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Do Credit Supply Shocks Affect Employment in Middle-Income Countries?

BY EMILIO GUTIERREZ, DAVID JAUME AND MARTÍN TOBAL*

Abstract

This paper studies the extent to which increases in bank credit supply available for small and medium firms can foster formal employment in Mexico. We use a detailed dataset containing loan-level information for all loans extended by commercial banks to private firms in Mexico during the 2010-2016 period, when the economy was relatively stable. To obtain exogenous variation in credit supply, we exploit differences in the regional presence of Mexican banks across local labor markets by combining pre-existing market shares with national-level changes in banks' credit supply, after accounting for local credit demand shocks. Then, we use employment registry data to compare changes in the number of formal workers registered by small and medium firms in local labor markets differently exposed to these shocks. We find that credit supply shocks have a large impact on formal employment: a positive credit shock of one standard deviation increases yearly employment growth by 0.45 percentage points (13 percent of the mean). Our results differ from the null to small effects identified by previous literature for developed countries, suggesting that credit supply shocks play a more prominent role for employment creation (and destruction) in low and middle-income countries.

JEL Codes: D22, D53, G01, G1, G21, J01, J23

KEYWORDS: Credit supply shocks, local labor market, formal employment.

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I. Introduction

Small and medium-sized firms (SMEs) have been a subject of great interest to both scholars and policymakers, as these enterprises play a critical role in the provision of employment around the globe (Ayyagari et al., 2011). However, the ability of SMEs to create jobs is hampered by their limited access to adequate finance, particularly in low and middle-income economies (LMIEs) in which credit constraints are significantly more severe than in advanced economies (AEs) (Beck at al. 2008; Ayyagari et al., 2011; Stein et al. 2013). Having lower saving rates, weaker investor protection, underdeveloped credit bureaus and less competitive banking environments, LMIEs have credit markets that are of a smaller size and less efficient in dealing with informational asymmetries (La Porta et al, 1997; Djankov et al, 2007; Calomiris et al, 2017). Thus, SMEs in these countries face higher interest rates, larger credit constraints and higher costs of switching across banks, implying that they are also more likely to benefit from positive credit supply shocks. Hence, using a similar empirical strategy as Greenstone et al (2019) for the case of the US, this paper studies the impact of bank-specific credit shocks on employment in a LMIE, Mexico.

The relationship between credit growth and aggregate economic outcomes has been well-documented in the macro literature, in which it has been shown that these variables tend to co-move for both AEs (Apostoaie et al., 2014; Azariadis, 2018) and LMIEs (García-Escribano and Han, 2015). However, identifying a causal link between credit and these outcomes is a difficult empirical task, for obvious concerns of omitted variables and reverse causality. Partially as a result of this difficulty, there has been traditionally a lack of empirical work credibly examining the effect of exogenous credit supply on real outcomes, and how this relationship varies for countries in different stages of economic development.

More recently, the increasing availability of detailed data on credit (at the firm or loan level) has spurred a surge of papers that construct credibly exogenous measures of credit supply shocks to study its impact on employment (Greenstone et al, 2019; Chodorow-Reich, 2014) and other real outcomes such as investment and exports (Fraisse, 2019; Amiti and Weinstein, 2018; Berton et al, 2018; Chodorow-Reich and Falato, 2017).[1] However, most of this literature focuses on the United States or other advance nations, for which these datasets are available. As noted above, credit

[1] See Guler et al (2019) for a review of the literature on the real effects of bank credit supply shocks using microdata.

supply shocks could have larger employment impacts in LMIEs, as firms in these countries are more likely to be credit constrained; indeed, our empirical results suggest that this is the case.

This paper contributes to this literature by measuring the causal relationship between credit supply shocks to small and medium firms (less than 250 employees) and changes in employment in the Mexican context. We exploit an extraordinarily detailed dataset containing loan-level information for the universe of loans extended by commercial banks to private firms in Mexico, together with publicly available information on the total number of employees reporting formal wages to the Mexican Social Security Institute. Our analysis focusses on the period 2010-2016, when the Mexican economy was relatively stable and credit availability to firms increased. To our knowledge, this is the first paper studying the effect of credit supply shocks on formal employment of small and medium firms in a developing country, and one of the few papers studying the relevance of credit supply shocks during normal times.[3]

We exploit differences in pre-existing bank market shares across Mexican labor markets, along with variation over time in total lending from each bank to empirically assess the causal link between credit shocks and changes in employment. In particular, we follow Greenstone et al. (2019) constructing our explanatory variable by first estimating changes in lending from each bank that cannot be explained by changes in credit demand across labor markets, and then calculating labor market-level weighted averages of these credit shocks, using the market share of each bank in each labor market as weights.[4] We conduct a series of checks that suggest that these shocks are likely exogenous to local market conditions. In essence, our empirical strategy asks whether labor

[3] In a related paper, Morais et al. (2019) estimate the employment effects of foreign monetary policy shocks affecting banks in Mexico linked to European and U.S. banks. They find that firms more exposed to increases in foreign interest rates had a small decline in employment levels, for a sample of relatively large Mexican firms, and acknowledged that this may be a lower bound estimate given that the effect is expected to be larger for small firms that are not well represented in their sample. Their analysis complements ours because it is focused on external monetary policy shocks on relatively large firms, while we analyze the effect of regional credit supply shocks on small and medium firms. A recent paper by Acosta and Cortés (2020), exploits the same dataset as ours to estimate the relationship between credit and employment. The main difference between our study and Acosta and Cortés (2020) is that they use re-payment of bank loans by local governments as the source of variation in credit supply at the local level. Aside from potential concerns regarding whether their instrument satisfied the exclusion restriction, we believe that our paper complements theirs by allowing to better explore the differences in the impact of credit on employment between Mexico and the USA, as our measures of credit supply shocks are constructed in the same manner as in Greenstone et al (2019), which finds no effects on employment during normal times in the US.

[4] The construction of shift-share measures of this kind and their defense as a source of arguably exogenous variation in a regressor of interest were first proposed by Bartik (1991) and have been exploited in a variety of settings. For instance, Aizer (2010) explores the impact of gender wage gaps on domestic violence; Autor et al (2013) and Dell et al.(2019) measure the impact of Chinese competition on US labor market outcomes and Mexico's homicide rates, respectively; Card (1990) estimates the elasticity of substitution between native and migrant labor; Gutierrez and Teshima (2018) measure the impact of import competition on firm-level environmental outcomes.

markets with banks that have higher idiosyncratic increase in firm credit availability also experience a larger change in employment outcomes.

We show that, for the Mexican context, credit supply shocks have a large and significant impact on formal employment of SMEs. Specifically, we find that in a labor market with a positive credit shock of one standard deviation, yearly employment increases 0.45 percentage points faster than in another labor markets with no shocks (13 percent of the mean yearly employment change in our sample). Moreover, we find that the changes in employment are larger in the upper half of the wage distribution, consistent with small formal firms facing important credit constraints that prevent them from acquiring inputs that are complements of high-skilled labor.

Although our estimated credit supply shocks are arguably exogenous from other factors that could alter local labor supply and local labor demand, we provide two related robustness exercises. First, we add time trends interacted with demographic variables to our specification to allow for differential time trends in each labor market depending on demographic characteristics of its population (education, age, access to basic services, etc.). Second, we add controls for local labor demand shocks to test if the credit supply shocks are related to the industry composition of local labor markets.[5] We show that our results are robust to these exercises.

Our results contrast with the moderate to null employment effects of recent papers that focus on the relationship between credit and employment in developed economies during normal times.[6] In the specific case of Greenstone et al. (2019), in which our empirical methodology is based, credit supply shocks in the United States have no effect on employment at small firms during the years prior to the 2009 recession, despite the fact that credit supply was growing rapidly. We explore potential economic and methodological reasons for this discrepancy: the institutional context of a

[5] There is a concern that banks and local labor markets may be concentrated in certain industries, thus the relative importance of each bank in a region may not be exogenous. However, endogeneity of the bank shares can be problematic if identification is based on a cross-section regression comparing changes in treated and untreated units with different baseline shares (Goldsmith-Pinkham et al., 2019). In our case with multiple time periods, the exogeneity of the shocks provide identification even when bank shares are endogenous because the addition of unit fixed effects control for these baseline differences (Borusyak et al., 2018). See section IV.d for further discussion.

[6] Many recent papers use firm level data from developed countries to study the relationship between employment and credit supply either during the 2009 financial crises or abrupt negative financial shocks, and find evidence of moderate negative effects on employment during these periods (Barbosa et al., 2019; Bentonilla et al, 2017; Berton et al., 2018; Boeri et al., 2013; Caggese et al., 2019; Chodorow-Reich, 2014; Giannetti and Simonov, 2013; Hochfellner et al., 2015; Huber, 2018; Popov and Rocholl, 2018). One exception is Berg (2018), which uses a lender cut-off rule on credit score to analyze the effect of loan rejections on assets and employment of European firms during the years following to the crises. This paper finds no effect on employment in general, although there is moderate negative effect on small and illiquid firms that cannot borrow from other banks and need to hold more cash for precautionary savings motives.

developing economy, the role of informality, and the unit of analysis (administrative units vs local labor markets).

