0.00958
	(0.394)	(0.862)	(.)	(0.146)	(0.162)	(0.00205)	(0.0938)
Bank ROA		80.34					33.35*
		(57.43)					(15.37)
log(Bank Size)		0.00332					0.0440
		(0.164)					(0.0296)
Capital Ratio		-0.0246					0.0124
		(0.124)					(0.0222)
Delinq. Ratio		-12.62					3.015
		(20.80)					(2.800)
Deposits/Liabilities		-1.681					-0.357
		(1.476)					(0.425)
Δ Gov. Bonds×Size			-0.586*			-0.515***	-0.497***
			(0.266)			(0.0591)	(0.101)
Size Dummy			-0.0675			0.0462	0.0270
			(0.0719)			(0.0409)	(0.0422)
Constant	-0.125	0.691	-0.0631	-0.125*	-0.132*	-0.153***	-0.863
	(0.0699)	(5.663)	(0.0611)	(0.0439)	(0.0496)	(0.0172)	(0.938)
R^2	0.780	0.801	0.048	0.005	0.008	0.017	0.026

Standard errors in parentheses. "*"=p <0.05 "**"= p <0.01 "***"= $p < 0.001$

The first column is a regression of the log change in total loans from bank i to firm j, against percent change in the holding of banks' government bonds (with firm-fixed-effects). The second column adds bank controls to this specification, while the third column adds size dummies. The fourth column runs the same specification as column one, but using OLS instead of FE on the sample of multi-relationship firms. The fifth column does the same on the full sample of firms. Column 6 and 7 also use the full sample of firms. In column 6 I add the size dummies; whereas in column 7 I add the bank-level and firm-level controls. For the latter, I include a dummy for each one of the 32 states where the firm might be located, dummies for whether or not the firm has multiple bank relationships, and dummies for whether the firm is a government-firm or private-firm. The total sample of firms is those firms with outstanding and active loans before and after the shock period (i.e. 2010Q4). Standard errors are clustered at the bank level. The firm size dummy takes a value of one if the firm has a total indebtedness level of less than 1m UDIS.

Table 11: Level of Indebtedness – Non-Services

Dependent variable: Δ log Loan size							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	FE	FE, bank controls	FE	OLS, multi	OLS, full	OLS, size	OLS, bank controls
Δ Gov. Bonds	0.0416	-0.694	0	-0.0473	-0.346**	0.0708*	0.0977
	(2.369)	(1.607)	(.)	(0.242)	(0.112)	(0.0307)	(0.0798)
Bank ROA		105.2					37.65
		(327.8)					(18.50)
log(Bank Size)		-0.358					0.00305
		(0.496)					(0.0233)
Capital Ratio		0.420					-0.0150
		(0.350)					(0.0160)
Delinq. Ratio		-55.18					0.456
		(43.52)					(2.325)
Deposits/Liabilities		3.639					-0.271
		(7.362)					(0.348)
Δ Gov. Bonds$\times$Size			-0.0963			-0.518***	-0.532***
			(0.181)			(0.123)	(0.121)
Size Dummy			-0.0465			0.0627	0.0741
			(0.147)			(0.0495)	(0.0497)
Constant	-0.172	-0.0551	-0.138	-0.173*	-0.114**	-0.170***	0.433
	(0.123)	(10.26)	(0.116)	(0.0674)	(0.0330)	(0.0192)	(1.024)
N	223	223	223	223	52,392	52,392	52,351
R^2	0.828	0.901	0.080	0.000	0.005	0.006	0.012

Standard errors in parentheses. "*"=$p<0.05$ "**"= $p<0.01$ "***"= $p<0.001$

The first column is a regression of the log change in total loans from bank i to firm j, against percent change in the holding of banks' government bonds (with firm-fixed-effects). The second column adds bank controls to this specification, while the third column adds size dummies. The fourth column runs the same specification as column one, but using OLS instead of FE on the sample of multi-relationship firms. The fifth column does the same on the full sample of firms. Column 6 and 7 also use the full sample of firms. In column 6 I add the size dummies; whereas in column 7 I add the bank-level and firm-level controls. For the latter, I include a dummy for each one of the 32 states where the firm might be located, dummies for whether or not the firm has multiple bank relationships, and dummies for whether the firm is a government-firm or private-firm. The total sample of firms is those firms with outstanding and active loans before and after the shock period (i.e. 2010Q4). Standard errors are clustered at the bank level. The firm size dummy takes a value of one if the firm has a total indebtedness level of less than 1m UDIS.

7 Appendix – Additional Robustness Checks

7.1 Bank-Fixed Effects

In this section, I repeat the three FE specifications, but using bank-fixed effects. Adding bank-fixed effects makes most controls (particularly bank-level controls) collinear and therefore omitted from the regressions. The only variables that remain are the change in banks' holdings of government assets, interacted with the size dummies, and the size dummies themselves. The results still show a negative estimate for the coefficient associated with a change in the holdings of government bonds by banks, and for that of the interaction of this same variable with the various size dummies. Therefore, qualitatively, the results do not change drastically. The results are shown in Table 7.1. Unlike the previous cases, which clustered the standard errors by bank, I report the robust standard errors.

