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Cross-border effects of regulatory spillovers: evidence from Mexico

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Abstract

I study the spillover of a macroprudential regulation in Spain to the Mexican financial system via Mexican subsidiaries of Spanish banks. The spillover caused a drop in the supply of household credit in Mexico. Municipalities with a higher exposure to Spanish subsidiaries experienced a larger contraction in household credit. These localized contractions caused a drop in macroeconomic activity in the local non-tradable sector. Estimates of the elasticity of loan-demand by the non-tradable sector to changes in household credit supply range from 1.6–3.5. These results emphasize the potential for cross-border effects of regulations in the presence of global banks.

Key words: Regulatory spillovers, capital shock, household credit.

JEL classification: F36, F42, G21.

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1 Introduction

Does macroprudential regulation have cross-border consequences on economic activity through the presence of global banks? An attempt to answer this question confronts two key challenges. The first challenge is to establish a causal link between a regulatory action and bank behaviour since both may be driven by confounding factors.[1] The second challenge is to identify the effect of any change in bank behaviour on economic activity.[2]

I address these challenges by using micro-data to study the effects of a specific macroprudential regulation in Spain on Mexico via the Mexican subsidiaries of Spanish banks. The Spanish regulation, even though unrelated to credit conditions in Mexico, caused a contraction in household credit supplied by these subsidiaries in Mexico. The variation in exposure to this contraction across Mexican municipalities provides a quasi-experiment to study the effect of drops in household credit supply on macroeconomic activity in different industrial sectors. I use credit issued to a sector as a proxy for investment and production in that particular sector to show that the localized contractions in household credit supply resulting from the Spanish regulation caused a contraction in economic activity in the non-tradable sector of Mexican municipalities.[3]

This unique combination of the *source* (a macroprudential regulation) and *nature* (lending to households) of the spillover has allowed me to study the macroeconomic effects of shocks in lending to households in an emerging economy.[4] Another key feature of the spillover was that the Spanish regulation had an asymmetric effect on lending to Mexican households

[1] Recent contributions to the literature have shown an impact of macroprudential regulations on cross-border bank lending. Cetorelli and Goldberg (2012), Houston et al. (2012) and Aiyar et al. (2014) study the effect of macroprudential regulations using cross-country data on bank lending.

[2] The academic literature on the effects of financial shocks has studied the impact on both bank lending (for example Peek and Rosengren (1997), Khwaja and Mian (2008), Schnabl (2012) and Iyer et al. (2013)) and economic activity (for example Peek and Rosengren (2000), Paravisini (2008), Chodorow-Reich (2014) and Paravisini et al. (2015)). To the best of my knowledge this is the first paper to establish a link between a cross-border spillover of a macroprudential regulation and macroeconomic activity.

[3] More than 80% of firm credit issued by commercial banks in Mexico is in the form of working capital. This feature makes credit aggregated at the level of industrial sectors a suitable proxy for economic activity in those sectors.

[4] Among recent contributions, Mian et al. (2013), Mian and Sufi (2014), Mondragon (2014) and Favara and Imbs (2015) have studied the economic effects of shocks to household balance sheets in the US. This paper studies the causal impact of a negative shock to household credit in an emerging economy. Further, distinctly from the earlier contributions which have relied on the distribution of domestic shocks for identification, my paper relies on the effects of a foreign macroprudential regulation.

and firms. Evidence based on loan-level data on lending to firms suggests that there was no change in lending to Mexican firms at the intensive or the extensive margin by the subsidiaries of Spanish banks as a consequence of the regulation.

The Spanish regulation was introduced in two waves in early 2012 by the Government of Spain to alleviate uncertainty surrounding the quality of the balance sheet of Spanish banks. This regulation imposed significant loan-loss provisions on Spanish real-estate assets held by Spanish banks as of December 2011.[5] The provision requirements of the regulation met near universal compliance by June 2012. BBVA and Santander - the two largest Spanish banking groups - reported additional provisions of 4.4 billion and 6.1 billion euros respectively in response to the regulation.[6] Neither bank raised additional equity to cover the provision requirements given the elevated cost of equity during this period.

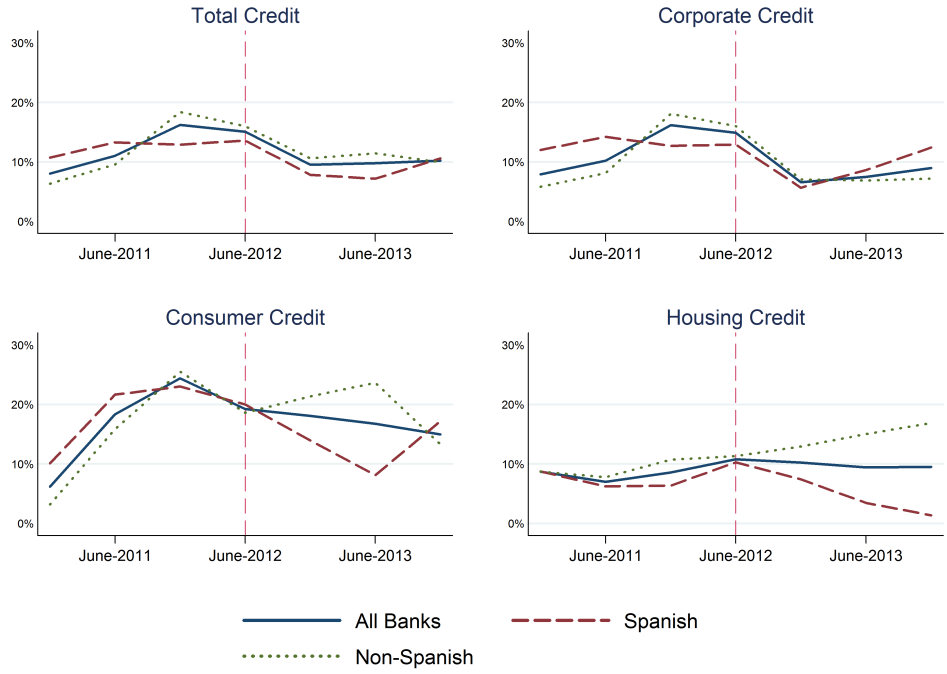
The hit to the capital position of the parent banks affected the operations of the Mexican subsidiaries of these two Spanish banking groups. Together, the two subsidiaries accounted for 48% of mortgages and 44% of consumer credit issued by commercial banks in Mexico in June 2012. These subsidiaries significantly contracted lending to Mexican households in the immediate aftermath of the regulation.

Figure 1 shows growth rates for commercial credit issued by Spanish and non-Spanish banks in Mexico during 2010-2013. There is a clear difference in the growth rate of consumer and housing credit issued by Spanish and non-Spanish banks after June 2012. Remarkably, there is no coincident difference between Spanish and non-Spanish banks in lending to firms. I exploit the variation in this shock to household credit supply across Mexican municipalities as a quasi-experiment. I use a difference-in-differences specification to show that municipalities with greater exposure to Spanish banks experienced larger declines in the growth rate of household credit. In particular, municipalities with a 10% higher pre-shock share of Spanish banks in the household credit market, the treatment variable, experienced a 2.5% higher drop in the growth rate of household credit between June 2012 to June 2013. This drop is seen in lending to households in the form of both mortgages and consumer credit.

[5]It is worth noting that the regulation was aimed solely at Spanish real estate assets and not at any other international real estate assets held by the Spanish banks through their branches or subsidiaries.

[6]The Spanish regulation affected more than 10% of the entire loan portfolio for BBVA, coverage for which went up from 18% in 2011 to 43% in 2012 (*Source:* Page 104, Risk Management, BBVA Annual Report 2012). The impact on the capital position of the Spanish banks was therefore quite large and unexpected.

Figure 1: Growth in credit lending by Spanish and non-Spanish banks in Mexico



Note: This figure plots growth rates of credit issued by Spanish and non-Spanish banks in Mexico during December 2010 to December 2013. The growth rate is calculated against the level a year ago for the corresponding credit type. There is a sharp decline in the growth rate of lending to households by Spanish banks after June 2012 (lower panels). Top left panel shows that there is no such contrast in the aggregate growth rate of lending to firms by Spanish and non-Spanish banks.

The reliance on an international source allows for clean identification of the shock to household credit supply. This is because identification in this paper is based on two key factors - relevant aspects of the Spanish regulation were unexpected and secondly, were unrelated to macroeconomic conditions in Mexico. Based on these factors, I argue that the contractions in lending to households at a municipality level are unlikely to be the result of expectations (as in Adelino et al. (2016)) or household demand (as in Gropp et al. (2014)). I can reject these alternative hypotheses since any valid confounding factor would have to be correlated with the treatment variable (exposure to Spanish banks).

I also study the impact of the localized contractions in household credit on macroeconomic activity in different economic sectors at a municipality level. As has been argued in Mian et al. (2013), a decline in household credit can lower aggregate demand and thereby affect

economic activity in the non-tradable sector of the economy.[7] I test whether the supply shock to household credit in Mexican municipalities also affected economic activity in any particular economic sector. In order to do so, I merge the data on lending to households with data on lending to 4-digit NAICS industrial sectors (279 in total) at a municipality level. I use credit at an industrial/sectoral level as a proxy for economic activity in that particular industry/sector. Credit issued by commercial banks to firms in Mexico is largely in the form of working capital (see table 1 (c)) and therefore a suitable proxy for economic activity.

As per the classification in Mian and Sufi (2014) and Mondragon (2014), I treat industries in the retail and restaurant sectors as non-tradable at a municipality level.[8] Mexican municipalities which experienced a larger contraction in lending to households also experienced a contraction in lending to the non-tradable sector.

Three pieces of evidence strongly suggest that the localized contractions in the non-tradable sector were a consequence of localized drops in lending to households (i.e. a drop in local aggregate demand) and not driven by a direct supply shock from Spanish banks. Firstly, the contraction in lending to the non-tradable sector in high exposure municipalities can be seen in lending by both Spanish and non-Spanish banks. Secondly, the contraction in the non-tradable sector is also observed in a sub-sample of Mexican municipalities in which at least 90% of the credit to firms in the non-tradable sector is issued by non-Spanish banks. Finally, I document a drop in the average interest rate of newly issued loans (or *marginal loans*) to firms in the non-tradable sector in the high exposure municipalities. This finding is consistent with a contraction in the local demand for goods and services produced by the non-tradable sector. If the contraction was the result of a direct supply shock from Spanish

[7] I develop a model of a Mexican municipality to develop intuition for the underlying mechanism. A shock to the level of household credit affects local aggregate demand as households delever in the face of lower available credit or if banks refuse to refinance or rollover existing debt. Since economic activity in the non-tradable sector is a function of the level of local demand, the model predicts a positive comovement between shocks to household credit and changes in investment and production in the non-tradable sector. The key assumption necessary to deliver comovement between household credit and local economic activity is short-term labour immobility between Mexican municipalities. Details of the model can be accessed in the online appendix for the paper. Key theoretical contributions that have studied demand effects of changes in household finance on economic activity are Eggertsson and Krugman (2012), Guerrieri and Lorenzoni (2017)and Midrigan and Philippon (2016).

[8] I remain agnostic about the classification in Mian and Sufi (2014) and test whether exposure to Spanish banks also explains contractions in other sectors of the local economy, such as construction, wholesale or services. As I discuss in section 5, the localized contractions in lending to households coincided with localized contractions in industries in the non-tradable sector alone.

banks, we would expect the average interest of marginal loans to increase.

On the strength of these results, I use exposure to Spanish banks, the treatment variable in the difference in differences specification mentioned earlier, as an instrument to measure municipality-level, exogenous shocks to household credit supply resulting from the Spanish regulation. Based on this IV setup, I estimate an elasticity of credit demand by the non-tradable sector to changes in household credit supply ranging from 1.6-3.5. The reported elasticity is highly robust. Weighted least square results using municipality characteristics such as population and GDP per capita as weights are similar to the OLS results. The coefficients do not change when small municipalities are dropped from the sample, indicating that the estimates are unlikely to be biased by the transmission of shocks across municipalities. Given the high concentration of both credit and economic activity in and around Distrito Federal (Mexico City), robustness checks show that the results are not driven specifically by municipalities in that area.

I have argued that the contraction in lending to the non-tradable sector can not be explained by a direct supply shock from Spanish banks. However, did the Spanish regulation have any direct impact on lending to Mexican firms? I use loan-level data from the Mexican credit registry and a regression specification akin to Khwaja and Mian (2008) to study whether there was a change in the contractual terms of marginal loans offered by the Spanish banks to Mexican firms obtaining such loans from multiple banks in the immediate aftermath of the Spanish regulation. Controlling for firm fixed-effects, there was no change in the level and average interest rate (intensive margin) of marginal loans offered by Spanish banks vis-a-vis the contractual terms of marginal loans offered by non-Spanish banks to the same firm.