First, it is possible that credit shocks could have a larger effect on firms' local credit access in Mexico, where more than 30 percent of small firms declare to be credit constrained. We find that our credit supply shocks are strong predictors of actual changes in credit during times of economic stability. Because our shocks are estimated by aggregating bank-specific shocks at the local labor market level, this result indicates that it is hard for Mexican firms to switch from one bank to another. These switching costs are likely larger in a LMIE country like Mexico, in which the institutional framework and the level of bank competition is weaker than in the U.S., making it harder for banks and firms to overcome informational asymmetries.

When looking that the type of credit that is most affected by the shocks, we find evidence that the increase in credit is concentrated precisely in the type of loans that is more subject to informational asymmetries, that is, credit without collateral and credit directed to young firms which have a shorter credit history than old firms (less than five years old). This argument is reinforced by the fact that in an LMIE like Mexico SMEs, the subject of ours and Greenstone et al (2019) study, are more credit constrained than in AE like the US. Thus, we interpret these results as evidence that a positive credit supply shock increases employment in Mexico during normal times because it significantly improves credit access and credit conditions faced by SMEs.

Another alternative but related reason could be that formal labor supply in Mexico is more elastic due to the existence of an informal sector. If this is the case, formal employment may increase more in Mexico when there is positive shift in labor demand because more workers are willing to take a formal job at the current wage. To explore the role of informality, we exploit the Mexican National Employment Survey *(Encuesta Nacional de Ocupación y Empleo, ENOE)*, and provide suggestive evidence that the increase in formal employment is not driven by a decrease in employment in the informal sector. Specifically, we find that increases in credit supply do not decline informal employment.[7]

Finally, we explore where the differences in the estimated impacts between Mexico and the US may be due to the definition of the unit of analysis. While we focus on comparing local labor

[7] Schneider and Enste (2000) review the earlier literature documenting the relationship between access to credit and informality. La Porta and Shleifer (2008) and Koeda and Dabla-Norris (2008). Catao et al. (2009) show that financial access is associated with more formal employment and more so for more external-finance dependent industries (á la Rajan and Zingales (1998)).

markets containing several administrative units (municipalities), Greenstone et al. (2019) consider U.S. counties, many of which are part of the same commuting zone. We show that performing our analysis at the municipality level delivers smaller point estimates (although the effects are still statistically significantly different from zero), suggesting that municipalities participating in the same labor market may also be affected by a shock in neighboring municipalities within the same labor market, and therefore are not an adequate (uncontaminated) control group. We then conclude that using labor markets as the unit of analysis is a relevant methodological decision, but it only explains part of the discrepancy between the positive effect in Mexico and the null results for the U.S. during normal times.

The rest of the paper is presented as follows. Section II discuss the importance of better understanding the effect of credit shocks on employment for the Mexican context. Section III describes the data and discuss the definition of the unit of observation. Section IV outlines the empirical strategy. Section V presents the results exploiting administrative data. Section VI explores the reasons behind the discrepancy between our results on those of the U.S. Section VII presents robustness checks. Section VIII concludes.

II. Institutional background

As it belongs to the group of LMIEs, Mexico is an interesting case to study to the impact of credit shocks on the employment of SMEs. Credit markets in LMIEs are narrower and less efficient than in rich nations, and thus, they usually provide less favorable financial conditions to firms. Faced with lower access to credit, higher interest rates and larger costs of switching across banks, firms in LMIEs could benefit to a larger extent from credit supply shocks. These shocks could have larger effects on easing credit constraints faced by SMEs, thereby generating larger employment impacts than in a rich country, such as the US.

The literature has identified several reasons why credit markets are underdeveloped in LMIEs. A first reason relates to differences in GPD per capita. Having smaller GDP per capita, LMIEs have lower saving rates (Masson et al, 1998; Loayza et al, 2000). Thus, they have fewer domestic resources available for intermediation, and therefore, credit market of a smaller size. In Mexico, for instance, the ratio of private credit to GDP is only a quarter of the same ratio in the US or, on average, the OECD countries (34.6 percent and around 144.6 percent, respectively).

Credit markets in LMIEs are also less efficient in dealing with informational asymmetries and channeling financial resources to firms. When lenders have uncertainty on borrowers' ability to repay their loans, they frequently charge higher interest rates and reduce credit availability, generating credit constraints. This is more relevant for SMEs, whose ability to repay is relatively more uncertain, for loans without collateral, for which the lender does not recover any of the loss in the case of a default and for young firms which do not have much credit history that could inform lenders on the probability of default (see Galindo and Miller, 2002 and Section IV c).

While these informational asymmetries are common to all countries, institutional frameworks are less prepared to deal with them in LMIEs. Lenders in these countries find it harder to force repayment or grab collateral because their legal investor protection is weaker, and can find it harder to obtain information on borrowers because their credit registries are undeveloped (La Porta et al, 1997; Djankov et al, 2007; Calomiris et al, 2017). These characteristics also explain, in part, why the ratio of private credit to GDP is lower in LMIEs (Djankov et al, 2007).

That the banking environment is less competitive could be an additional reason for why credit conditions are deteriorated for SMEs in LMIEs. While the link between market structure and credit conditions is in principle unknown, it has been shown that bank concentration increases credit constraints (Beck et al., 2003). This effect is only found for small firms and for countries in which the institutional framework sufficiently weak, such as LMIEs. Also important for the purpose of this paper, a less competitive environment, along with lower saving rates and a weaker institutional framework, could result in higher costs of switching for firms across banks.

Regarding Mexico, its ratio of private credit to GDP is similar to that of some LMIEs, including Albania (33.0%) and Indonesia (38.8%) but smaller than that of some its Latin American pairs, such as Chile (99.0%), Brazil (52.8%) and Colombia (43.8%). Further, a large fraction of firms in Mexico are credit-constrained, and this is more relevant for the case of SMEs. Kuntchev et al. (2013) show that 28.3 percent of SMEs firms report being credit constraints in Mexico, similar to the average for Latin America (30 percent).[8]Along similar lines, INEGI's Economic Census of 2019 (the Mexican Statistical Office) shows that 36.8 percent of Mexican firms were in need of external financing in 2018 but did not use banking credit, among other things, because their

[8] Kuntchev et al. (2013) define a firm to be credit-constrained if (i) it its applications were rejected or did not apply for loans even though it needed external finance; or, (ii) despite having used external finance, it did not apply for loans even though they were in need of external financing or applied for loans but were rejected.

applications were rejected or because the offered interest rate was too high.[9] The data from this census also shows that credit rationing in Mexico is a problem that impairs mostly SMEs: only 3 percent of large firms (more than 250 employees) report being credit constraint.

Related to these points, there is evidence that firms in Mexico find it costly to switch banks. Galindo and Schiantarelli (2002) show that access to credit in this country (and other Latin American economies) depends on the closeness of the relationship between firms and banks. de la Garza and Lopez-Videla (2015) show that firm-bank relationship length mitigates credit rationing for Mexican firms. That is, credit markets in Mexico are small, the proportion of its credit-constrained firms is large, particularly for SMEs, and switching costs are relevant for access to credit; all in all, this suggests that bank-specific credit supply shocks that ease financial conditions can be largely beneficial to Mexican firms, particularly if they already have a relationship with a bank.

An additional reason for why Mexico is an interesting case to study the impact of credit shocks on the employment of SMEs is its employment structure. In Mexico, SMEs account for a significantly larger part of employment and employment growth than in advanced economy like the US. Specifically, INEGI's Economic Census of 2019 shows that SMEs in Mexico, defined as firms with at most 250 employees, accounted for 71 percent of total employment in 2018. In contrast, data from the U.S. Bureau of Labor Statistics show that firms with the same number of employees accounted for only 45 percent of total private employment over the first quarter of 2019 in the US. Thus, an improvement in the credit conditions of SMEs in Mexico, for instance due to a positive credit supply shock, has the potential to generate larger employment effects.

In summary, the institutional framework in Mexico makes it more difficult for firms and banks to overcome informational asymmetries than in a developed economy, resulting in credit rationing and worse credit conditions, particularly for SMEs. Moreover, the lower ability to deal with asymmetric information and the lower level of bank competition increases the costs of firms to switch banks, making them more vulnerable to bank-specific shocks.[10] This makes our empirical strategy particularly appealing for addressing our research question and implies that a positive

[9] In INEGI's census, it is considered that firms that did not use banking credit even though they were in need of external financing as those that reported not having used banking credit for any reason other than "not needing it."

[10] Note that our empirical strategy, based on Bartik-type measures of credit supply shocks, is based on bank-specific shocks aggregated at the labor market level.

credit supply shock has the potential to generate larger employment impacts in Mexico than in more developed economies, such as the US.

III. Data

Our analysis combines four datasets: a dataset held by the Central Bank (*Banco de Mexico, Banxico*) including detailed information on the universe of new credit lines issued by private banks to firms in the country; the publicly available data on formal employment published by the Mexican Social Security Institute (*Instituto Mexicano del Seguro Social, IMSS*); the Mexican Employment Survey *(ENOE)*; and information from the 2010 Mexican census.