	Baseline			Services			Non-Services		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	PYME	Micro	Indebtedness	PYME	Micro	Indebtedness	PYME	Micro	Indebtedness
Δ Gov. Bonds×Size	-0.187	-0.248	-0.417	-0.297	-0.586	-0.585*	-0.0531	-0.0963	-0.0219
	(0.209)	(0.245)	(0.226)	-0.288	-0.324	-0.284	(0.348)	(0.330)	(0.340)
Dummy *Small*	-0.179*			-0.115			-0.313		
	(0.0812)			-0.0874			(0.191)		
Dummy *Indebtedness*		-0.130			-0.0675			-0.0465	
		(0.0862)			-0.0935			(0.138)	
Dummy *Micro*			-0.0530			-0.0802			-0.294
			(0.0757)			-0.0844			(0.160)
Constant	1.540***	1.504***	1.433***	-0.0259	-0.0631	-0.0559	0.0853	-0.138	0.0512
	(0.0742)	(0.0794)	(0.0660)	-0.0771	-0.0811	-0.0711	(0.178)	(0.120)	(0.144)
N	868	868	868	642	642	642	223	223	223
R^2	0.034	0.032	0.033	0.046	0.048	0.049	0.090	0.080	0.091

7.2 Marginal Credits

This robustness check repeats the baseline analysis for the transmission of liquidity shock, but focuses entirely on *marginal* credits. In other words, I drop all credits that were not originated on the same period as the report period.

The table is reported in a condensed manner. There are four categories, namely: "Fixed Effects (FE)", which contains the main FE regressions with and without bank controls, and with each of the Size Dummies [31]; these include columns (1) to (5). "OLS Multi", which contains the baseline regression (without controls) for the multi-relationship sample; this category includes only column (6). Next, "OLS Full" contains the regressions without bank controls for the full sample, meaning all firms, regardless of the number of bank relationships they hold, and adds one by one the different size dummies; this category includes columns (7) to (10). Finally, "OLS Full with bank controls" adds bank controls to the previous specifications, including the size dummies.

There is virtually no change for the "Fixed Effects" and the "OLS Multi" specifications, if anything, there seems to be a loss of significance. In the third category ("OLS Full") There is a change of sign in the coefficient for the interaction term between the size dummy and the change in the holdings of government bonds by Mexican banks. This is problematic because the coefficients seem to be significant. Something similar happens for the fourth category, which adds bank controls to the former specification. If we interpret these coefficients as true, it would mean that banks that experienced a higher increase in liquidity due to the sale of Mexican Government bonds, also did not increased their credit to smaller firms as much, relative to larger firms. This would contradict the main story that emerges from the baseline results. However, there are large potential biases in the OLS specification, so this interpretation should be take with caution.

[31] Small Firm, Micro Firm, Firm with Low Level of Indebtedness, in that order.

			FE			OLS Multi		OLS Full			OLS Full with bank controls		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
shock	-0.945	-1.569	1.393	0	0	-0.291	-0.260	-0.0193	-0.00854	-0.00330	0.0426	0.129	0.172
	(2.160)	(2.850)	(1.429)	(.)	(.)	(0.358)	(0.214)	(0.0296)	(0.0337)	(0.0280)	(0.183)	(0.195)	(0.211)
Bank ROA		76.78									147.0***	147.4***	148.9***
		(294.4)									(12.29)	(12.49)	(12.86)
log (Size)		0.0917									0.0673	0.0620	0.0572
		(0.998)									(0.0393)	(0.0397)	(0.0406)
icap		0.0593									-0.0465	-0.0463	-0.0468
		(0.405)									(0.0252)	(0.0251)	(0.0257)
delinq		-13.02									21.97***	21.54***	21.34***
		(57.66)									(4.764)	(4.778)	(4.821)
proxliq		-1.347									-1.426**	-1.448**	-1.481**
		(4.763)									(0.408)	(0.404)	(0.405)
int_shock			-2.187	0.0495	0.394			-0.585	-0.632	-0.604	-0.230	-0.360*	-0.381
			(2.142)	(1.572)	(1.308)			(0.355)	(0.362)	(0.345)	(0.136)	(0.164)	(0.188)
Size Dummy			2.998	0.484	0.477			0.348**	0.376**	0.432**	0.112	0.155*	0.230**
			(2.041)	(0.306)	(0.283)			(0.107)	(0.113)	(0.131)	(0.0604)	(0.0622)	(0.0687)
_cons	0.390**	-1.992	-2.056	0.0278	0.0223	0.385	0.470*	0.144	0.127	0.0703	-0.790	-0.690	-0.647
	(0.123)	(27.87)	(1.748)	(0.224)	(0.215)	(0.204)	(0.180)	(0.0851)	(0.0827)	(0.0703)	(0.971)	(1.000)	(1.029)
N	207	207	207	207	207	207	120017	120017	120017	120017	119968	119968	119968
R^2	0.699	0.726	0.729	0.208	0.207	0.003	0.002	0.007	0.009	0.009	0.054	0.054	0.055
Standard errors in parentheses													
="* p<0.05	** p<0.01	*** p<0.001"											