Nor is there any effect at the extensive margin - marginal loans discontinued (exit) or marginal loans issued for the first time (entry) after the regulation was introduced were not more likely to be issued by Spanish banks. This evidence suggests that the international spillover of the Spanish regulation did not have a direct impact on lending to Mexican firms in a borrowing relationship with the subsidiaries of Spanish banks. I discuss factors that may account for this lack of an effect on lending to Mexican firms in section 4.4. While contributions such as Gambacorta and Mistrulli (2004), Faulkender and Petersen (2006) and Jimenez et al. (2012) have focused on the impact of capital requirements on lending to firms, the results of my paper suggest that spillovers from macroprudential regulations can have

asymmetric effects on lending to firms and households by affected banks.

To the best of my knowledge, this is the first paper to establish a causal link between an exogenous drop in the supply of household credit and economic activity driven by the cross-border spillover of a macroprudential regulation. The rest of the paper is organized as follows. Section 2 discusses the macroprudential regulation introduced by the Spanish Government in 2012. Section 3 describes the data and the empirical methodology followed to measure the supply shock to household credit and the subsequent effect on the macroeconomy of Mexican municipalities. Sections 4 and 5 report the empirical results and section 6 concludes.

2 Spanish Regulation and Spillover to Mexico

2.1 Macroprudential regulation in Spain

The newly elected government of Mariano Rajoy in Spain introduced a financial reforms package in early 2012, just 10 weeks after coming to power in December 2011. The reforms were introduced in two rounds - first in February 2012 and then in May 2012 - with the specific aim of restoring investor confidence in Spanish banks by (1) providing greater transparency on the quality of real estate assets in the balance sheet of Spanish banks and (2) by restructuring their balance sheet to reflect the uncertainty in the value of those real estate assets. These twin objectives were attained by imposing loan-loss provisions on asset classes related to Spanish real estate.

The first round of reforms, titled the Royal Decree Law 02/2012 and introduced on 3rd February 2012, significantly revised the loan-loss provisions for assets related to real estate. *Specific* provisions were revised upwards for assets which incurred the greatest impairment in their value during the period, namely assets related to land acquisition, foreclosure or projects under development classified as 'Troubled' or 'Doubtful'. On top of this change, a *one-off* loan-loss provision of 7% was imposed on the outstanding amount on all standard real estate assets as of December 2011.[9] The second round of reforms, the Royal Decree Law

[9]Please see Saurina (2009) for an exhaustive treatment of provision requirements in Spain. *Specific* provisions are the asset specific capital requirements based on the average loan losses resulting from holding that specific asset. *General* provisions are imposed on a per-period basis by the central bank, Banco de España, as a counter-cyclical macroprudential tool. The *general* provisions are akin to the counter-cyclical capital buffers imposed by many regulators in financial systems worldwide. The *one-off* loan-loss provisions in RDL 02/2012 and RDL 18/2012 were on top of any *specific* or *general* provisions held on outstanding real

18/2012 of May 2012, pushed upwards the *one-off* loan-loss provision in RDL 02/2012 by 7-45% for different types of mortgage-backed real estate assets.

The above measures were met with full compliance by the Spanish banks as reported by the Banco de España in their bi-annual Financial Stability Report (FSR) published in November 2012. Even though the compliance deadline was December 31st 2012, the Banco de España reported that nearly all the banks complied with the additional provision requirements by June 2012, far ahead of schedule. Figure 2 (a) from the November 2012 FSR shows a clear uptick in the provisions held by Spanish banks as a percentage of their operating income, an almost 50% increase for the quarter ending in June 2012. Another important consideration for this paper is that the regulations were unanticipated. While there was an anticipation for financial reforms in Spain during late 2011/early 2012, the exact nature and extent of the financial reforms were not clear until the introduction of Royal Decree Law (RDL) 02/2012.[10]

2.2 Cross-border spillover of the regulation to Mexico

The *one-off* loan-loss provisions described in section 2.1 imposed a significant hit to the capital position of Spanish banks. As two of the largest Spanish banking groups, BBVA and Santander bore the largest capital burdens of the twin regulations. Figure 2 (b) shows the very second chart from the 'Earnings Report' in BBVA's 2012 Annual Report which identifies the increase in loan-loss provisions as the primary reason behind the drop in net attributable profits in 2012 (against 2011) despite an increase in operating income. The report argues that the drop in profitability was a result of the 4.4 billion euros hit to retained earnings because of the additional loan-loss provisions imposed by RDL 02/2012 and RDL 18/2012. The corresponding figure for Santander was an outlay of 6.1 billion euros.

BBVA and Santander have a significant presence in Mexico through their respective subsidiaries. Why would the shock to the capital position of the parent bank in Spain affect the operations of Mexican subsidiaries of these two banks which adhere to Mexican

estate loans as of December 2011.

[10]The election manifesto of PP, the winners of the December 2011 elections, mentions the likelihood of financial reforms to confirm banking regulations in Spain with international best standards and with regulations elsewhere in Europe. While the election outcome and some financial reforms post-election were expected, there was no clarity on the nature and extent of the financial reforms. The retrospective loan-loss provisions were particularly unanticipated.

regulations? Bankscope data shows that BBVA Group owned 100% of the equity in BBVA Bancomer Mexico and the Santander Group owned 100% of Santander Mexico as of June 2012. This suggests that funding available to the Mexican subsidiaries was vulnerable to shocks to the capital position of the parent banking groups. In addition, the parent banking groups were not in a position to offset the negative shock to their capital position by issuing additional equity. Equity was particularly expensive for most Spanish banks during this period as evidenced by the elevated levels of their CDS spreads.[11]

The Spanish regulation might have also spilled over to Mexico because of the Mexican subsidiaries using the higher *specific* provisions stipulated in the RDL 02/2012. For example, Santander reports raising provision requirements for mortgages issued in Brazil and Chile in their Annual Report for 2012. Even though neither bank reports doing so in Mexico, in reality, both the channels described above could be at play in the spillover of the twin regulations to the Mexican subsidiaries.

2.3 Effect of the regulation on lending in Mexico

BBVA Bancomer is the largest banking group in Mexico. It was the leading lender of commercial credit of all types - housing credit, consumer credit and corporate credit - in Mexico in 2012.[12] In June 2012, it accounted for 28% of all commercial credit issued by banks in Mexico, with a strong dominance in the mortgage and consumer credit markets where it issued 37% and 44% of loans by value at a national level.[13] Together, BBVA Bancomer and Santander Mexico issued 48% of the household credit and 40% of the commercial credit in the Mexican financial system in 2012.

[11]The elevated CDS spreads were related to the Spanish sovereign debt crisis and came down only after the ECB president Mario Draghi's reassurances to do 'whatever it takes' to preserve the single currency. While a watershed moment in the Eurozone crisis, the effects on CDS spreads were felt only in the last quarter of 2012. In addition, the Mario Draghi announcement is unrelated to the spillover described in this paper since, if anything, it would have caused effects exactly opposite to the ones identified in this paper. For example, lower funding costs for parent banks should lead to an expansion in lending by profitable subsidiaries and not a contraction.

[12]Consumer credit aggregates credit issued as credit cards, payroll credit, personal loans, car loans or durable goods' loans. Corporate credit is the credit issued to entrepreneur's and firms. Commercial credit, distinct from corporate credit, refers to the entire portfolio of credit issued by banks. Almost 98% of housing credit is issued as mortgages - hence housing credit is used interchangeably as mortgage credit.

[13]Not only do Spanish banks have a significant presence in Mexico, Mexico has a weighty presence in the income statements of these banks. 25% and 13% of the annual profits of BBVA and Santander respectively are attributed to Mexico in 2012.

Figure 1 shows that the Mexican subsidiaries of these two banks contracted lending to Mexican households in the immediate aftermath of the introduction of the Spanish regulation. There is a clear decline in the growth rate of lending to households by Spanish banks after June 2012. On the other hand, lending to households by non-Spanish banks experienced faster growth when compared to periods prior to June 2012. This difference in the growth rate of lending to households by Spanish and non-Spanish banks can be seen in both consumer credit (mostly credit cards) and housing credit (mortgages). The annual reports of both BBVA and Santander call out the Mexican mortgage market as being particularly profitable. The Mexican subsidiaries of these banks contracted lending to households at a time when their competitors seem to be doing the exact opposite, indicating their inability to sustain their growth rate in the Mexican household credit market in periods after the introduction of the Spanish regulation.

Another noteworthy feature of figure 1 is the lack of a similar differential trend in the growth rate of lending to firms by Spanish and non-Spanish banks over the same period. This suggests that the effect of the Spanish regulation was concentrated on lending to households. While such an inference can not be made using the aggregate growth trends of figure 1, in the next section I describe the data and empirical strategy used to make causal claims regarding the effect of the regulation on lending and economic activity in Mexico.

3 Data and Empirical Methodology

3.1 Data description

I build a disaggregated database of credit lending in Mexico to study the impact of the Spanish regulation on Mexico. I combine data from two sources - publicly available data from CNBV for household credit and proprietary credit registry data for firm credit to build a half-yearly panel of outstanding credit at a bank-municipality level in Mexico from June 2011 to June 2013.[14]

Household credit is reported monthly at a bank-municipality level and disaggregated into

[14]CNBV stands for *Comisión Nacional Bancaria y de Valores* or the *National Banking and Securities Commission;* http://www.cnbv.gob.mx/Paginas/default.aspx. It is an independent agency in Mexico tasked with the supervision and regulation of the Mexican financial system. Consequently, regulatory financial data is directly reported to the CNBV.

mortgages and consumer credit. Consumer credit is an aggregate of credit issued as credit cards, personal loans, car loans, payroll credit and durable goods' loans. The reason for limiting the database to the period 2011-13 is that municipality level data on the amount of credit issued as credit cards, almost 13% of total commercial credit in our sample, is available only starting February 2011. CNBV only reports the number of credit cards at a municipality level in periods prior to 2011. Even so, the available data allows me to observe changes in lending to households at a municipality level in periods centered around the introduction of the Spanish regulation.

Data on firm credit is obtained from the Mexican credit registry, 'R-04C' (also reported monthly), which includes loan level data on outstanding credit between banks and firms. For each loan, banks report the interest rate, date of origination, maturity, and quality of collateral of the loan. Banks also report firm-level characteristics such as number of employees, revenue and industry. A firm's industry is represented by a 5-digit code that can be matched to the 2007 NAICS industrial classification at a 5 digit level.[15] I aggregate the outstanding credit reported in the credit registry at a 4-digit NAICS industry-bank-municipality level.

The 279 4-digit NAICS industries are classified into the non-tradable and tradable sectors based on the criterion used in Mian and Sufi (2014). All industries that are a part of the retail and restaurant sector are classified as non-tradable and industries with gross imports+exports greater than USD $ 500,000 or USD 10,000/employee are classified as tradable. The tradable industries are identified using disaggregated trade data for Mexico in year 2010 downloaded from the International Trade Statistics Database maintained by Comtrade, UN. The 'gross trade/employee' data is obtained by combining the industry-level trade data with the industry-level employment data from the 2009 Mexican Census.[16] Remaining industries are classified as per the description of their 2-digit NAICS code (for e.g. 'Construction', 'Wholesale', etc.).

In addition to aggregating lending to firms at a bank-municipality-industry level, I use

[15]'R-04C' 5-digit codes perfectly match NAICS-2007 Industrial Classification for most industries except the NAICS-2007 industries starting with 44 and 45 (43 and 46 in 'R-04C'), the 'Retail' and 'Wholesale' sectors respectively. A reconciliation between the unmatched 'R-04C' industry and their counterpart in NAICS-2007 is provided in the online Appendix.

[16]While I use the same thresholds used by Mian and Sufi (2014) to classify industries as tradable, I find a close match with the industries identified by them as tradable despite my classification being based on Mexican trade data. Industries identified as tradable largely belong to the manufacturing sector.

the loan-level data from the credit registry to study the effect of the Spanish regulation on lending to Mexican firms at the intensive and the extensive margin.