III.a. Credit

All commercial banks are mandated to submit monthly reports (electronically) to the regulator, the National Banking and Values Commission (*Comisión Nacional Bancaria y de Valores, CNBV),* with detailed information about all new and existent loans extended to firms in the country, regardless of firm and loan size. For each loan, a large set of characteristics is reported. Importantly for the purpose of this study, for each loan we observe the receiving firm's number of employees and location (municipality), the issuing bank, and the loan size.

From these monthly reports, we construct two datasets. The first one contains information at the labor market-commercial bank level and we use it to construct our measure of supply-driven credit shocks. The second one aggregates the data at the labor market level and is used as an outcome variable to explore the relationship between credit supply shocks at the bank level and loan originations in local labor markets more exposed to these shocks. For both datasets, we restrict the set of all loan originations to those granted to private firms with less than fifty employees, aggregating the data at the yearly level.[11]

For the first dataset, which consists of yearly measures of total lending to small firms at the bank-labor market level, we impose some sample restrictions to ensure comparability over the period of analysis. In total, 47 different banks report at least one credit issued during the period

[11] We exclude loans granted to the local and federal governments, as well as loans granted to firms operated by the public sector. Firms' number of employees is reported by firms in their loan application, and is updated every time firms are granted a new credit line. To reduce measurement error, we consider firm size as the median number of employees reported by each firm throughout the whole period for which we have data.

2010-2016. However, two important facts are worth highlighting. First, as is standard in the literature, for each group of banks that participated in a merger during the period analyzed, we recode the banks' identifiers to correspond to a single one throughout the whole 2010-2016 period (which leaves us with 44 bank identifiers in total). Second, we restrict the sample to banks that report at least one credit line issued to firms in at least two labor markets each year in the data (23 out of 44). All remaining loans are assigned to a single "other banks" identifier. The second dataset simply contains the sum of all new loan amounts granted to small firms each year by all banks in the reports.

III.b. Formal Employment

In order to analyze the impact of credit on formal employment, we exploit a publicly available dataset that IMSS publishes monthly, and contains municipality-level information on the total number of registered workers by firm size, sector, and workers' characteristics (such as gender and wage categories).

IMSS is the institution in charge of providing healthcare services to formal workers in the private sector. And, because all private firms in Mexico are required to contribute a fraction of each of their employees' salary to IMSS, the institution has access to detailed information on the wages of all workers in private firms, from which it has been producing monthly publicly available data on the total number of employees disaggregated by gender, firm size and wage categories in each municipality in Mexico since 1997. We exploit this information for the month of December each year for the sample period for which we have credit data (2010-2016), and extract the total number of employees, the total number of employees for low and high wage brackets (less or more than two minimum wages), and average salaries in small firms at the end of each year in each municipality, which we aggregate at the labor market level. Small firms are defined as those with less than 250 employees and cover around 80 percent of the universe of formal workers.

III.c. ENOE

While the administrative data provided by IMSS allow us to measure formal employment rather precisely, they do not allow us to explore the effects of the credit shocks on informal employment, which account for around 60 percent of total employment in Mexico during the period analyzed. In order to shed light on the impact of the credit shocks on employment in the informal

sector, we exploit information from the Mexican Employment Survey (ENOE). To maximize comparability between the results using administrative data and those exploiting these survey, we exploit the publicly available information for the fourth quarter in each year for the 2010-2016 period, and calculate the number of formal and informal employees (and the sum of both) in small and medium-sized firms in each of the labor markets for which ENOE includes observations. For consistency with the definition of formality used when exploiting IMSS data, we define formal workers as those who declare being affiliated to IMSS, and informal workers as those who do not report an affiliation to any of the formal healthcare providers in Mexico (IMSS, ISSSTE and PEMEX). Unfortunately, the results obtained from ENOE are not be fully comparable with those obtained exploiting the IMSS administrative data, as ENOE's sample has a strong focus on large, urban localities.

III.d. 2010 Census

Finally, we construct a set of labor market characteristics, which we use to shed light on the validity of our identification strategy. The most recent census was conducted in 2010 by the Mexican Statistics and Geography Institute *(Instituto Nacional de Estadística, Geografía e Informática, INEGI),* precisely the first year for which we have data on credit at the local level. From this census, we construct a series of socio-economic indicators for each municipality (which we then aggregate at the labor market level) including total population, the fraction of the population in different age groups (less than fifteen, fifteen to sixty-four, and sixty five and over), the fraction of immigrants (population born out-of-state), the fraction catholic, indigenous, illiterate, with completed primary and secondary education, the fraction of the population with health insurance, the fraction of households with a female head, and the fraction of households with access to running water, sewerage and electricity.

III.e. Definition of the units of observation

In order to explore the impact of credit shocks on real outcomes, it is essential to identify the relevant units of analysis. Credit shocks to one particular firm (or region) may affect real outcomes not only for the affected firm, but also to other firms nor directly affected by the credit shock but which, for example, hire labor from the same market or have an economic relationship (clients, suppliers or competitors) with neighboring firms directly affected by the credit shock

(Herreño, 2019). In order to illustrate in better detail the intuition behind this argument, this section starts by presenting a very simple example, and then describes how we chose to define the units of analysis for our estimation of the impact of credit shocks on formal employment.

Consider then a single labor market with two firms, A and B, and a mass of potential homogeneous employees. Both firms' production function's arguments are capital and labor, and participate in the same competitive labor market (intersection between total supply and demand determine wages). Assume further that, due to credit constraints, firm A faces a borrowing limit that does not allow it to scale production and labor to the point its marginal product of labor equals the market wage.[12] If firm A is subject to an exogenous positive credit supply shock (e.g. there is an increase in deposits for a bank with which firm A has a long credit history), this borrowing limit moves up, allowing the firm to expand and hire more labor. In equilibrium, the increase in labor demand in the market push wages up for all firms. But, because of this increase in the price of labor, firm B's previous combination of labor and capital is not optimal anymore (as it participates in the same labor market as firm A), even if firm B was never credit constrained. As a response to this increase in wages, firm B may end up declining the amount of labor hired.

In this very simple example, a difference-in-differences estimation of the impact of the credit shock on employment that compares the changes in employment in firm A (who received the positive credit shock) with those in firm B, deliver an upward biased estimate of the real effect of the credit shock on total employment. More generally, the direction and magnitude of the bias depends on the degree in which these firms are interrelated and participate in the same markets. In other words, the Stable Unit Treatment Value Assumption (SUTVA) is violated in the case of firm B, given that its response depends on a credit shock (treatment) assigned to another firm in the same local labor market. Thus, a firm-level difference-in-differences estimation cannot provide unbiased estimates of the causal effect of credit shocks on employment.

In order to correctly measure the impact of credit shocks on employment, the employment (and thus, the credit) outcomes should be measured at the labor market level. This aggregation allows us to pick up not only the effect for firm A, but also that of all the neighboring firms participating in the same labor market.

[12] Alternatively, even if firm A is not credit constraint a positive credit supply shock may diminish the interest rate of new loans, lowering the price of capital goods (see Section VI.a) and increasing labor demand if labor and capital are complements.

We group municipalities into labor markets following the procedure implemented by Blyde et al. (2019). The algorithm used by Blyde et al.(2019) construct local labor market based on commuting zones, and operates as follows: first, it identifies 599 urban municipalities in the data that receive immigrants as "central", and classifies each of them as a separate labor market; second, it follows an iterative procedure adding the rest of the municipalities to each of these markets based on geographic distance and on whether residents of the municipality commute to the "central" one for work purposes. The remaining 190 municipalities that were not assigned to any central municipality after the iterative process were defined as separate, individual labor markets. The final grouping of municipalities into labor markets is illustrated in Figure 1.

III.e. Sample Restrictions and Descriptive Statistics

For the analysis, we restrict the sample to 461 labor markets with non-zero observations for new credit lines for small firms and the number of employees in small firms during the period analyzed. In all labor markets, more than one bank issued a loan during the period analyzed. Figure 1 shows the geographic location of labor markets in our restricted sample, and Table 1 shows observable characteristics for labor markets included and excluded from the empirical analysis. Not surprisingly, the labor markets in our restricted sample have a higher population, a larger fraction of the population aged between 15 and 64 years old, higher education levels, and relatively higher access to public services, such as running water, sewerage and electricity. Our final sample includes 60 percent of all labor markets as defined by Blyde et al. (2019), but concentrates 97 percent of the country's population.