3.2 Summary Statistics

The credit database described above covers outstanding credit to households (as mortgages and consumer credit) and firms (by sector) for 999 Mexican municipalities.[17] Figures 3 (a) and (b) shows the distribution of these municipalities on a map of Mexico and table 2 shares summary statistics for municipality characteristics. The municipalities in the database have an average size of 1193 sq. km. and are drawn from all the 32 Mexican states. The low level of financialization in Mexico is also apparent in access to credit at a municipality level. The average Mexican municipality in the sample has a Credit/GDP ratio of just 19.9%. The level of credit at a municipality level expanded year on year; I report this increase using changes in log-levels of credit series between June 2011 and June 2012. The variation in the presence of Spanish banks is measured by municipality-specific share of Spanish banks in markets for different credit types. These shares are computed using the bank-municipality dimension of the database. The share of Spanish banks in the household credit market has an average value of 50% and is normally distributed across the municipalities (figure 5 (a)).

I also consider a sub-sample of municipalities with very limited lending by Spanish banks to firms in the non-tradable sector. This reduces the sample to 379 municipalities in which the non-Spanish banks issue at least 90% of the credit to firms in the non-tradable sector. Any effect on lending to the non-tradable sector identified in this sub-sample is unlikely to be the result of a direct supply shock from Spanish banks. As I shall show shortly, the results from the full sample closely match the results from the sub-sample. These 379 municipalities are also drawn from all the 32 states, are uniformly distributed across the different regions of Mexico (figures 4 (a) and (b)) and importantly, have a normally distributed share of Spanish banks in the household credit market which matches the distribution of this variable in the full sample (table 5 (b)). Changing the 90% threshold used to define the sub-sample does

[17] Mexico has 2456 municipalities. The municipalities included in the sample are the ones which have complete data on all credit types for the entire duration covered by the database. The 999 municipalities comprising the sample account for 97.9% and 94.1% of the total credit issued by commercial banks and total economic activity at a national level. The corresponding figure for the sub-sample of 379 municipalities (described later in this sub-section) is 7.4% and 11.1% respectively. The credit figures are based on data for June 2012. The GDP shares are based on the 2009 Mexican census.

not alter the sub-sample results in a significant way.

3.3 Empirical methodology

I use exposure to Spanish banks at a municipality level to measure local changes in lending and economic activity as a consequence of the spillover of the Spanish regulation via the Mexican subsidiaries of Spanish banks. I use exposure to Spanish banks to define a difference-in-differences specification to measure these localized effects.

Figure 6 depicts the quasi-experiment underlying the difference-in-differences specification. I construct a treatment variable $Post \cdot Spanish\ Share_{j,2011}$ where $Post$ refers to periods after June 2012 and $Spanish\ Share_{j,2011}$ is the share of Spanish banks in the household credit market in municipality 'j' in June 2011, a year before the introduction of the Spanish regulation. I regress changes in lending to households in periods centered around the introduction of the Spanish regulation (June 2012) on the treatment variable as per the following specification,

$$\Delta \log(h_{jt}) = \beta \cdot Post \cdot Spanish\ Share_{j,2011} + f_j + f_t + \varepsilon_{jt}, \tag{1}$$

where h_{jt} is the household credit issued in municipality 'j' at time 't', f_j is the municipality fixed-effect and f_t is the time fixed-effect. The time fixed-effects control for time-specific factors that affect all municipalities equally and the municipality fixed-effects control for municipality-specific trends in the growth of household credit. Standard errors are clustered at a municipality level to allow for serial correlation in the credit series.

The coefficient β on the treatment variable is the change in the growth rate of household credit explained by exposure to Spanish banks in periods after the introduction of the Spanish regulation. I interpret the coefficient to be the causal impact of the Spanish regulation based on the assumptions underlying the difference-in-differences specification. Numerous factors support the use of this identification strategy. The treatment variable - exposure to Spanish banks in the household credit market - is normally distributed (figure 5), does not correlate with municipality specific characteristics and high exposure municipalities are not concentrated in a particular region of Mexico (figure 3 (b)). Figure 7 (a) shows parallel trends in the growth rate of housing credit between high-exposure and low-exposure municipalities and placebo tests discussed in section 5.1 also support the lack of municipality-specific trends

in relevant credit series.

The distribution of the supply shock across Mexican municipalities allows me to study the effect of local contractions in household credit on economic activity in different sectors of the local economy. I do so by estimating ψ_s in equation 2 where I use $Post \cdot Spanish\ Share_{j,2011}$ as an instrument for the municipality level drops in lending to households related to the Spanish regulation. The regression specification is given by,

$$\Delta \log(c_{sjt}) = \psi_s \cdot \Delta \hat{\log}(h_{jt}) + f_j + f_t + \zeta_{sjt}, \tag{2}$$

where c_{sjt} is the credit lent to sector 's' in municipality 'j' at time 't'. More than 80% of all the credit reported in the Mexican credit registry is in the form of working capital (see table 1 (c)) and I treat credit to sector 's' as a proxy for economic activity in sector 's'. Therefore, ψ_s can be interpreted as an estimate of the elasticity of credit demand by sector 's' to changes in lending to households.

The exclusion restriction requires that the instrument be uncorrelated with the error term in the second stage, i.e. $E(Post \cdot Spanish_{j,2011} * \zeta_{sjt}) = 0$. I test for this condition by showing that any effect on lending to any specific sector, particularly the non-tradable sector, explained by the instrument is unlikely to be a direct effect or driven by omitted variables, for e.g., as would be the case if the Spanish shares were to capture a direct supply shock to firms in the non-tradable sector. I do this in three ways. First, I show that the contraction in lending to the non-tradable sector was seen in lending by both Spanish and non-Spanish banks. Second, I share evidence on contractions in the non-tradable sector in a sub-sample of 379 municipalities where at least 90% of the credit to firms in the non-tradable sector is issued by non-Spanish banks. Finally, I check whether the changes in the average interest rate of marginal loans issued to firms in the non-tradable sector in high exposure municipalities between June 2011 and December 2012 were consistent with a drop in credit demand and not credit supply.[18]

Did the Spanish regulation have a direct impact on lending to Mexican firms? I use firm loan-level data from the Mexican credit registry and a regression specification akin to Khwaja and Mian (2008) to study changes in the lending relationship between Spanish banks

[18]June 2011 is roughly a year before the Spanish regulation took effect. December 2012 is roughly 6 months after the Spanish banks reported compliance with the regulations. Please see section 4.3 for the specification for the regressions based on average interest rates of marginal loans issued to different sectors.

and Mexican firms at the intensive and the extensive margin.

For changes in the intensive margin, I study a sample of Mexican firms obtaining marginal loans from multiple banks in June 2011 and December 2012. The marginal loans data is at a bank-firm level and includes the total size and average interest rate of all the loans originated by a bank to a firm in the three months preceding a given time period.[19] I test whether there was a change in the loan-terms (in size and average interest rate) issued by Spanish banks to Mexican firms in this sample. The regression specification is given by,

$$\Delta(loan - term)_{ib} = \beta_{int} \cdot \mathbb{D}_b(Spanish = 1) + f_i + \eta_{1ib}, \tag{3}$$

where $\Delta(loan - term)_{ib}$ refers to the change in the loan-terms of marginal loans issued to firm 'i' by bank 'b' between June 2011 and December 2012, $\mathbb{D}_b$ is the dummy variable for Spanish banks and f_i is the firm fixed-effect. The firm fixed-effect controls for factors that affect a firm's lending relationships with all banks proportionately, such as a change in the demand for credit over the period. The coefficient on the Spanish banks' dummy shows whether the terms of marginal loans offered by a Spanish bank to a given firm changed over the period in a manner distinct from the terms offered by non-Spanish banks to the same firm.

I also test whether the Spanish regulation affected lending to Mexican firms at the extensive margin using the sample of firms obtaining marginal loans from multiple banks in June 2011 and December 2012. I create a variable $Exit_{ib}$ which takes value 1 in case a firm i that obtained marginal loans from bank b in June 2011 did not do so in December 2012. I regress the variable $Exit_{ib}$ on a Spanish bank dummy in the presence of firm fixed-effects as per equation 4 to test whether the loans discontinued in December 2012 were more likely to be those issued by Spanish banks. Equivalently, I create a variable $Entry_{ib}$ which takes value 1 in case the firm i obtained a marginal loan from bank b in December 2012 but not in June 2011. This variable helps to test whether the new loans originated for the first time in December 2012 were more likely to be issued by Spanish banks.

$$Exit_{ib} = \beta_{ext} \cdot \mathbb{D}_b(Spanish = 1) + f_i + \eta_{2ib}, \tag{4}$$

[19] For example, the marginal loans for June 2011 are all the loans originated during the period April-June 2011. In equation 3, I study the changes in the loan-terms of marginal loans for June 2011 and December 2012.

The *exit* and *entry* regressions are run on slightly different sub-samples of bank-firm relationships. As in Khwaja and Mian (2008) and others, *exit* regressions are based on bank-firm relationships that existed in June 2011 (before the regulation) and *entry* regressions are based on bank-firm relationships in December 2012 (after the regulation).

In contrast with earlier contributions, I focus my study of the intensive and extensive margin effects on marginal loans only and not all outstanding loans. This has been possible because the date of origination in the loan-level data allows me to focus on the marginal loans issued at a bank-firm level in a period before and a period after the introduction of the Spanish regulation.

4 Empirical Results

4.1 Spillover of the regulation to Mexican households

I use the difference-in-differences specification described in equation 1 to show that municipalities with a higher exposure to Spanish banks saw a greater decline in the growth rate of household credit in periods after the introduction of the Spanish regulation. To measure the slow-down in lending to households, I use annual data on lending to households from June 2011 to June 2013, a year prior to and after the Spanish regulation came into effect. I report regression results based on equation 1 in tables 4 (a) and (b).

The estimated β (the coefficient on the treatment variable) is highly negative and significant. Results show that a 10% higher exposure to Spanish banks predicts a drop of 2.5% in the growth rate of household credit an year after the introduction of the Spanish regulation. Further, the slow-down in lending to households comes from drops in the growth rates of both consumer credit and housing credit (columns (2) and (3) of table 4 (a)). These results hold for the full sample of 999 municipalities and the sub-sample of 379 municipalities (table 4 (b)). Thus, the variation in the share of Spanish banks in local household credit markets leads to a variation in 'treatment' to the supply shock resulting from the Spanish regulation.

I check whether the contraction in household credit in high exposure municipalities comes specifically from lending by the two Spanish banks. This unearths an interesting result. While Spanish banks contracted lending in high-exposure municipalities, non-Spanish banks (particularly the Mexican banks) expanded lending to households in the same municipalities.

Therefore, the coefficient β captures the contraction in lending to Mexican households net off any household credit substituted by non-Spanish banks.

4.2 Effect on local non-tradable sector

Mexican municipalities that experienced a contraction in lending to households also experienced a contraction in lending to the non-tradable sector. This is evident in table 5 which shows results from regressing growth in lending to specific sectors on the treatment variable using the specification described in equation 1.[20] In this sub-section and the next, I share evidence which suggests that this contraction in lending to the non-tradable sector reflects a drop in economic activity driven by the contraction in lending to households.

I find that the contraction in lending to the non-tradable sector in table 5 (a) is unlikely to be the result of a direct supply shock from Spanish banks. The contraction in lending to the non-tradable sector is also seen in the sub-sample of 379 municipalities where non-Spanish banks issue more than 90% of lending to firms in the non-tradable sector (table 5 (b)). Further, I disaggregate the municipality-level credit to the non-tradable sector used in table 5 into credit issued by Spanish and non-Spanish banks. I test whether the contraction in lending to the non-tradable sector captured by the treatment variable ($Post{\cdot}Spanish\ Share_{j,2011}$) can be seen in lending by both Spanish and non-Spanish banks and report results in table 6. The result from the sub-sample of 379 municipalities (table 6 (b)) strongly suggests that the contraction in the non-tradable sector resulted from lending by both Spanish and non-Spanish banks and is unlikely to be driven by a direct supply shock from Spanish banks. The corresponding result from the full sample of municipalities is less conclusive.

I argue that the localized contractions in lending to the non-tradable sector are reflective of a contraction in economic activity driven by localized contractions in lending to households. I formalize this claim by estimating the elasticity of credit demand by the non-tradable sector to changes in lending to households (ψ_s in equation 2) using the IV approach described in section 3.3. Since changes in lending to the non-tradable sector and changes in lending to households are both endogenous, I instrument for changes in lending to households using the treatment variable $Post \cdot Spanish\ Share_{j,2011}$. This way I exploit the quasi-experiment to measure localized drops in lending to households resulting from the Spanish regulation (the

[20] I find parallel trends in the growth rate of credit to firms in the non-tradable sector between high-exposure and low-exposure municipalities (figure 7 (b)).

first stage) to identify an effect on economic activity in the non-tradable sector (the second stage).

The elasticity of credit demand by the non-tradable sector to changes in lending to households are reported using regressions based on the full sample and the sub-sample of 379 municipalities in tables 7 and 8 respectively. The first stage has a F-stat of 52 for the full sample and 14.5 for the sub-sample. The estimated elasticity is 1.65 for the full sample and 3.49 for the sub-sample. In other words, a 1% drop in the growth rate of household credit caused an estimated drop of 1.65-3.49% in the growth of credit demand by the non-tradable sector across Mexican municipalities.

4.3 Interest rate evidence on the demand channel

I provide additional evidence for the claim that the contraction in lending to the non-tradable sector in high exposure municipalities can not be explained by a direct supply shock from Spanish banks. Changes in the average interest rate of marginal loans issued to firms in the local non-tradable sector were consistent with a drop in the localized demand for their goods and services and not a direct supply shock from Spanish banks. A contraction in credit demand by the non-tradable sector is expected to lead to a decline in the average interest rate of marginal loans. If the contraction was instead driven by a supply shock from Spanish banks, the effect on the interest rate of marginal loans would be opposite.

I use loan-level contractual terms to create a database of the average interest rate of marginal loans issued to different sectors at a municipality level. In particular, I compare the average interest rate of marginal loans issued to the tradable and the non-tradable sector in December 2012 (6 months after the shock) against the level in June 2011 (a year before the shock). I use the difference-in-differences specification described in equation 1 to test whether there was a change in the interest rate of the marginal loans issued to specific sectors that is explained by the treatment variable, $Post \cdot Spanish\ Share_{j,2011}$. The regression specification is given by,

$$IntRate_{sjt} = \gamma_s \cdot Post \cdot Spanish\ Share_{j,2011} + f_j + f_t + \vartheta_{sjt},$$

where $IntRate_{sjt}$ is the average interest rate of marginal loans issued to sector 's' in municipality 'j' at time 't', f_j and f_t are municipality and time dummies respectively, and

$Post \cdot Spanish\ Share_{j,2011}$ is the treatment variable.

Results in table 9 show a decline in the average interest rate of marginal loans issued to the non-tradable sector in high exposure municipalities. This drop is observed in both the full sample (table 9 (a)) and sub-sample municipalities (table 9 (b)). The sub-sample result is crucial since it rules out the drop being a by-product of a supply shock to firms which generally receive higher interest rates (such as riskier firms). The result from the sub-sample, where credit to firms in the non-tradable sector is largely issued by non-Spanish banks, strongly suggests that the contraction in the non-tradable sector is unlikely to be the result of a direct supply shock from Spanish banks.

4.4 Spillover of the regulation to Mexican firms

Even if the contraction in the non-tradable sector was not driven by a direct supply shock from Spanish banks, were loans to Mexican firms by Spanish banks affected by the Spanish regulation? In this sub-section I share loan-level evidence on the lack of any direct impact of the Spanish regulation on lending to Mexican firms at the intensive or the extensive margin.

I report regressions results based on equation 3 in table 10 which test for changes in the loan-size and average interest rate (intensive margin) of marginal loans issued at a bank-firm level between June 2011 and December 2012. Marginal loans issued by Spanish banks did not see a change in loan size and average interest rate that were significantly different from the changes in the size and average interest rate of marginal loans issued to the same firm by non-Spanish banks. These results are based on a sample of 792 firms that obtain marginal loans from multiple banks in June 2011 and December 2012 (columns (1)-(4)). Results do not change in the sub-sample of 103 firms belonging to the non-tradable sector (columns (5)-(8)).

At the extensive margin, I use the regression specification described in equation 4 to show that marginal loans discontinued or marginal loans issued for the first time after the regulation were not more likely to be issued by Spanish banks. For regressions on the discontinuation of marginal loans, I use all the marginal loans issued in June 2011 at a bank-firm level. Among these loans, a bank-firm relationship discontinued in December 2012 is indicated by the variable $Exit_{ib}$. Similarly, I use all the marginal loans issued in December 2012 at a bank-firm level to test whether a bank-firm relationship that did not exist in June

2011 (indicated by $Entry_{ib}$) was more likely to be with Spanish banks. The regression results are reported in table 11.

Controlling for firm fixed-effects, marginal loans discontinued in December 2012 were not more likely to be those issued by Spanish banks (columns (1)-(2)). Interestingly, even though marginal loans issued for the first time in December 2012 were more likely to be issued by Spanish banks (columns (3)-(4)), the coefficients are an order of magnitude smaller than the ones reported in Khwaja and Mian (2008). Finally, the lack of any extensive margin effect also holds true in a restricted sample of only firms in the non-tradable sector (columns (5)-(8)).

Together, these results suggest that the Spanish regulation only led to a contraction in lending to households. The regulation did not affect lending to Mexican firms at the intensive or extensive margin. I discuss two candidate explanations for this asymmetric effect. Firstly, the Regulatory Consistency Assessment Program (RCAP) for Mexico, conducted by the Bank for International Settlements, highlights that Mexico imposes relatively high capital requirements on mortgages[21]. A second compelling argument, unrelated to the capital requirements on individual asset classes, is the unobserved strength of relationship between banks and firms. Academic literature has emphasized the importance of proprietary information acquisition (or relationship lending,) as the basis of a bank-firm link (as in Sharpe (1990), Rajan (1992) and von Thadden (1995)). It is possible that, having received a shock to their capital position, Mexican subsidiaries of Spanish banks prioritised lending from which they are more likely to extract relationship or incumbency rents in the future.

In reality both these factors might underlie the asymmetric effect. A more granular picture of the contraction in lending to Mexican households is necessary to distinguish between falsifiable theories that may account for the asymmetric effect. I do not conduct an empirical assessment of the aforementioned channels given the current lack of loan-level data on lending to households in Mexico.

[21]The latest RCAP for Mexico discusses the capital requirements over the period 2012-2016. The report mentions that in context of risk weights, "the Mexican treatment for residential mortgage exposure is more conservative than Basel". Admittedly, the higher requirements apply to mortgage loans with loan-to-value ratios (LTV) > 80. I do not observe lending to Mexican households at the right level of disaggregation to assess whether only loans with higher LTVs experienced a contraction as a result of the Spanish regulation.

5 Robustness Checks

5.1 Placebo tests

I argued in section 4 that parallel trends (in figure 7) suggest the lack of differential trends in household credit issued in high and low exposure Mexican municipalities. I provide additional evidence on the lack of differential trends using placebo tests to show that exposure to Spanish banks does not predict any changes in the growth rate of lending to households or firms in periods before June 2012. The placebo experiment is centered around June 2011 and figure 6 shows a diagrammatic representation of the main experiment and the placebo experiment next to each other. The variable $Post - Placebo$ identifies periods after June 2011, the treatment period of the hypothetical placebo experiment. I check whether the alternate treatment variable $Post - Placebo \cdot Spanish\ Share_{j,2011}$ predicts any differences in the growth of credit to households and firms in the non-tradable sector during December 2010 to December 2011. If there indeed were municipality-specific trends that were captured by exposure to Spanish banks, the alternate treatment variable would capture those trends in the placebo experiment.

The placebo experiment results for mortgage credit and credit to firms in the non-tradable sector are shown in table 12. The share of Spanish banks in the household credit market does not predict any differential trends among high and low exposure municipalities in periods before the introduction of the Spanish regulation. Therefore, the municipality level contractions in lending to households and firms in the non-tradable sector explained by exposure to Spanish banks in the main experiment is unlikely to be the result of municipality-specific trends.

5.2 Municipality sub-samples

I report robustness checks against any potential bias in the estimates due to the transmission of local shocks across the borders of a municipality. The average size of a Mexican municipality in the full sample of 999 municipalities is 1193 sq. km., with the municipality at the 10th percentile spread across 65 sq. km. There is a potential for the transmission of a shock to household credit in a given municipality on economic activity in bordering municipalities driven by demand spillovers which can bias the estimates of the elasticities

reported in section 4.2. Such demand spillovers are likely to be stronger for smaller municipalities, particularly if there is a bunching of small municipalities. In table 14, I show that the treatment effect on lending to the non-tradable sector is robust to the exclusion of small municipalities.

Column (1) of table 14 shows the contraction in the non-tradable sector in high exposure municipalities. In columns (3) and (4), I repeat this regression after excluding municipalities in Distrito Federal (DF) and nearby states of Estado de Mexico and Morales which form a large contiguous area of relatively small municipalities.[22] Dropping these central municipalities does not change the coefficient on the treatment variable. In Column (5), the results also hold for a sample of municipalities that are larger than 200 sq. km.. Moreover, the coefficient is stable to the threshold we pick to drop observations from smaller municipalities. These results, which hold for both the full sample of 999 and sub-sample of 379 municipalities, suggest that the estimates in tables 5 and 7 are unlikely to be biased by the transmission of shocks across municipalities.

As an additional check, I report results by aggregating data at a metropolitan level. Mexico has 59 metropolitan areas. In results I present in the online appendix, the loss in power by aggregating data by metropolitan areas does not allow me to identify any effect of exposure to Spanish banks on lending to households or firms in the non-tradable sector.

5.3 Firm size

I test whether the contraction in the non-tradable sector reported in table 5 is driven by firms of any particular size. I repeat the difference-in-differences specification of equation 1 on credit to the non-tradable sector broken down by firm size. The credit registry provides a categorical variable indicating the number of employees of every borrowing firm. I split the credit to the non-tradable sector at a municipality level into three categories - credit to firms with less than 50 employees, firms with 50-200 employees and firms with >200 employees. Results reported in table 15 show that the drop in lending to the non-tradable sector is largely driven by firms with less than 50 employees.

Does the lack of an effect on large firms go against the hypothesis that the drop in credit demand by the non-tradable sector was the result of local drops in household spending in

[22]The result also holds if we drop the municipalities in Tlaxcala and Puebla, states which form a part of Valle de Mexico, along with DF, Estado de Mexico and Morales, the largest metropolitan area in Mexico.

high exposure municipalities? There are three reasons to believe this not to be the case. Firstly, there was not a concurrent drop in credit demand by small firms in other sectors. Secondly, the drop in lending to small firms in the non-tradable sector was also seen in the sub-sample of 379 municipalities where most of the credit to firms in the non-tradable sector is issued by non-Spanish banks. Finally, it is likely that the larger firms in the non-tradable industries are better equipped to move their inventories across municipalities which insulates them from local shocks.

5.4 Alternate definitions for non-tradable industries

I remain agnostic about the classification criterion used to classify 4-digit NAICS industries to the non-tradable sector by showing the effect of treatment on credit series based on alternative classification criterion. I take the municipality level credit to industries in the retail and restaurant sectors as the *base* and separately add credit to firms in 5 different sectors - Construction, Wholesale, Transportation, Professional Services and Other Services - to check whether the results of table 5 still hold after the inclusion of the additional sectors. The results for the resulting credit series are reported in table 16.

Except in the case of the transportation sector, exposure to Spanish banks does not explain any contraction in the alternative credit series created after the inclusion of the different sectors. This result is consistent across the full sample and the restricted sample of 379 municipalities. This suggests that the localized contractions in household credit resulting from the Spanish regulation affected economic activity in industries belonging to the retail, restaurant and transportation sectors.

6 Conclusion

I identify an exogenous drop in household credit supply in Mexico resulting from the cross-border spillover of a macroprudential regulation in Spain. Rough calculations suggest that the spillover led to ~600 million USD worth of mortgages not being issued in Mexico over the period June 2012 to June 2013, equivalent to almost a 1% drop in the growth of mortgages at an aggregate level.

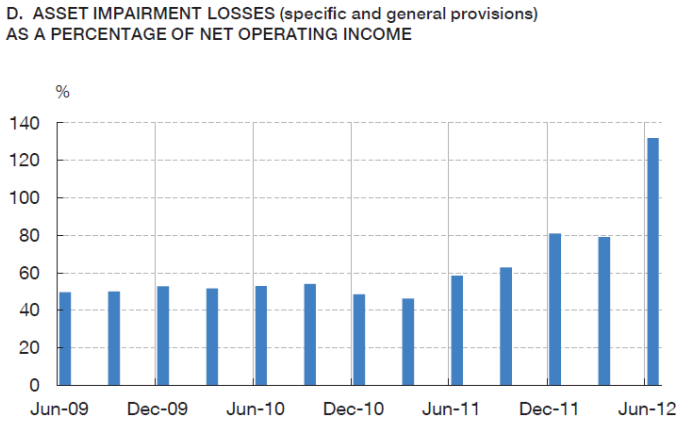
I use the variation in exposure to this drop across Mexican municipalities as a quasi-

experiment to show the effect of a believably exogenous, localized contraction in lending to households on economic activity. Lack of access to credit can force households to deleverage or lower the likelihood of receiving debt refinancing or debt rollover services from banks. Theoretically, it is relatively simple to show a link between household leverage or lending to financially constrained households on aggregate demand and economic activity in the non-tradable sector. While earlier studies, such as those by Mian et al. (2013) and Mondragon (2014), have found evidence for this link in the US, this paper shows that such a link exists in a relatively under-financed economy such as that of Mexico. The impact on the non-tradable sector highlights how the transmission of financial shocks can affect economic activity through an impact on lending to households, over and above any impact on lending to firms.