IV. Empirical strategy

IV.a. Credit Shocks

Following Greenstone et al. (2019), we construct what are arguably exogenous shocks to local credit conditions through a modified Bartik-type instrument. Specifically, we start by estimating an equation that decomposes labor-market level changes in credit into labor market and bank-specific components, by running a set of separate regressions (one for each year $t \in \{1,2,\dots,T\}$ in our data) of the following form:

$$\Delta \ln\left(Q_{m,b,1}\right) = \alpha_{m,1} + \gamma_{b,1} + \epsilon_{m,b,1}$$

$$\Delta \ln(Q_{m,b,2}) = \alpha_{m,2} + \gamma_{b,2} + \epsilon_{m,b,2}$$

…

$$\Delta \ln(Q_{m,b,T}) = \alpha_{m,T} + \gamma_{b,T} + \epsilon_{m,b,T},$$

where the outcome variable is the log change in all new credit originations from bank *b* in labor market *m* between each pair of consecutive years T and $T-1$, α_m denote labor market fixed effects, γ_b denote bank fixed effects, and $\epsilon_{m,b}$ is an error term (the time period subscript has been omitted for clarity). The labor market fixed-effects capture the average change in lending to a labor market by all banks in our data. Therefore, each of the bank-time fixed effects ($\gamma_{b,T}$) are estimates of each bank's change in credit supply that is not explained by changes in each of the labor market's economic conditions that affect lending from all banks in the same magnitude (in percentage points), and they constitutes our measure of idiosyncratic bank shocks for each period.[13]

Defining $L_{i,b,f,m,t}$ as the amount of a new loan *i*, by bank *b*, to firm *f*, located in labor market *m*, originated in period *t*, we first calculate each of the bank's market share in each labor market as:

$$s_{b,m,t} = \frac{\sum_f (L_{i,b,f,m,t})}{\sum_b \sum_f (L_{i,b,f,m,t})}$$

Then, we calculate our local labor market level predicted lending shock, $Z_{m,t}$, as a weighted average of the bank-specific shocks for each labor market, using each bank's market share in that labor market as its weight. That is,

$$Z_{m,t} = \sum_b (s_{b,m,t} \times \hat{\gamma}_{b,t}),$$

where the $\hat{\gamma}_{b,t}$ are the bank fixed effects estimated for each period.

IV.b. On the validity of our instrument

Figure 2 shows the size of the estimated credit shock in each labor market in four different years. Looking across the different panels, we find that the estimated shocks present large variation across regions for a given year and over time within a labor market. We are aware of the recent

[13] Note that these credit supply shocks are not necessarily centered on zero. In fact, in our sample the average credit supply shock is 4.7 percent, indicating that bank credit supply was increasing during our period of analysis. Normalizing the estimated shocks (mean and standard deviation equal to zero and one, respectively) does not alter our results.

literature that questions whether Bartik-type instruments can arguably satisfy the exogeneity condition for the estimation of causal effects. Goldsmith-Pinkham et al. (2019) illustrate how, in strict terms, the exogeneity assumption can be interpreted as assuming that the bank shares are exogenous. However, Borusyak et al. (2018) show that, with multiple time periods, the exogeneity of the shocks can provide identification, even when shares are endogenous.[14]

Taken together, these insights translate into the standard identification that allows to interpret the estimates as causal. In our case, this means that our measure of the credit-supply shocks must be uncorrelated with other observed or unobserved labor market characteristics that can predict changes in the outcome variable. In order to partially test for the validity of this assumption, in this section we explore whether our shocks are correlated with labor market level observable characteristics (other than the banks' market shares).

Table 2 compares observable characteristics for labor markets above and below the 2012 median credit shock we calculate. Differences in means are small. Out of eighteen observable characteristics in our data, only two of them are significantly different from zero at a high (5 percent) confidence level. A linear regression of the 2012 shock against all observable characteristics listed in Table 2 cannot reject that all the estimated coefficients are jointly zero.

IV.c. Estimating Equation

Having constructed the supply-driven credit shocks at the local labor market level, we estimate regressions of the following form to recover their causal impact on employment outcomes:

$$ln(y_{mt}) = \beta_1 Z_{m,t} + \beta_2 Z_{m,t-1} + \beta_3 Z_{m,t-2} + \gamma_m + \pi_t + \varepsilon_{m,t}, \qquad (1)$$

where $ln(y_{mt})$ is the outcome variable in labor market *m*, in period *t* (total new credit and changes in formal employment in small firms), the $Z_{m,t}$ are defined as above, γ_m are labor market fixed effects, π_t are period fixed effects, and $\varepsilon_{m,t}$ is an error term. The coefficients of interest are then the β, which can be interpreted as the percentage change in formal employment in small firms associated with a one percent change in new credit to small firms.

[14] In section IV.d, we further discuss the importance of multiple time periods for the identification to rely on the exogeneity of the shocks and not in the shares.

V. Results

V.a. Credit shocks and credit originations

For our empirical strategy to correctly identify the causal relationship between credit and formal employment, the credit shocks we construct must not only be exogenous to local labor market level conditions (which we partially test in section IV.b) but also predict credit at the local level. We provide evidence of this relationship in Table 3, which presents the results from regressing the observed credit levels in each labor market against our shock measures. Column 1 only includes the contemporaneous shock as a regressor. To explore if there are dynamic effects of credit shocks on total credit, Columns 2 and 3 additionally include the shock in the previous year and in the previous two years as controls, respectively. The sample across specifications is restricted to years for which we observe these three shocks (2012-2016). The estimated relationship between our measure of credit-supply shocks and total credit is also presented graphically in Figure 3, panel A.

The estimated coefficients for the contemporaneous shock across specifications is large, positive, and significantly different from zero at a high confidence level. Our measure of supply-driven credit shocks are good predictors of total credit to small firms in local labor markets. The estimate is also stable across specifications, indicating that shocks are relatively independent over time, and that the coefficient associated with the contemporaneous shock in Column 1 is not picking up any dynamic effect. In terms of economic significance, the average credit shock in our sample is 0.081, meaning that shocks during this period were positive on average, and its standard deviation is 0.094. Thus, in a local labor market receiving a positive shock of one standard deviation, credit to small firms increases by 9.2 percent (0.11*0.841) with respect to labor markets with no credit shock.

The results are consistent with the hypothesis that it is costly for firms in Mexico to switch credit suppliers. As a result, bank-firm relationships are stable, and firms respond quickly and strongly to temporal changes in the credit conditions offered by their traditional credit supplier.

V.b. Credit shocks and formal employment

Table 4 shows the reduced form results using formal employment in small firms as the dependent variable, restricting the sample to 2012-2016, the time periods for which we observe the

contemporaneous and the two previous credit shocks (Figure 3, panel B presents this relationship graphically). Column 1 only includes the contemporaneous shock as a regressor. Columns 2 and 3 additionally include the shock in the previous year and in the previous two years as controls, respectively.

The coefficients associated to the contemporaneous shock are positive and significantly different from zero at a high confidence level, and stable across specifications. Unlike Greenstone et al. (2019) we find strong effects of credit shocks on formal employment for small firms in the Mexican context during normal times. The point estimate in Column 1 indicates that in a labor market with a positive credit shock of one standard deviation, yearly employment increases 0.45 percentage points faster than in another labor markets with no shocks. This represents 13 percent of the mean yearly employment change in our sample (3.45 percent), and suggest that credit supply shocks can have a very large effect in emerging economies where small firms represent a larger share of total employment and are more likely to be credit constrained.

V.c. Heterogeneous employment effects by wage categories

Recent literature (Moser et al, 2018) has documented that, for the US context, changes in credit supply may affect high and low skill workers differently depending on their degree of complementarity with capital. In light of this literature, in this subsection, we explore whether credit shocks can also have a heterogeneous impact on number of workers earning more or less than 2 minimum wages in each labor market.[15]

Table 5 presents the results of our main specification on yearly changes in log of low wage formal employees and for high wage formal employees in each local labor market, separately for workers earning less (Column 1) and more (Column 2) than two minimum wages. In the case of low wage employment, we find that the point estimate associated with exposure to credit shocks is positive but not statistically significantly different from zero. For high wage employment we find a large and positive effect of credit shocks on high wage employment. The estimated effect on high wage employment is twice as large compared to the effect on total employment.

[15] Data on formal employment does not include information about the educational level of the worker, preventing us to perform the analysis by skill level.

Taken together, our findings are consistent with different capital-skill complementarities in firms' production functions if the credit is used to finance capital acquisitions. If high-skilled workers are more complementary to capital than low-skilled workers, after an exogenous decline in the price of capital (a positive credit shock) firms should increase capital stocks, hiring relatively more high-skilled workers than low-skilled workers.[16]

It is worth noticing that these results could also indicate that credit supply shocks are concentrated on firms that tend to hire more high-wage labor. That is, firms for which the estimated credit supply shocks ease credit constraints (compliers) may tend to hire more high-wage workers than firms with no access to credit before and after the shock (non-compliers). This could be the case if more productive firms pay higher wages and have more access to credit markets, but they are still credit constrained. Then, the employment effects concentrated on high-wage workers may be driven by the characteristics of the affected firms rather than capital-skill complementarities. Unfortunately, we do not observe the productivity of the firm nor the skill level of workers in our data, and we cannot disentangle these two interesting mechanisms.

V.d. Differential Impacts by Shocks' Magnitude

Our main specification implicitly assumes that the impact of credit supply shocks on employment is linear. In order to explore the extent to which this assumption is valid in our context, and more generally, how the magnitude of the credit shocks affect employment, we run regressions of the following form:

$$ln(y_{mt}) = \sum_k \beta_k \mathbb{I}\big(Z_{m,t} \in (K)\big) + \gamma_m + \pi_t + \varepsilon_{m,t}, \qquad (2)$$

where $\mathbb{I}\left(Z_{m,t} \in (K)\right)$ are *k* indicator variables taking value of one if the credit shock, $Z_{m,t}$, lies in the following *K* intervals: $(-\infty, -0.1]$, $(-0.1, -0.05]$, $(0.05, 0.1]$, $(0.1, 0.15]$, $(0.1, 0.15]$, $(0.15,\ 0.2]$, $and\ (0.2, \infty)$, and all the other variables are defined as in equation (1).

Each of the β_k should then be interpreted as the difference in the outcome for labor markets where the shock lied in interval *K* with respect to labor markets where the shock was smaller than 0.05 in absolute value (the excluded category). Results of this estimation are presented graphically

[16] For recent research on different capital-skill complementarities, see for example Krusell et al. (2000), Acemoglu and Autor (2011), Acemoglu and Restrepo (2018), and Caunedo et al. (2020). These papers find evidence that high skill workers are relatively more complement to capital than low skill workers. Thus, in the event of a changes in the stock or quality of capital benefits are concentrated on high skill workers.

in Figure 4. Perhaps unsurprisingly, negative shocks are associated with a decrease in formal employment. Conversely, a positive shock implies an increase in the outcome of interest. Moreover, according to these results, the credit supply shocks seem to have a close to linear impact on formal employment.

VI. Why credit shocks affect employment in Mexico but not in the U.S.?

The results presented this far stand in contrast with the paper by Greenstone et al. (2019), which exploits similar empirical strategies and finds no effects of credit on employment for the U.S. during times in which the economy is stable. In this section, we explore whether the differences in the institutional framework, the type of labor markets we analyze (namely, the existence of a large informal sector), or the definition of the unit of analysis can explain the differences in results.

VI.a. Credit supply shocks in Mexico and the US

The first reason for why credit shock can have larger impacts on employment of SMEs in Mexico than in the US during times of economic stability relates to differences in their financial system. Credit constraints are more frequent in Mexico than in a developed country, such as the US, and obtaining good credit conditions, including sufficiently low interest rates, is harder for small Mexican firms. In part, this is because the institutional framework and competitive environment make it difficult to overcome asymmetric information, raising switching costs in Mexico, particularly for SMEs, for credit without collateral and for credit to new firms whose credit history is short (see Section II).

Hence, credit constraint SMEs may benefit more from bank-specific idiosyncratic credit supply shock, and there are many of them in a middle-income country like Mexico. This, in turn, is consistent with the evidence presented Section V, according to which supply-driven credit shocks are good predictors of total credit to small firms in local labor markets. The estimated coefficients are large, positive, and significantly different from zero at a high confidence level and stable across all specifications considered.

In approaching whether the impact of credit-supply shocks relates to characteristics of the Mexican financial system, we follow the intuition that asymmetric information is more relevant for credit without collateral and for credit to new firms, and undertake an additional empirical exercise.

In particular, we run the model from equation (1) separately for credit with and without collateral, as well as credit to new and old firms (new firms are defined as those less than 5 years old).

Table 6 shows the results from this exercise. Looking across the first 4 columns of this table, it becomes clear that positive credit supply shocks mostly increases credit without collateral. That is, the shocks have a larger increasing impact precisely on the type of credit that banks are most likely to ration due to asymmetric information concerns. Closely related to this point, Table 6 also shows that these shocks have a five-time larger impact on credit to new firms than on credit to old firms. New enterprises have a shorter credit history and are thus more strongly exposed to asymmetric information concerns. These results are consistent with the idea that the credit supply shocks we identify in Mexico increase access to credit to SMEs, especially those that are more likely to be credit constraint.

Since the characteristics of baking systems in low and middle-income countries, and particularly in Mexico, result in both credit rationing and higher interest rates for small firms, we further extend the analysis to investigate the impact of the credit-supply shocks we identify on interest rates. Table 8 shows that the credit shocks diminish the interest rate that banks in Mexico charge to small firms. We find that a positive credit-supply shocks are beneficial to firms not only because of quantitative reasons, that is because they increase credit to small firms, but also because they reduce interest rates. This is also suggestive that the shocks improve the credit conditions faced by these firms.

VI.b. The importance of the informal sector

One of the most salient differences between developed and developing economies' labor markets is the size of their informal sector. In this section, we explore whether the large increase in formal employment associated with credit supply shocks can be explained by the existence of a considerable mass of potential formal workers employed in the informal sector. Thus, the same positive credit supply shock in a low or middle-income country, shifting upwards the labor demand, could have larger impacts on employment levels because the labor supply in the formal sector in these countries is more elastic.[17]

[17] In the classical development literature of dual labor markets, it is often assumed that people are working informally because they are unable to work formally. Thus, supply in the formal sector is perfectly elastic and formal employment is solely determined by labor demand. More recent papers consider that many informal jobs might actually be preferred

Table 7 then presents results of our main specification, using the measures of formal and informal employment in small firms obtained from ENOE as dependent variables. Panel A presents the results including all labor markets for which ENOE contains information. However, as the survey is only designed to be representative for a small set of urban areas, Panel B restricts the sample only to labor markets in which these cities are contained. For comparability, in Columns 1 and 2 reproduce our main estimates using credit and formal employment (calculated from IMSS administrative data) as dependent variables, restricting the sample to labor markets from which we calculate the employment outcomes from ENOE. Columns 3 and 4 use the measures of formal and informal employment obtained from ENOE as dependent variables, respectively.

The first two columns in both panels show that our main estimates are not sensitive to the sample restrictions. Perhaps due to the noise induced by ENOE's sampling procedure, none of the estimated coefficients using outcome variables constructed from ENOE is significantly different from zero when we include all the labor markets for which ENOE contains at least one survey respondent. However, in Panel A, the coefficient associated to the contemporaneous credit shocks is positive when using total employment (column 3), formal employment (column 4) and informal employment (column 5) as the outcome. Importantly, the coefficient in column 4 is also similar in magnitude to the one obtained when using formal employment measured from IMSS administrative data as the outcome of interest.

In order to shed light on whether the lack of power in the estimates presented in Panel A, Panel B presents the results restricting the sample to labor markets in which the cities for which the survey is representative are contained. The first two columns indicate that the results using credit and employment from administrative data sources are not sensitive to this additional sample restriction. The coefficients of interest in columns 3, 4 and 5 are larger in magnitude than in Panel A and, although still relatively noisier, all positive. Credit shocks seem to positively affect total employment *and* informal employment, suggesting that the effects found for formal employment using IMSS administrative data cannot be driven by workers shifting from the informal to the formal sector.[18]

to other low-paid formal jobs, so that labor supply in the formal sector is not necessarily more elastic in countries with a large informal sector. See Fields (2011) for further details.

[18] While the relatively large point estimates obtained when using informal employment as the outcome of interest can be explained by lack of precision, they are also consistent with recent literature that suggests that credit expansions have positive impacts on the informal sector in the Mexican context (Bruhn and Love, 2014).

V.c. Differences in the unit of analysis

We end the comparison of our results with those in Greenston et al. (2019) by exploring the importance of defining local labor markets as the relevant unit of analysis. For this purpose, we replicate our main results recalculating all explanatory and dependent variables at the municipality level, which is the finest geographic partition of the data that our context allows. Results are presented in Table 7. Panel A reproduces the estimates found in the previous sections (using labor markets as the unit of analysis), and Panel B presents the analogous estimates when using municipalities as the unit of analysis. For the two main outcomes of interest, total credit to small firms (Column 1) and formal employment in small firms (Column 2), the coefficients associated to the credit shocks is positive and similar in magnitude (we cannot reject statistically that they are equal). Nonetheless, the estimates using municipalities as the unit of analysis are noisier, despite the increase in the number of observations, and smaller in absolute value.

Our results suggest that municipalities participating in the same labor market may also be affected by a credit supply shock in neighboring municipalities within the same labor market, and therefore are not an adequate (uncontaminated) control group. The main reason for this is that firms in those close municipalities can be indirectly affected by the credit shock. This is consistent with Huber (2018), who find that the indirect effects of credit supply shocks can be large, and depend on the intensity of local agglomeration spillovers (knowledge spillovers, transport costs, the quality of workers in the local labor market) and the effect on local aggregate demand, which may transgress municipalities administrative boundaries.

We then conclude that defining labor markets as the relevant unit of observation is an important methodological decision. It results in more precise estimates and larger in magnitude, and helps to explain part of discrepancy between the results for Mexico and the U.S. However, it is not the only reason behind identifying effects of credit supply shocks on employment in the Mexican context during times of economic stability.

VII. Robustness checks

Although the credit supply shocks estimated by equation (1) are arguably exogenous from other factors that could alter local labor supply and local labor demand, we specifically test it in this section. First, we add time trends interacted with demographic variables to our specification to

allow for differential time trends in each labor market depending on the characteristics of its population (education, age, access to basic services, etc.). Second, we test if our results are robust to adding local labor demand shocks as control, which measures the predicted changed in employment in each labor market given its industry composition and the national employment trends in each industry and could be related to the baseline banks shares in each labor market.