Thus, this paper establishes a causal link between a regulation in Spain and lending and macroeconomic activity in Mexican municipalities with a higher exposure to Spanish banks. A key feature of the cross-border spillover of the Spanish regulation is that it caused an asymmetric effect on lending to households and firms. I document evidence that the spillover did not have any direct impact on lending to Mexican firms by Spanish banks. The potential for asymmetric effects on different parts of a bank's lending portfolio emphasizes the importance of accounting for this possibility to avoid unintended consequences from macroprudential regulations.

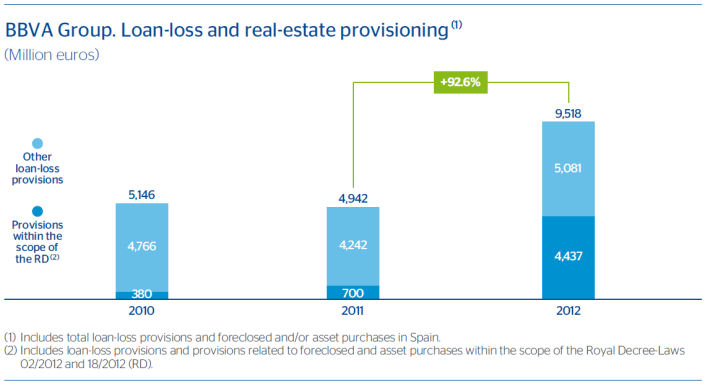
Figure 2: Effect of Spanish regulation on loan-loss provisions

(a) Loan-loss provisions vs Net Operating Income in Spain



Source: Financial Stability Report, Banco de España, November 2012 (page 30). Note: This figure shows the sharp increase in the provisions held by Spanish banks (% of net operating income in June 2012) as a consequence of the macroprudential regulations RDL 02/2012 and RDL 18/2012.

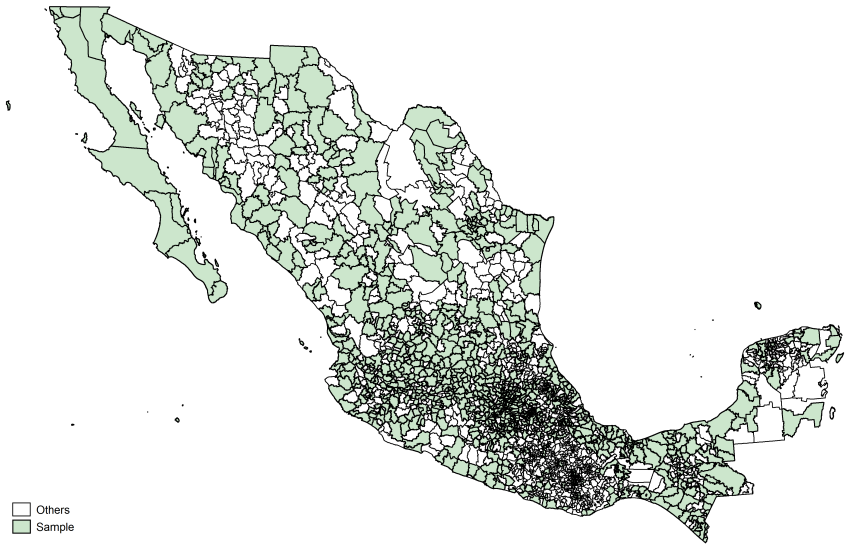
(b) Loan-loss provisions imposed on BBVA by RDL 02/2012 and RDL 18/2012



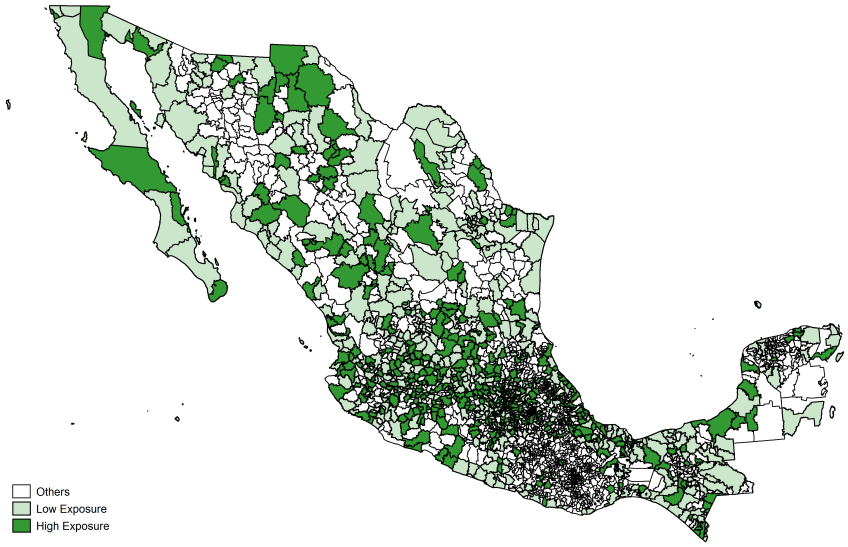
Source: BBVA in 2012, the BBVA banking group annual report for 2012 *(page 65). Note:* This figure shows the total burden of loan loss provisions imposed on BBVA by RDL 02/2012 and RDL 18/2012 (dark blue area in the bar for 2012).

Figure 3: Mexican municipalities covered by the database

(a) The full sample



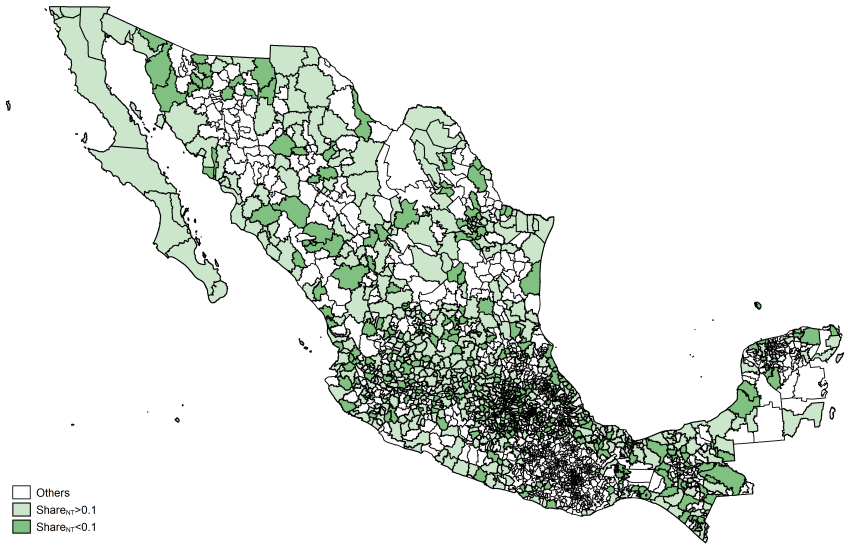
(b) Share of Spanish banks in the household credit market across Mexican municipalities



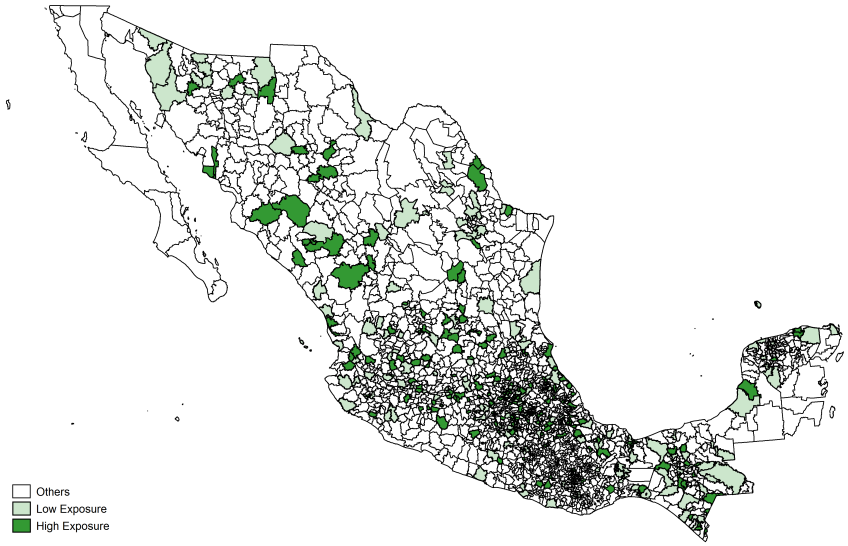
Note: Figure (a) shows the spatial distribution of the 999 municipalities covered in the database. Figure (b) shows the spatial distribution of municipalities with high and low exposure to Spanish banks. High exposure municipalities had a share of Spanish banks in the household credit market higher than the median value in June 2011.

Figure 4: Sub-sample of 379 municipalities

(a) Sub-sample municipalities in darker green



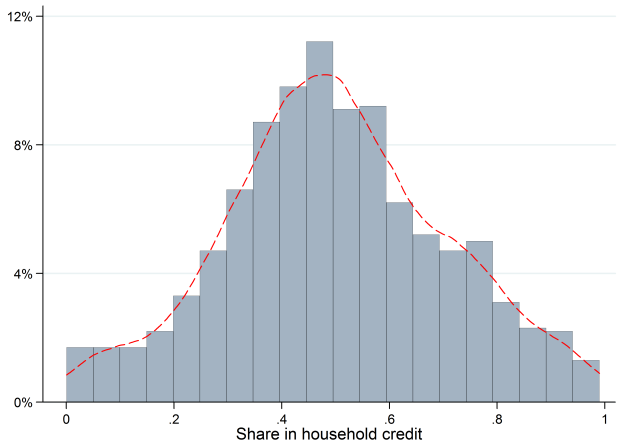
(b) Share of Spanish banks in the household credit market across sub-sample municipalities



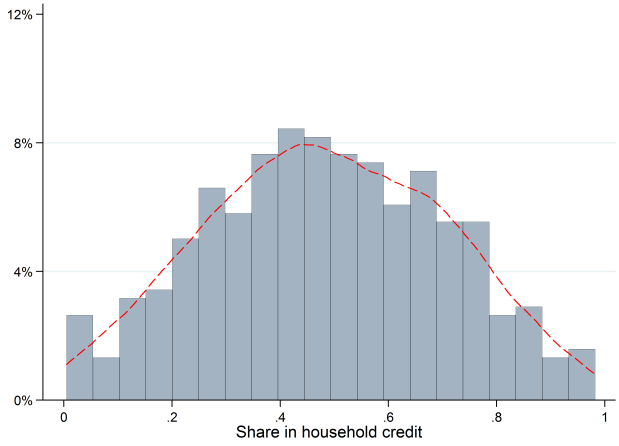
Note: Figure (a) shows the spatial distribution of the 379 municipalities Spanish banks issue less than 10% of the credit issued to firms in the non-tradable sector (i.e.$Share_{NT} < 0.1$). Figure (b) distinguishes high exposure municipalities in which the share of Spanish banks in the household credit market was higher than the median value in June 2011.