Table 9 shows the results from these two exercises. The inclusion of municipality demographic characteristics interacted with year dummies (Panel A) does not change our main results.[19] The point estimate is similar in magnitude to the estimations excluding these controls, with the exception of the coefficient for high wage that is slightly lower but not statistically significantly different from that in Table 5. We interpret this as evidence that the estimated credit supply shocks do not follow any particular trend across municipalities associated with other underlying characteristics of these municipalities that could bias our estimates.

Table 9 also present results controlling for local demand shocks (Panel B). The local demand shocks are constructed by interacting baseline differences in industrial composition with national percentage changes in industry employment (excluding the labor market of interest).[20] That is:

$$LDS_{mt} = \sum_{i=1}^{I} \theta_{m,i,t-1} \left(\frac{\pi_{-m,i,t} - \pi_{-m,i,t-1}}{\pi_{-m,i,t-1}} \right), \qquad (3)$$

where LDS_{mt} is the predicted local demand shock in local labor market m for year t, $\theta_{m,i,t-1}$ are industry i employment shares in baseline year $t-1$, and $\pi_{-m,i,t}$ is the number of workers at the national level in industry i in year t, excluding local labor market m. This index can be interpreted as the predicted yearly changes in employment due to the local industry composition of local labor market m and the industry-specific national employment trends.

If the estimated credit supply shocks were related to the industry composition of local labor markets due to, for example, banks and labor markets specializing in some industries, it could be the case that our estimates are picking up these baseline differences and the results may be bias. In

[19] The demographics characteristics used in the regression are displayed in Table 2, and include the share of the population in different age intervals (0-14 and 15-64), share of migrants, share of indigenous population, share with different schooling (illiterate, primary and secondary), share not cover with social insurance, and share living in households with electricity.

[20] This Bartik style instrument has been widely used in the literature. For a recent paper, see Notowidigdo (2020).

other words, the bank shares $s_{b,m,t}$ used to construct the credit shock $Z_{m,t}$ might be related to the industry composition in each labor market.

However, the endogeneity of the bank shares can be problematic if identification is based on a before and after comparison with, for example, a cross-section regression comparing changes in treated and untreated units with different baseline shares (Goldsmith-Pinkham et al., 2019). In our case with multiple time periods, the exogeneity of the shocks can provide identification even when shares are endogenous (Borusyak et al., 2018). Intuitively, because of the panel structure of our data, we can control for any local labor market baseline differences (fixed-effects) and the variation in the estimated credit supply shocks over time is generated by the shocks and not by the shares.[21] Thus, we do not expect our estimates to change with the introduction of local labor demand shocks. As expected, Table 9 shows that our results are robust to the inclusion of local labor demand shocks, so that the magnitude of our point estimates and its statistical significance is practically the same that those of Tables 3-5.

VIII. Conclusions

Although credit supply is usually mentioned as a key determinant of economic growth and employment creation in developing economies, identification of this causal link is scarce due to data availability restrictions. This paper measures the causal relationship between credit supply shocks to small firms and employment in the Mexican context. We exploit an extraordinarily detailed dataset containing loan level information on the universe of loans extended by commercial banks to private firms in Mexico during the 2009-2016 period, coupled with publicly available information on the total number of employees reporting positive formal wages to the Mexican Social Security Institute during the same time period. We argue that the relevant units of observation for the analysis of the impact of credit supply on employment outcomes are local labor markets. Otherwise, credit shocks to some firms may generate spillovers to other neighboring firms invalidating their use as control units in a standard difference-in-differences analysis. We construct our explanatory variable by first estimating idiosyncratic changes in lending from each bank that cannot be explained by changes in demand for credit across labor markets, and then calculating a labor-market level weighted average of these credit shocks, using the market share of each bank in

[21] Borusyak et al. (2018) show that unit fixed effects play a key role in shift share estimates by isolating variation in shocks over time.

each labor market as weights. We conduct a series of checks that suggest that these shocks are likely exogenous to local market conditions.

Our findings show that, for the Mexican context, credit supply shocks have a large and significant impact on formal employment. This contrast to recent findings that focus on the relationship between credit and employment in developed economies (Greenstone et al, 2019), and suggest that credit supply shocks can have a larger effect in emerging economies where small firms represent a larger share of total employment and they tend to be more credit constrained. Specifically, we find that a positive credit shock equal to one standard deviation increases yearly employment changes by 0.45 percentage points, which represents 13 percent of the mean yearly employment change in our sample (3.45 percent). The changes in employment are concentrated in the upper half of the wage distribution. These results are consistent with small formal firms' facing important credit constraints that prevent them from acquiring inputs that are complements of high skilled labor.

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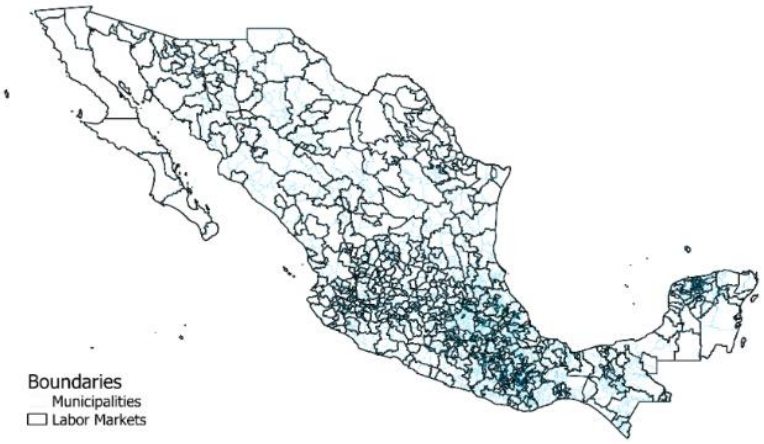
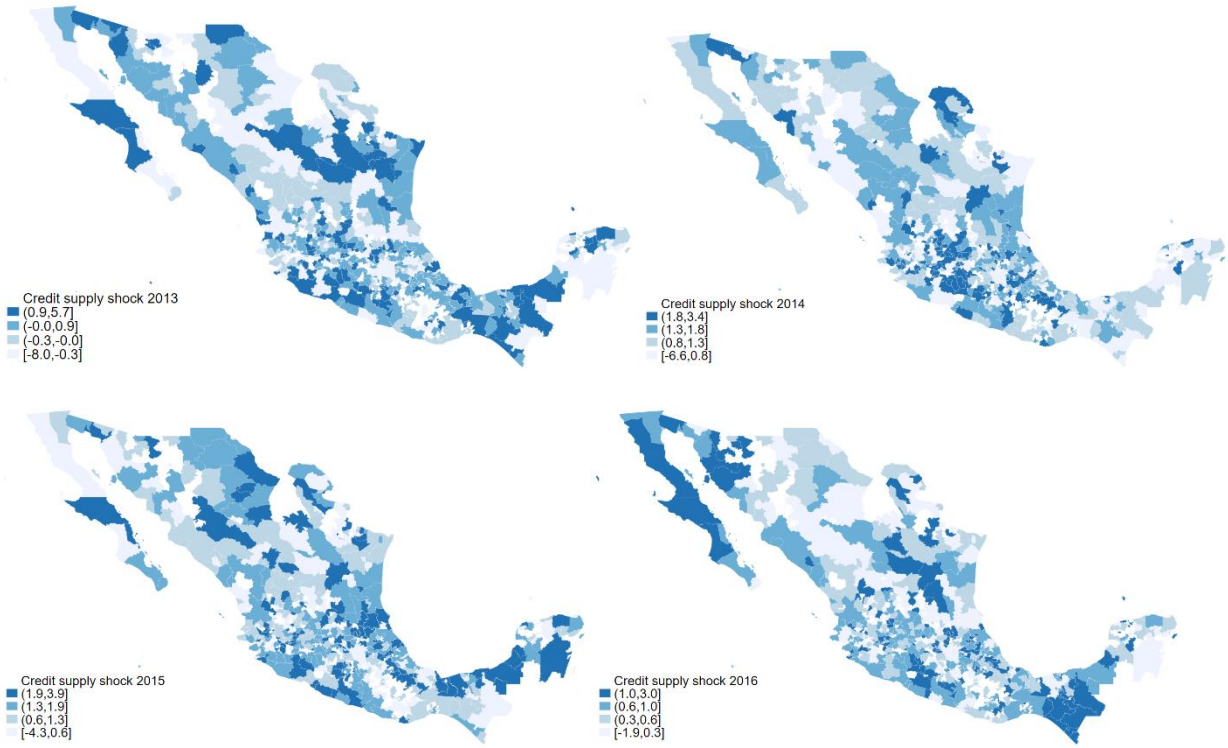
Figures

Figure 1: Local labor markets and municipalities



Notes: Authors' classification of local labor markets following Blyde et al.(2019). Municipalities are assigned to different markets according to commuting data. Local labor market boundaries in shown in black. Municipality boundaries are shown in blue.