Figure 5: Distribution of the share of Spanish banks in household credit markets across Mexican municipalities

(a) Full sample - 999 municipalities

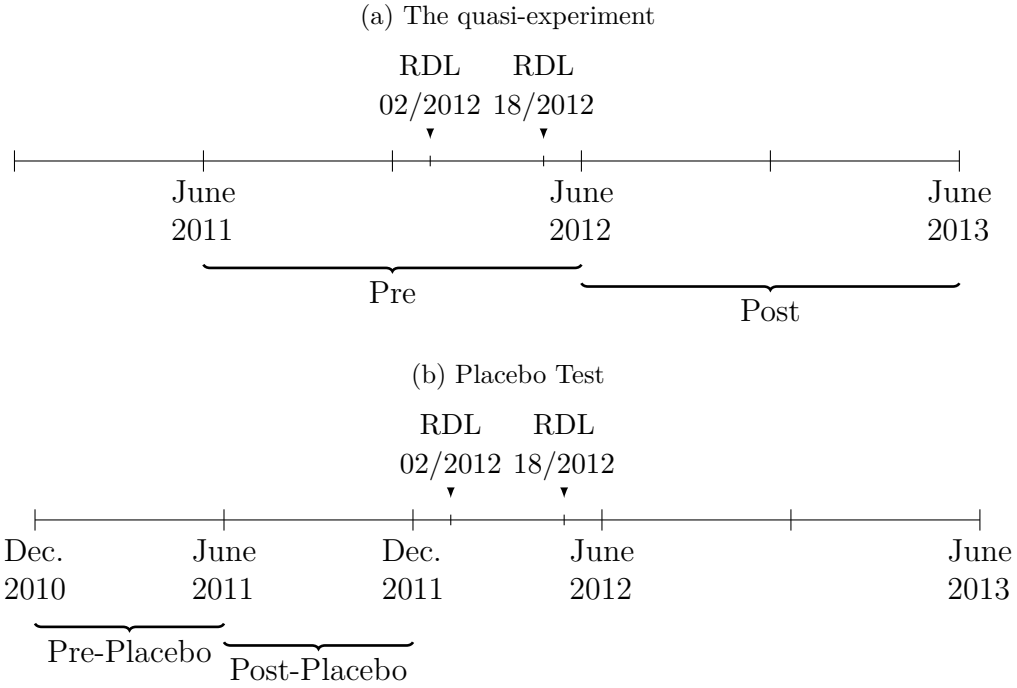


(b) Sub-sample - 379 municipalities



Note: The figures above show the distribution of the share of Spanish banks in household credit markets across Mexican municipalities for (a) the full sample and (b) the sub-sample of 379 municipalities. The sub-sample also presents a rich variation in the exposure to the financial shock as captured by the municipality level share of Spanish banks in the household credit market.

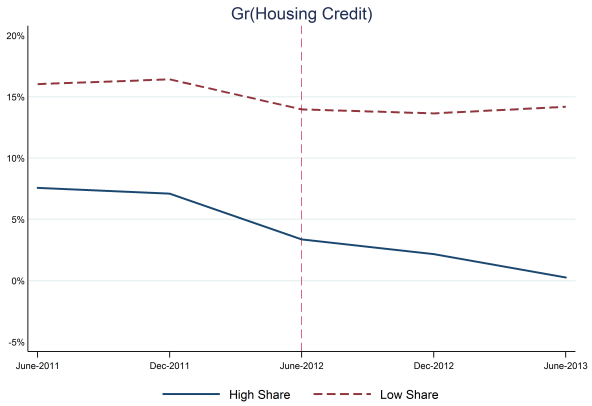
Figure 6: Experiment design



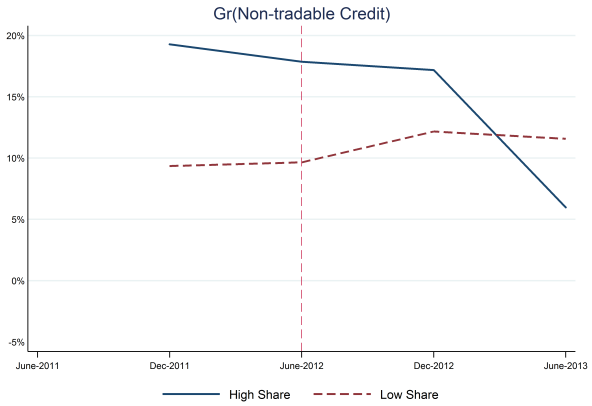
Note: The figure above shows a diagrammatic representation of the quasi-experiment. The Spanish regulation, RDL 02/2012 and RDL18/2012, were introduced in early February and May 2012. The supply shock to household credit is measured by comparing the growth in household credit across Mexican municipalities with different levels of exposure to the shock a year before (*Pre*) and after (*Post*) June 2012 using a difference-in-differences specification. The placebo test is conducted using a hypothetical experiment in June 2011 to show that the exposure to Spanish banks does not predict different trends in the growth of household credit in periods before the introduction of the Spanish regulation.

Figure 7: Parallel trends

(a) Parallel trends in growth of housing credit



(b) Parallel trends in growth of credit to the non-tradable sector



Note: The figures above plot the growth rate for total housing credit and credit to the non-tradable sector in Mexican municipalities with high and low exposure to Spanish banks. High exposure municipalities were in the top tercile of the distribution of the municipality-level share of Spanish banks in the household credit market in June 2011. Low exposure municipalities were in the bottom tercile of the distribution of the municipality-level share of Spanish banks in the household credit market in June 2011. A similar picture emerges when municipalities are classified into high or low exposure groups based on the median municipality share of Spanish banks in the household credit market.

Table 1: Summary statistics for credit issued by commercial banks in Mexico in June 2012

(a) Share of Spanish and non-Spanish banks

	Mortgages	Consumer Credit	Corp. Cred.	Total Cred.
Spanish	48%	44%	35%	38%
Non-Spanish	52%	56%	65%	62%

(b) Summary statistics for mortgages issued by the largest banks

Bank	Share	Maturity (in month)	Avg. Int Rate
BBVA Bancomer	36.7%	229	11.1
Santander	11.7%	207	10.4
Banamex	15.2%	212	10.4
HSBC	4.7%	232	10.2
Scotiabank	11.3%	222	10.5
Banorte/Ixe	15.8%	222	10.4
Inbursa	0.3%	167	10.0

(c) Summary statistics for corporate credit issued by the largest banks

Bank	Share	Maturity (in months)	Avg. Int Rate	Working Capital %
BBVA Bancomer	20.0%	38	7.4	90%
Santander	16.0%	39	7.5	77%
Banamex	14.9%	37	6.8	90%
HSBC	8.3%	36	7.5	94%
Scotiabank	3.9%	35	6.6	55%
Banorte/Ixe	12.2%	62	8.3	85%
Inbursa	8.3%	57	7.4	100%

Note: Table (a) shows the share of Spanish and non-Spanish banks in different credit markets in Mexico in June 2012. Table (b) shows the market share, average maturity and average interest rate of mortgages and table (c) shows the market share, average maturity, average interest rate and the share of working capital of corporate credit issued by the 7 largest banks in Mexico in June 2012. *Source - CNBV, R-04 credit registry.*

Table 2: Summary statistic for municipality characteristics (full sample)

	count	mean	sd	p10	p90
Population, 2013	999	103446	204974	9898	228190
Area in sq. km.	999	1193	2830	65	2722
GDP p.c., 2010	999	11131	4655	6265	16513
Number of accounts, 2013	999	3995	5031	457	8386
Number of ATM transactions, 2013	999	6633	8100	0	15048
Number of credit cards, 2013	999	1156	2223	165	2463
Access to credit	count	mean	sd	p10	p90
Household credit p.c.[a]	999	6642	20745	910	11326
Corporate credit p.c.[a]	999	7222	79638	71	9562
Total credit p.c.[a]	999	13865	92383	1184	20344
Household credit/GDP[b]	999	0.111	0.525	0.008	0.127
Corporate credit/GDP[b]	999	0.088	0.948	0.001	0.117
Total credit/GDP[b]	999	0.199	1.294	0.011	0.253
Δ log Household credit	999	0.20	0.18	0.00	0.38
Δ log Corporate credit	999	0.29	0.64	-0.26	0.86
Δ log Credit to non-trad. sector	999	0.27	0.77	-0.37	1.18
Δ log Credit to trad. sector	687	0.31	1.18	-0.51	1.26
Exposure to Spanish banks	count	mean	sd	p10	p90
Share in household credit	999	0.50	0.21	0.24	0.78
Share in corporate credit	999	0.33	0.28	0.00	0.77
Share in credit to non-trad. sector	999	0.33	0.35	0.00	0.99
Share in credit to trad. sector	707	0.40	0.37	0.00	1.00
Share in total credit	999	0.46	0.20	0.20	0.73

Source: CNBV, Census 2009, UN Reports, R-04

Note: This table shows the summary statistic for the 999 municipalities covered in the credit database. *a* - per capita figures for 2012. *b* - figure for 2010 using municipality level GDP from census 2009.

Table 3: Summary statistic for municipality characteristics (sub-sample)

	count	mean	sd	p10	p90
Population, 2013	379	44448	72675	7019	88286
Area in sq. km.	379	870	1557	56	1902
GDP p.c., 2010	379	9824	3875	5800	14556
Number of accounts, 2013	379	2252	3018	314	5982
Number of ATM transactions, 2013	379	3842	5414	0	9858
Number of credit cards, 2013	379	655	721	124	1637
Access to credit	count	mean	sd	p10	p90
Household credit p.c.[a]	379	4967	17687	725	6812
Corporate credit p.c.[a]	379	2671	11723	31	5590
Total credit p.c.[a]	379	7638	24489	854	13459
Household credit/GDP[b]	379	0.084	0.315	0.005	0.111
Corporate credit/GDP[b]	379	0.043	0.175	0.000	0.084
Total credit/GDP[b]	379	0.127	0.427	0.008	0.219
Δ log Household credit	379	0.23	0.20	-0.00	0.44
Δ log Corporate credit	379	0.33	0.80	-0.44	1.21
Δ log Credit to non-trad. sector	379	0.24	0.90	-0.56	1.36
Δ log Credit to trad. sector	185	0.38	1.59	-0.51	1.59
Exposure to Spanish banks	count	mean	sd	p10	p90
Share in household credit	379	0.48	0.22	0.19	0.78
Share in corporate credit	379	0.18	0.25	0.00	0.58
Share in credit to non-trad. sector	379	0.01	0.03	0.00	0.05
Share in credit to trad. sector	197	0.29	0.36	0.00	1.00
Share in total credit	379	0.43	0.21	0.14	0.73

Sub-sample municipalities with $\text{Share}_{NT}<0.1$

Note: This table shows the summary statistic for the 379 municipalities with limited lending to firms in the non-tradable sector by Spanish banks. *a* - per capita figures for 2012. *b* - figure for 2010 using municipality level GDP from census 2009.

Table 4: Effect of Spanish regulation on lending to households

(a) Regressions based on the full sample

VARIABLES	(1) Δ log (Household Credit)	(2) Δ log (Housing Credit)	(3) Δ log (Consumer Credit)
Post*Spanish Share$_{2011}$	-0.267***	-0.258***	-0.209***
	(0.0370)	(0.0712)	(0.0436)
Observations	1,998	1,908	1,998
Number of municipalities	999	960	999
R-squared	0.684	0.660	0.624
Mun. Fixed-effects	Yes	Yes	Yes
Time Fixed-effects	Yes	Yes	Yes

Clustered standard errors at a municipality level
*** p<0.01, ** p<0.05, * p<0.1

(b) Regressions based on the sub-sample of 379 municipalities

VARIABLES	(1) Δ log (Household Credit)	(2) Δ log (Housing Credit)	(3) Δ log (Consumer Credit)
Post*Spanish Share$_{2011}$	-0.228***	-0.423***	-0.120*
	(0.0605)	(0.124)	(0.0620)
Observations	758	701	758
Number of municipalities	379	354	379
R-squared	0.626	0.594	0.624
Mun. Fixed-effects	Yes	Yes	Yes
Time Fixed-effects	Yes	Yes	Yes

Clustered standard errors at a municipality level
*** p<0.01, ** p<0.05, * p<0.1

Note: The tables above show regression results of changes in log-levels of credit to households on the treatment variable $Post \cdot Spanish\ Share_{2011}$. Data from two periods are used - June 2012 and June 2013; variable *Post* indicates June 2013. Exposure to Spanish banks is measured by the municipality level share of Spanish banks in the household credit market in June 2011. Table (a) shows results for the full sample and table (b) shows results for the 379 sub-sample municipalities where non-Spanish banks issue at least 90% of the credit to firms in the non-tradable sector. The coefficient on the treatment variable indicates a drop in the growth of household credit in municipalities with a high Spanish share in lending to households.