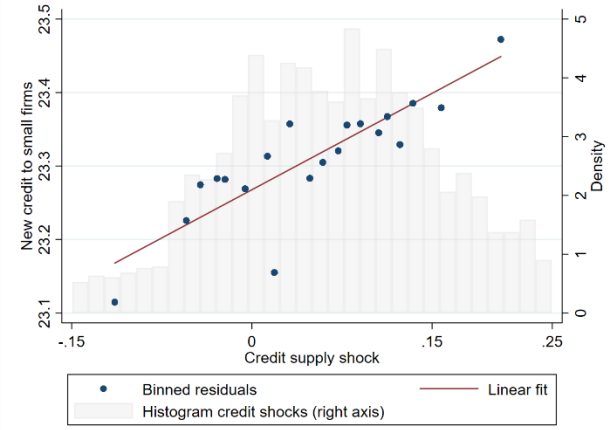
Figure 2: Exposure to shocks for local labor markets in sample



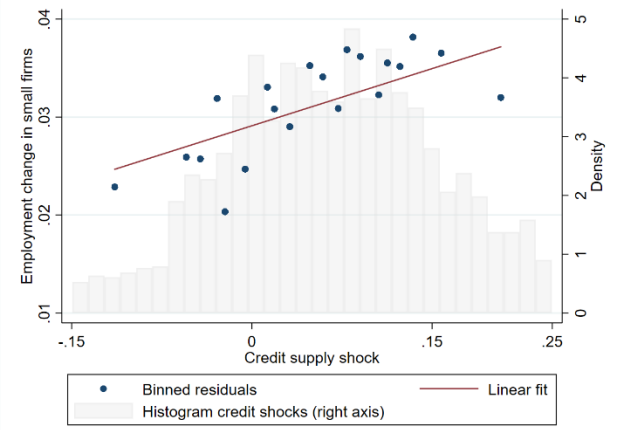
Notes: Authors' calculations of credit shocks at the local labor market level. The figure shows the average estimated credit supply shock by baseline year. The figure also shows the geographic location of labor markets in our restricted sample (labor markets excluded from the empirical analysis are shown in white). In all labor markets, more than one bank issued a loan during the period analyzed.

Figure 3: Main results

Panel (a): New credit to small firms

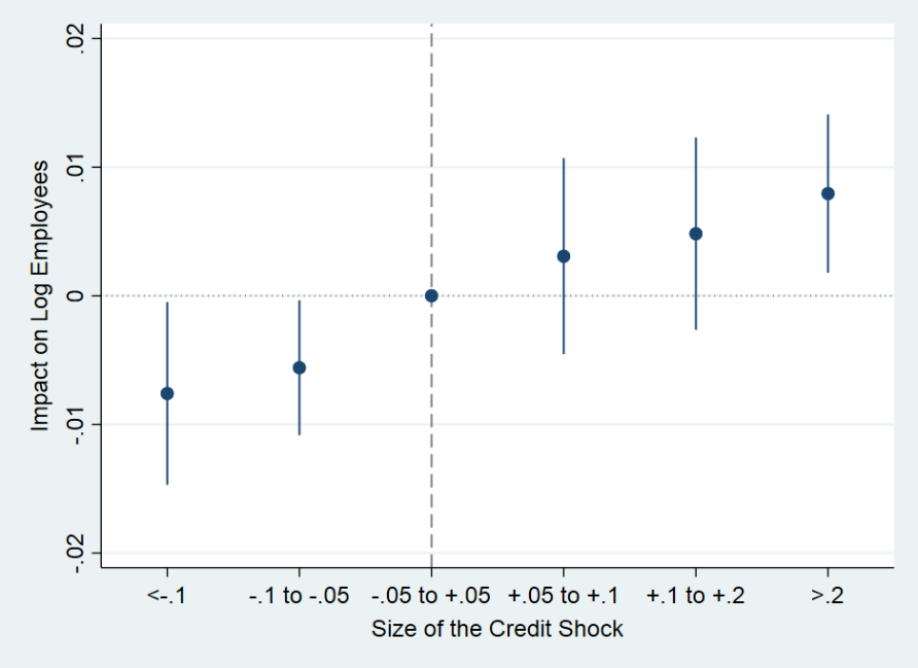


Panel (b): Employment change



Notes: The figures are binned scatterplots showing the relationship between credit supply shocks and new credit to small firms (a) and credit supply and employment changes in small firms (b). The horizontal axis shows the credit supply shocks, which varies at the municipality –year level. The vertical axis shows the residuals of new credit to small firms (a) and changes in employment to small firms (b) for each municipality-year cell, controlling for municipality and year fixed effects. The data are divided into 20 equally sized groups based on the magnitude of the credit shocks. The histogram of credit shocks is shown in gray bars at the back of the figure and its value is displayed in the right axis. Each point corresponds to the group average of the variable on the vertical axes.

Figure 4: Differential Impacts by Shocks' Magnitude



Notes: Authors' estimation of equation (2) for changes in log of formal employees in small firms in each labor market as the dependent variable. Regressions include local labor markets and year fixed effects. The graph shows point estimates (blue dots) for different magnitudes of the supply size shock (grouped in bins). Observations are weighted by number of workers in small firms in each labor market-year cell. The dashed line corresponds to the excluded category. The blue lines represent 90 percent confidence intervals of each of the point estimates.

Tables

Table 1: Descriptive characteristics of local labor markets in the sample

Descriptive Statistics

Variable	Not in Sample	In Sample	Difference
Population (thousands)	20.470	473.736	453.266***
	(27.954)	(2,028.758)	(112.047)
Fraction of population under 15 yo	0.301	0.301	-0.001
	(0.054)	(0.031)	(0.003)
Fraction of population between 15 and 64	0.585	0.614	0.029***
	(0.045)	(0.027)	(0.003)
Fraction of population over 65 yo	0.105	0.075	-0.030***
	(0.051)	(0.023)	(0.003)
Fraction of population born in State	0.920	0.867	-0.053***
	(0.084)	(0.099)	(0.007)
Fraction of pop. who lived in a different state in 2005	0.022	0.025	0.003**
	(0.022)	(0.022)	(0.002)
Fraction of pop. that speaks indigenous language	0.258	0.075	-0.183***
	(0.330)	(0.157)	(0.018)
Fraction of pop. that's illiterate	0.145	0.093	-0.052***
	(0.091)	(0.055)	(0.005)
Fraction of pop. with completed elementary school (and no more)	0.214	0.189	-0.025***
	(0.056)	(0.039)	(0.003)
Fraction of pop. with completed secondary school (and no more)	0.200	0.216	0.016***
	(0.056)	(0.042)	(0.003)
Fraction of pop. with health insurance	0.367	0.332	-0.035***
	(0.190)	(0.118)	(0.011)
Fraction of pop. with seguro popular	0.412	0.354	-0.058***
	(0.204)	(0.152)	(0.013)
Fraction of pop. that's catholic	0.858	0.854	-0.004
	(0.125)	(0.108)	(0.008)
Fraction of HH with female head	0.223	0.230	0.007**
	(0.060)	(0.036)	(0.003)
Fraction of HH with dirtfloor	0.154	0.076	-0.078***
	(0.144)	(0.068)	(0.008)
Fraction of HH with electricity	0.942	0.968	0.027***
	(0.079)	(0.034)	(0.004)
Fraction of HH with water	0.804	0.855	0.051***
	(0.189)	(0.131)	(0.011)
Fraction of HH with sewerage	0.668	0.854	0.187***
	(0.264)	(0.130)	(0.014)
Observations	328	461	789

Notes: Authors' estimation based on the 2010 census information aggregated at the local labor markets identified by Blyde et al. (2019). The table shows the descriptive statistics for local labor markets in and out of our main sample as well as their statistical difference. *** indicates significance at the 1% level, ** indicates significance at the 5% level and * indicates significance at the 10% level.

Table 2: Baseline labor market characteristics and magnitude of credit supply shocks

Observable Characteristics by Shock Size (2012)			
Variable	Below Median Shock	Above Median Shock	Difference
Population (thousands)	415.372	532.353	116.980
	(2,667.753)	(1,054.888)	(189.105)
Fraction of population under 15 yo	0.299	0.302	0.003
	(0.032)	(0.030)	(0.003)
Fraction of population between 15 and 64	0.612	0.615	0.003
	(0.027)	(0.027)	(0.003)
Fraction of population over 65 yo	0.079	0.071	-0.008***
	(0.026)	(0.020)	(0.002)
Fraction of population born in State	0.872	0.862	-0.010
	(0.105)	(0.091)	(0.009)
Fraction of pop. who lived in a different state in 2005	0.026	0.025	-0.000
	(0.027)	(0.017)	(0.002)
Fraction of pop. that speaks indigenous language	0.079	0.071	-0.008
	(0.162)	(0.152)	(0.015)
Fraction of pop. that's illiterate	0.092	0.095	0.004
	(0.053)	(0.058)	(0.005)
Fraction of pop. with completed elementary school (and no more)	0.194	0.184	-0.010***
	(0.038)	(0.039)	(0.004)
Fraction of pop. with completed secondary school (and no more)	0.217	0.216	-0.002
	(0.041)	(0.043)	(0.004)
Fraction of pop. with health insurance	0.329	0.335	0.007
	(0.116)	(0.119)	(0.011)
Fraction of pop. with seguro popular	0.367	0.341	-0.026*
	(0.155)	(0.147)	(0.014)
Fraction of pop. that's catholic	0.864	0.845	-0.019*
	(0.104)	(0.111)	(0.010)
Fraction of HH with female head	0.227	0.232	0.005
	(0.037)	(0.034)	(0.003)
Fraction of HH with dirtfloor	0.074	0.078	0.004
	(0.070)	(0.066)	(0.006)
Fraction of HH with electricity	0.967	0.970	0.003
	(0.034)	(0.033)	(0.003)
Fraction of HH with water	0.864	0.845	-0.019
	(0.119)	(0.141)	(0.012)
Fraction of HH with sewerage	0.847	0.862	0.015
	(0.139)	(0.121)	(0.012)
Observations	231	230	461

Notes: Authors' estimation based on the 2010 census information aggregated at the local labor markets identified by Blyde et al. (2019), and our estimates of the credit supply shocks. The table shows the descriptive statistics for local labor markets above and below the median credit supply shock in our sample, as well as their statistical difference. *** indicates significance at the 1% level, ** indicates significance at the 5% level and * indicates significance at the 10% level.