Table 5: Effect of Spanish regulation on sector level credit

(a) Regressions based on the full sample

VARIABLES	(1) Δ log(Non-trad.)	(2) Δ log(Non-trad.+Const.)	(3) Δ log(Tradable)
Post*Spanish Share$_{2011}$	-0.440**	-0.287*	-0.0560
	(0.186)	(0.173)	(0.249)
Observations	1,998	1,998	1,741
Number of municipalities	999	999	933
R-squared	0.432	0.445	0.514
Mun. Fixed-effects	Yes	Yes	Yes
Time Fixed-effects	Yes	Yes	Yes

Clustered standard errors at a municipality level
*** p<0.01, ** p<0.05, * p<0.1

(b) Regressions based on the sub-sample of 379 municipalities

VARIABLES	(1) Δ log(Non-trad.)	(2) Δ log(Non-trad.+Const.)	(3) Δ log(Tradable)
Post*Spanish Share$_{2011}$	-0.797**	-0.470	-0.461
	(0.321)	(0.305)	(0.593)
Observations	758	758	424
Number of municipalities	379	379	233
R-squared	0.422	0.407	0.544
Mun. Fixed-effects	Yes	Yes	Yes
Time Fixed-effects	Yes	Yes	Yes

Clustered standard errors at a municipality level
*** p<0.01, ** p<0.05, * p<0.1

Note: The tables above show regression results of changes in log-levels of credit to specific sectors on the treatment variable $Post \cdot Spanish\ Share_{2011}$. Data from two periods are used - June 2012 and June 2013; variable *Post* indicates June 2013. Table (a) shows results for the full sample and table (b) shows results for the 379 sub-sample municipalities. In column (1), I report a contraction in lending to the non-tradable sector (retail and restaurant sectors) in high-exposure municipalities. In column (2), I report the effect of exposure to Spanish banks on lending to an alternative credit series which classifies the retail, restaurant and construction sectors as non-tradable. The result from the alternative series suggests that the construction sector was unaffected.

Table 6: Contraction in lending to the non-tradable sector by Spanish and non-Spanish banks

(a) Regressions based on the full sample

VARIABLES	(1)	(2)	(3)
	Δ log (Non-tradable)		
	Total	Spanish	Non-Spanish
Post*Spanish Share$_{2011}$	-0.344*	-0.320	0.0622
	(0.184)	(0.305)	(0.316)
Observations	1,222	1,222	1,222
R-squared	0.526	0.498	0.463
Number of municipalities	656	656	656
Mun. Fixed-effects	Yes	Yes	Yes
Time Fixed-effects	Yes	Yes	Yes

Clustered standard errors at a municipality level
*** p<0.01, ** p<0.05, * p<0.1

(b) Regressions based on the sub-sample of 379 municipalities

VARIABLES	(1)	(2)	(3)
	Δ log (Non-tradable)		
	Total	Spanish	Non-Spanish
Post*Spanish Share$_{2011}$	-1.174**	-1.864*	-1.240**
	(0.562)	(1.027)	(0.576)
Observations	201	201	201
R-squared	0.625	0.571	0.643
Number of municipalities	132	132	132
Mun. Fixed-effects	Yes	Yes	Yes
Time Fixed-effects	Yes	Yes	Yes

Clustered standard errors at a municipality level
*** p<0.01, ** p<0.05, * p<0.1

Note: The tables above show regression results of changes in log-levels of credit to firms in the non-tradable sector on the treatment variable $Post \cdot Spanish\ Share_{2011}$. Credit at a municipality level is further disaggregated into credit issued by Spanish and non-Spanish banks to test whether the contraction in the non-tradable sector observed in the high exposure municipalities was the result of a direct supply shock from Spanish banks. Data from two periods are used - June 2012 and June 2013; variable *Post* indicates June 2013. Results from the sub-sample of 379 municipalities (table (b)) strongly suggest that the contraction reported in the non-tradable sector resulted from credit issued by both Spanish and non-Spanish banks.

Table 7: Elasticity of credit demand by the non-tradable sector to changes in household credit for the full sample

(a) First Stage

VARIABLES	(1)	(2) Δ log (Household Credit)	(3)	(4) Δ log (Household Credit)
Post*Spanish Share$_{2011}$		-0.267***		-0.245***
		(0.0370)		(0.0436)
Observations		1,998		1,336
Number of municipalities		999		667
Mun. Fixed-effects		Yes		Yes
Time Fixed-effectsb		Yes		Yes

Clustered standard errors at a municipality level
*** p<0.01, ** p<0.05, * p<0.1

(b) Second Stage

VARIABLES	(1)	(2)	(3)	(4)
	Δ log (Non-trad.)		Δ log (Tradable)	
	OLS	2SLS	OLS	2SLS
Δ log (Household Credit)	0.570**	1.649**	-0.0659	0.135
	(0.222)	(0.711)	(0.345)	(1.262)
Observations	1,998	1,998	1,405	1,336
Number of municipalities	999	999	737	668
F-stat		52.07		26.15
Mun. Fixed-effects	Yes	Yes	Yes	Yes
Time Fixed-effects	Yes	Yes	Yes	Yes

Clustered standard errors at a municipality level
*** p<0.01, ** p<0.05, * p<0.1

Note: The tables above show IV regression results of changes in log-levels of credit at a sector level on changes in log-levels of credit to households for the full sample of 999 municipalities. Changes in log-levels of household credit are instrumented by the treatment variable based on the municipality level shares of Spanish banks in the household credit market in June 2011. Data from two periods are used - June 2012 and June 2013; variable *Post* indicates June 2013. Table (a) shares the first stage results which show a very high F-stat and table (b) shows the elasticity of credit demand by different sectors to changes in household credit at a municipality level.

Table 8: Elasticity of credit demand by the non-tradable sector to changes in household credit for the sub-sample

(a) First Stage

VARIABLES	(1)	(2) Δ log (Household Credit)	(3)	(4) Δ log (Household Credit)
Post*Spanish Share$_{2011}$		-0.228***		-0.265**
		(0.0605)		(0.110)
Observations		758		348
Number of municipalities		379		174
Mun. Fixed-effects		Yes		Yes
Time Fixed-effectsb		Yes		Yes

Clustered standard errors at a municipality level
*** p<0.01, ** p<0.05, * p<0.1

(b) Second Stage

VARIABLES	(1)	(2) Δ log (Non-trad.)	(3)	(4) Δ log (Tradable)
	OLS	2SLS	OLS	2SLS
Δ log (Household Credit)	0.196	3.488**	-0.0194	2.487
	(0.398)	(1.708)	(0.527)	(2.603)
Observations	758	758	389	348
Number of municipalities	379	379	215	174
F-stat		14.28		5.83
Mun. Fixed-effects	Yes	Yes	Yes	Yes
Time Fixed-effects	Yes	Yes	Yes	Yes

Clustered standard errors at a municipality level
*** p<0.01, ** p<0.05, * p<0.1

Note: The tables above show IV regression results of changes in log-levels of credit at a sector level on changes in log-levels of credit to households for the sub-sample of 379 municipalities. Changes in log-levels of household credit are instrumented by the treatment variable based on the municipality level shares of Spanish banks in the household credit market in June 2011. Data from two periods are used - June 2012 and December 2013; variable *Post* indicates June 2013. Table (a) shares the first stage results which show a high F-stat and table (b) shows the elasticity of credit demand by different sectors to changes in household credit at a municipality level.

Table 9: Effect of Spanish regulation on the average interest rate of marginal loans

(a) Regressions based on the full sample

VARIABLES	(1) Avg. Int. (Non-trad.)	(2) Avg. Int. (Tradable)
Post*Spanish Share$_{2011}$	-2.471**	-0.946
	(1.034)	(1.433)
Observations	1,361	989
Number of municipalities	811	604
R-squared	0.837	0.878
Mun. Fixed-effects	Yes	Yes
Time Fixed-effects	Yes	Yes

Clustered standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

(b) Regressions based on the sub-sample of 379 municipalities

VARIABLES	(1) Avg. Int. (Non-trad.)	(2) Avg. Int. (Tradable)
Post*Spanish Share$_{2011}$	-4.257**	-1.972
	(1.820)	(1.712)
Observations	408	254
Number of municipalities	273	170
R-squared	0.819	0.919
Mun. Fixed-effects	Yes	Yes
Time Fixed-effects	Yes	Yes

Clustered standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Note: The tables above show regression results of the average interest rate of marginal loans issued at a sectoral level in December 2012 and June 2011 on the treatment variable $Post \cdot Spanish\ Share_{2011}$. The variable *Post* indicates December 2012 and exposure to Spanish banks is measured by the municipality level share of Spanish banks in the household credit market in June 2011. Table (a) shows results for the full sample and table (b) shows results for the 379 sub-sample municipalities. Results show a decline in the interest rate charged for marginal loans to firms in the non-tradable sector in municipalities with higher exposure to Spanish banks.

Table 10: Effect of Spanish regulation on lending to Mexican firms at the intensive margin

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	All Firms				Non-Tradable Firms			
	Δ log(Loan Size)		Δ(Int. Rate)		Δ log(Loan Size)		Δ(Int. Rate)	
	OLS	FE	OLS	FE	OLS	FE	OLS	FE
Dummy (Spanish=1)	0.119	0.170*	-0.0244	0.0253	-0.0294	-0.119	-0.0623	-0.326
	(0.0736)	(0.0935)	(0.112)	(0.140)	(0.211)	(0.276)	(0.331)	(0.466)
Observations	1,716	1,716	1,717	1,717	219	219	219	219
R-squared	0.002	0.482	0.000	0.484	0.000	0.396	0.000	0.478
Number of firms		792		792		103		103
Firm Fixed-effects		Yes		Yes		Yes		Yes

Clustered standard errors at a firm level

*** p<0.01, ** p<0.05, * p<0.1

Note: The results above show whether the Spanish regulation affected the average loan size and average interest rate of marginal loans issued to Mexican firms by the Mexican subsidiaries of Spanish banks. The sample includes firms borrowing marginal loans from multiple banks in both June 2011 and December 2012 (columns (1)-(4)). Results show no change in the aforementioned loan-terms of marginal loans issued by Spanish banks in response to the Spanish regulation. The results hold in a sub-sample of firms in the non-tradable sector (columns (5)-(8)).

Table 11: Effect of Spanish regulation on lending to Mexican firms at the extensive margin

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	All Firms				Non-Tradable Firms			
	Exit?		Entry?		Exit?		Entry?	
	OLS	FE	OLS	FE	OLS	FE	OLS	FE
Dummy (Spanish=1)	0.0222**	0.0178	0.0360***	0.0300***	0.0233	0.0437	0.0473**	0.0284
	(0.0104)	(0.0122)	(0.00926)	(0.0110)	(0.0246)	(0.0290)	(0.0229)	(0.0273)
Observations	8,900	8,900	10,614	10,614	1,469	1,469	1,679	1,679
R-squared	0.000	0.517	0.001	0.519	0.001	0.489	0.002	0.546
Number of firms		3,919		4,690		642		753
Firm Fixed-effects		Yes		Yes		Yes		Yes

Clustered standard errors at a firm level

*** p<0.01, ** p<0.05, * p<0.1

Note: The results above show whether the Spanish regulation affected the origination or discontinuation of marginal loans issued to Mexican firms by the Mexican subsidiaries of Spanish banks. The regressions test whether (i) marginal loans issued on June 2011 but discontinued in December 2012 (*exit*) and (ii) marginal loans issued in December 2012 but not in June 2011 (*entry*) were more likely to be issued by Spanish banks (columns (1)-(4)). Neither the '*exit*' nor the '*entry*' of marginal loans is explained by exposure to Spanish banks. The results hold in a sub-sample of firms in the non-tradable sector (columns (5)-(8)).

Table 12: Effect of Spanish regulation on credit lending in Mexico - Placebo

VARIABLES	(1)	(2)	(3)	(4)
	Δ log (Housing Credit)		Δ log (Non-trad.)	
	Full sample	Sub-sample	Full sample	Sub-sample
Post-Placebo*Spanish Share$_{1106}$	0.117	0.141	0.209	0.145
	(0.114)	(0.177)	(0.331)	(0.541)
Observations	1,889	689	1,959	728
Number of municipalities	951	350	998	379
R-squared	0.551	0.567	0.464	0.471
Mun. Fixed-effects	Yes	Yes	Yes	Yes
Time Fixed-effects	Yes	Yes	Yes	Yes

Clustered standard errors at a municipality level

*** p<0.01, ** p<0.05, * p<0.1

Note: The table above shows regression results of changes in log-levels of household credit and credit to firms in the non-tradable sector on an alternate treatment variable - $Post - Placebo \cdot Spanish\ Share_{2011}$. Data from two periods are used - June 2011 and December 2011; variable $Post - Placebo$ indicates December 2011 and checks for any evidence of treatment assuming a placebo experiment which took place in June 2011. The regression specification is similar to the one used for table 4. The alternate treatment variable does not explain any municipality specific trends in lending to households or to the non-tradable sector picked up by exposure to Spanish banks ($Spanish\ Share_{2011}$).