Table 3: Effect of credit supply shocks on loan originations at the local labor market level

Dependent Variable: Log of Total New Credit to Small Firms			
	1	2	3
Shock in period t	0.841***	0.828***	0.833***
	(0.303)	(0.309)	(0.311)
Shock in period t-1		-0.105	-0.111
		(0.293)	(0.312)
Shock in period t-2			-0.0488
			(0.185)
N	1938	1938	1938
R-sq	0.995	0.995	0.995

Notes: Authors' estimation of equation (1) for log of loan originations to small firms in local labor markets as the dependent variable. Regressions include local labor markets and year fixed. The table shows point estimates of the effect of credit supply shocks on loan originations. Observations are weighted by number of workers in small firms in each labor market-year cell. Standard errors are clustered at the local labor market level. *** indicates significance at the 1% level, ** indicates significance at the 5% level and * indicates significance at the 10% level.

Table 4: Effect of credit supply shocks on employment

Dependent Variable: Change in Log of Formal Employees in Small Firms			
	1	2	3
Shock in period t	0.0445***	0.0438**	0.0458**
	(0.0172)	(0.0177)	(0.0190)
Shock in period t-1		-0.00532	-0.00805
		(0.0147)	(0.0153)
Shock in period t-2			-0.0220
			(0.0141)
N	1937	1937	1937
R-sq	0.283	0.283	0.284

Notes: Authors' estimation of equation (1) for changes in log of formal employees in small firms in each labor markets as the dependent variable. Regressions include local labor markets and year fixed. The table shows point estimates of the effect of credit supply shocks on changes in employment. Observations are weighted by number of workers in small firms in each labor market-year cell. Standard errors are clustered at the local labor market level. *** indicates significance at the 1% level, ** indicates significance at the 5% level and * indicates significance at the 10% level.

Table 5: Effect of credit supply shocks on low wage employment

Dependent Variable: Change in Log of Formal Employees in Small Firms		
	Low Wage Employees	High Wage Employees
	1	2
Shock in period t	-0.0201	0.0898**
	(0.0343)	(0.0432)
N	1935	1930
R-sq	0.387	0.305

Notes: Authors' estimation of equation (1) for changes in log of formal employees earning less and more than two minimum wages in small firms in each labor market as the dependent variable. Regressions include local labor markets and year fixed effects. The table shows point estimates of the effect of credit supply shocks on changes in low wage employment and high wage employment in column (1) and (2) respectively. Observations are weighted by number of workers in small firms in each labor market-year cell in 2010. Standard errors are clustered at the local labor market level. *** indicates significance at the 1% level, ** indicates significance at the 5% level and * indicates significance at the 10% level.

Table 6: Effect on credit characteristics

Dependent Variable:	*By collateral*		*By firms age*		
	Log Change Credit with Collatetal	Log Change Credit without Collatetal	Log Change Credit for New Firms	Log Change Credit for Old Firms	Log Change Interest Rate
Shock in period t	-0.324	0.441**	2.071***	0.392*	-0.250***
	(0.356)	(0.209)	(0.422)	(0.211)	(0.0854)
N	1200	1928	1060	1626	1938
R-sq	0.621	0.609	0.313	0.506	0.785

Notes: Authors' estimation of equation (1) for main outcome variables. Regressions include local labor markets and year fixed effects. The first two columns show results for differentiating log credit changes for credit with and without collateral. Columns three and four differentiate log credit changes for new firms (5 years old or less) and older firms (more than 5 years old). The last column contains results for the log change of the average interest rate. The table shows point estimates of the effect of credit supply shocks on changes in credit characteristics. Observations are weighted by number of workers in small firms in each labor market-year cell in 2010. Standard errors are clustered at the local labor market level. *** indicates significance at the 1% level, ** indicates significance at the 5% level and * indicates significance at the 10% level.

Table 7: Effect of credit supply shocks (ENOE sample)

Panel A: All Labor Markets with Observations in ENOE

Dependent Variable:	Log Credit	Log Employment (IMSS)	Log Total Employment (ENOE)	Log Formal Employment (ENOE)	Log Informal Employment (ENOE)
Shock in period t	0.884***	0.0429**	0.102	0.0550	0.104
	[0.308]	[0.0179]	[0.129]	[0.165]	[0.151]
N	1,224	1,224	1,224	1,224	1,224

Panel B: Cities for which ENOE Sample is Representative

Dependent Variable:	Log Credit	Log Employment (IMSS)	Log Total Employment (ENOE)	Log Formal Employment (ENOE)	Log Informal Employment (ENOE)
Shock in period t	1.476***	0.0514***	0.255**	0.0853	0.330**
	[0.263]	[0.0185]	[0.105]	[0.112]	[0.130]
N	140	140	140	140	140

Notes: Authors' estimation of equation (1) for different outcome variables. Regressions include local labor markets and year fixed effects. The table shows point estimates of the effect of credit supply shocks on changes in credit and employment. Observations are weighted by number of workers in small firms in each labor market-year cell in 2010. Standard errors are clustered at the local labor market level. *** indicates significance at the 1% level, ** indicates significance at the 5% level and * indicates significance at the 10% level.

Table 8: Effect of credit supply shocks in local labor markets and municipalities

Panel A: Local Labor Markets as the Unit of Analysis

	Log Change in Credit	Log Change in Formal Employees	Log Change in Low Wage Employees	Log Change in High Wage Employees
Shock in period t	0.978***	0.0445***	-0.0201	0.0898**
	(0.303)	(0.0172)	(0.0343)	(0.0432)
N	1938	1937	1935	1930
R-sq	0.995	0.283	0.387	0.305

Panel B: Municipalities as the Unit of Analysis

	Log Change in Credit	Log Change in Formal Employees	Log Change in Low Wage Employees	Log Change in High Wage Employees
Shock in period t	0.703**	0.0352**	0.00968	0.0412*
	(0.274)	(0.0171)	(0.0321)	(0.0246)
N	4050	4037	4033	3977
R-sq	0.172	0.250	0.325	0.236

Notes: Authors' estimation of equation (1) for different outcome variables using local labor markets (panel A) or municipalities (panel B) as the unit of analysis. Regressions include region and year fixed effects. The table shows point estimates of the effect of credit supply shocks on changes in credit and employment. Observations are weighted by number of workers in small firms in each labor market-year cell in 2010. Standard errors are clustered at the local labor market level. *** indicates significance at the 1% level, ** indicates significance at the 5% level and * indicates significance at the 10% level.

Table 9: Robustness checks

Panel A: Controlling for linear trends by local labor market characteristics

Dependent Variable:	Log Change in Credit	Log Change in Formal Employees	Log Change in Low Wage Employees	Log Change in High Wage Employees
Credit Supply Shock in Period t	0.710***	0.0433**	0.00995	0.0590**
	(0.185)	(0.0170)	(0.0218)	(0.0280)
N	1938	1937	1935	1930
R-sq	0.996	0.332	0.454	0.305

Panel B: Controlling for local labor demand shocks

Dependent Variable:	Log Change in Credit	Log Change in Formal Employees	Log Change in Low Wage Employees	Log Change in High Wage Employees
Credit Supply Shock in Period t	0.825***	0.0403**	-0.0199	0.0901**
	(0.310)	(0.0173)	(0.0344)	(0.0433)
N	1937	1937	1935	1930
R-sq	0.995	0.289	0.387	0.305

Notes: Authors' estimation of equation (1) for main outcome variables. Regressions include local labor markets and year fixed effects. Panel A further controls for local labor markets demographics characteristics displayed in Table 2 interacted with year dummies. These characteristics include the share of the population in different age intervals (0-14 and 15-64), share of migrants, share of indigenous population, share with different schooling (illiterate, primary and secondary), share not cover with social insurance, and share living in households with electricity. Panel B controls for local labor demand shocks estimated by equation (3), which controls for the predicted changed in employment given the industry composition of each local labor market and the national employment trends in each industry. The table shows point estimates of the effect of credit supply shocks on changes in credit and employment. Observations are weighted by number of workers in small firms in each labor market-year cell in 2010. Standard errors are clustered at the local labor market level. *** indicates significance at the 1% level, ** indicates significance at the 5% level and * indicates significance at the 10% level.