Table 13: Effect of Spanish regulation on the average interest rate of marginal loans - Placebo

(a) Regressions based on the full sample

VARIABLES	(1) Avg. Int. (Non-trad.)	(2) Avg. Int. (Tradable)
Post*Spanish Share$_{2011}$	-0.785	2.576*
	(1.099)	(1.356)
Observations	1,359	978
Number of municipalities	818	594
R-squared	0.811	0.828
Mun. Fixed-effects	Yes	Yes
Time Fixed-effects	Yes	Yes

Clustered standard errors at a municipality level
*** p<0.01, ** p<0.05, * p<0.1

(b) Regressions based on the sub-sample of 379 municipalities

VARIABLES	(1) Avg. Int. (Non-trad.)	(2) Avg. Int. (Tradable)
Post*Spanish Share$_{2011}$	-0.903	0.546
	(2.124)	(1.809)
Observations	402	238
Number of municipalities	268	157
R-squared	0.788	0.904
Mun. Fixed-effects	Yes	Yes
Time Fixed-effects	Yes	Yes

Clustered standard errors at a municipality level
*** p<0.01, ** p<0.05, * p<0.1

Note: The tables above show regression results of the average interest rate of marginal loans at a sectoral level in December 2013 and June 2011 on the treatment variable $Post \cdot Spanish\ Share_{2011}$. Variable *Post* indicates December 2013. Results show that the treatment variable does not pick up any significant difference in the average interest rate of the marginal loans issued to firms in the non-tradable and tradable sector at a municipality level in December 2013 when compared to the levels in June 2011. Results do not change if the average interest rates for December 2011 are used instead of December 2013. These are the placebo tests for the results in table 9 which show a drop in the average interest rate of marginal loans issued to firms in the non-tradable sector in high Spanish share municipalities in December 2012.

Table 14: Effect of Spanish regulation on lending to the non-tradable sector - robustness Checks

(a) Regressions based on the full sample

VARIABLES	(1)	(2)	(3)	(4)	(5)
	Δ log (Non-trad.)				
	OLS	WLS	excluding-DF	excluding-DF/MX/MO	Area>200 sq. km.
Post*Spanish Share$_{2011}$	-0.440**	-0.436*	-0.433**	-0.427**	-0.435**
	(0.186)	(0.226)	(0.188)	(0.197)	(0.214)
Observations	1,998	1,998	1,966	1,728	1,400
Number of municipalities	999	999	983	864	700
R-squared	0.432	0.461	0.431	0.439	0.460
Mun. Fixed Effects	Yes	Yes	Yes	Yes	Yes
Time Fixed Effects	Yes	Yes	Yes	Yes	Yes

Clustered standard errors at a municipality level
*** p<0.01, ** p<0.05, * p<0.1

(b) Regressions based on the sub-sample of 379 municipalities

VARIABLES	(1)	(2)	(3)	(4)	(5)
	Δ log (Non-trad.)				
	OLS	WLS	excluding-DF	excluding-DF/MX/MO	Area>200 sq. km.
Post*Spanish Share$_{2011}$	-0.797**	-1.035**	-0.798**	-0.809**	-0.679*
	(0.321)	(0.464)	(0.321)	(0.329)	(0.379)
Observations	758	758	754	662	490
Number of municipalities	379	379	377	331	245
R-squared	0.422	0.442	0.422	0.440	0.459
Mun. Fixed-effects	Yes	Yes	Yes	Yes	Yes
Time Fixed-effects	Yes	Yes	Yes	Yes	Yes

Clustered standard errors at a municipality level
*** p<0.01, ** p<0.05, * p<0.1

Note: The regression results in the tables above check for the robustness of the contraction in the non-tradable sector in Mexican municipalities with high exposure to Spanish banks reported in table 5. Table (a) shows results for the full sample and table (b) shows results for the 379 sub-sample municipalities. The coefficient reported in column (1) is robust to dropping the observations of municipalities in and around Mexico City (belonging to the states Distrito Federal, Mexico and Morales). The results are also robust to dropping smaller municipalities (column (5)) which are more likely to suffer any bias from the spillover of localized shocks across their borders.

Table 15: Effect of Spanish regulation on lending to the non-tradable sector by firm-size

(a) Regressions based on the full sample

VARIABLES	(1)	(2)	(3)
	Δ log (Non-trad.)		
Size, # of emp.	1-50	50-200	>200
Post*Spanish Share$_{2011}$	-0.479**	0.186	0.556
	(0.195)	(0.382)	(1.235)
Observations	1,978	519	218
Number of municipalities	991	266	113
R-squared	0.436	0.330	0.691
Mun. Fixed Effects	Yes	Yes	Yes
Time Fixed Effects	Yes	Yes	Yes

Clustered standard errors at a municipality level
*** p<0.01, ** p<0.05, * p<0.1

(b) Regressions based on the sub-sample of 379 municipalities

VARIABLES	(1)	(2)	(3)
	Δ log (Non-trad.)		
Size, # of emp.	1-50	50-200	>200
Post*Spanish Share$_{2011}$	-0.680**	-1.080	-2.236
	(0.337)	(1.121)	(1.780)
Observations	750	100	28
Number of municipalities	376	52	15
R-squared	0.433	0.292	0.894
Mun. Fixed Effects	Yes	Yes	Yes
Time Fixed Effects	Yes	Yes	Yes

Clustered standard errors at a municipality level
*** p<0.01, ** p<0.05, * p<0.1

Note: The tables above show regression results of changes in log-levels of credit to the non-tradable sector by firm-size on the treatment variable $Post \cdot Spanish\ Share_{2011}$. Data from two periods are used - June 2012 and June 2013; variable *Post* indicates June 2013. Table (a) shows results for the full sample and table (b) shows results for the 379 sub-sample municipalities. The contraction in lending to the non-tradable sector is concentrated in firms with 1-50 employees.

Table 16: Effect of Spanish regulation on lending to the non-tradable sector - alternate classification criterion

(a) Regressions based on the full sample

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
	Δ log (Non-trad. + ...)					
	-	Const.	Wholesale	Trans.	Prof. Services	Other Services
Post*Spanish Share$_{2011}$	-0.440**	-0.287*	-0.140	-0.463**	-0.0857	-0.304*
	(0.186)	(0.173)	(0.180)	(0.180)	(0.174)	(0.182)
Observations	1,998	1,998	1,998	1,998	1,996	1,998
Number of municipalities	999	999	999	999	999	999
R-squared	0.432	0.445	0.410	0.434	0.462	0.416
Mun. Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Time Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes

Clustered standard errors at a municipality level
*** p<0.01, ** p<0.05, * p<0.1

(b) Regressions based on the sub-sample of 379 municipalities

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
	Δ log (Non-trad. + ...)					
	-	Const.	Wholesale	Trans.	Prof. Services	Other Services
Post*Spanish Share$_{2011}$	-0.797**	-0.470	-0.363	-0.820**	-0.428	-0.621*
	(0.321)	(0.305)	(0.290)	(0.317)	(0.280)	(0.325)
Observations	758	758	758	758	758	758
Number of municipalities	379	379	379	379	379	379
R-squared	0.422	0.407	0.409	0.418	0.464	0.397
Mun. Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Time Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes

Clustered standard errors at a municipality level
*** p<0.01, ** p<0.05, * p<0.1

Note: The tables above show regression results of changes in log-levels of the credit series based on alternate criterion for classifying industries as non-tradable on the treatment variable $Post \cdot Spanish\ Share_{2011}$. The different credit series are obtained by using lending to the retail and restaurant sectors as the *base* and adding credit to specific sub-sectors (mentioned as column names) to the *base*. Data from two periods are used - June 2012 and June 2013; variable *Post* indicates June 2013. Table (a) shows results for the full sample and table (b) shows results for the 379 sub-sample municipalities. Results show that the localized contractions in lending to households resulting from the Spanish regulation coincided with contractions in lending to firms in the local retail, restaurant and transportation sectors.

References

Manuel Adelino, Antoinette Schoar, and Felipe Severino. Loan Originations and Defaults in the Mortgage Crisis: The Role of the Middle Class. *Review of Financial Studies*, 29(7): 1635–1670, 2016.

Shekhar Aiyar, Charles W. Calomiris, John Hooley, Yevgeniya Korniyenko, and Tomasz Wieladek. The international transmission of bank capital requirements: Evidence from the UK. *Journal of Financial Economics*, 113(3):368–382, 2014.

Nicola Cetorelli and Linda S. Goldberg. Banking globalization and monetary transmission. *Journal of Finance*, 67(5):1811–1843, 2012.

Gabriel Chodorow-Reich. The Employment Effects of Credit Market Disruptions: Firm-level Evidence from the 2008-9 Financial Crisis. *Quarterly Journal of Economics*, 129(1):1–59, 2014.

Gauti B. Eggertsson and Paul Krugman. Debt, Deleveraging, and the Liquidity Trap: A Fisher-Minsky-Koo Approach. *Quarterly Journal of Economics*, 127(3):1469–1513, 2012.

Michael Faulkender and Mitchell A. Petersen. Does the source of capital affect capital structure? *Review of Financial Studies*, 19(1):45–79, 2006.

Giovanni Favara and Jean Imbs. Credit Supply and the Price of Housing. *American Economic Review*, 105(3):958–992, 2015.

Leonardo Gambacorta and Paolo Emilio Mistrulli. Does bank capital affect lending behavior? *Journal of Financial Intermediation*, 13(4):436–457, 2004.

Reint Gropp, John Krainer, and Elizabeth Laderman. Did consumers want less debt? consumer credit demand versus supply in the wake of the 2008-2009 financial crisis. *Available at SSRN 2402086*, 2014.

Veronica Guerrieri and Guido Lorenzoni. Credit Crises, Precautionary Savings, and the Liquidity Trap. *Quarterly Journal of Economics*, 132(3):1427–1467, 2017.

Joel F. Houston, Chen Lin, and Yue Ma. Regulatory arbitrage and international bank flows. *Journal of Finance*, 67(5):1845–1895, 2012.

Rajkamal Iyer, Jose-Luis Peydro, Samuel da Rocha Lopes, and Antoinette Schoar. Interbank Liquidity Crunch and the Firm Credit Crunch: Evidence from the 2007-2009 Crisis. *Review of Financial Studies*, pages 347–372, 2013.

Gabriel Jimenez, Steven Ongena, Jose-Luis Peydro, and Jesus Saurina Salas. Macroprudential policy, countercyclical bank capital buffers and credit supply: Evidence from the Spanish dynamic provisioning experiments. *National Bank of Belgium Working Paper*, (231), 2012.

Asim Ijaz Khwaja and Atif Mian. Tracing the Impact of Bank Liquidity Shocks: Evidence from an Emerging Market. *American Economic Review*, 98(4):1413–1442, 2008.

Atif Mian and Amir Sufi. What Explains the 2007-2009 Drop in Employment? *Econometrica*, 82(6):2197–2223, 2014.

Atif Mian, Kamalesh Rao, and Amir Sufi. Household Balance Sheets, Consumption, and the Economic Slump. *Quarterly Journal of Economics*, 128(4):1687–1726, 2013.

Virgiliu Midrigan and Thomas Philippon. Household leverage and the recession. 2016.

John Mondragon. Household credit and employment in the Great Recession. *Available at SSRN 2521177*, 2014.

Daniel Paravisini. Local Bank Financial Constraints and Firm Access to External Finance. *Journal of Finance*, 63(5):2161–2193, 2008.

Daniel Paravisini, Veronica Rappoport, Philipp Schnabl, and Daniel Wolfenzon. Dissecting the effect of credit supply on trade: Evidence from matched credit-export data. *Review of Economic Studies*, 82(1):333–359, 2015.

Joe Peek and Eric S. Rosengren. The International Transmission of Financial Shocks: The Case of Japan. *American Economic Review*, 87(4):495–505, 1997.

Joe Peek and Eric S. Rosengren. Collateral Damage: Effects of the Japanese Bank Crisis on Real Activity in the United States. *American Economic Review*, 90(1):30–45, 2000.

Raghuram G. Rajan. Insiders and Outsiders: The Choice between Informed and Arm's-Length Debt. *Journal of Finance*, 47(4):1367–1400, 1992.

Jesus Saurina. Dynamic provisioning. Crisis Response Note; No. 7, The World Bank, 2009.

Philipp Schnabl. The International Transmission of Bank Liquidity Shocks: Evidence from an Emerging Market. *Journal of Finance*, 67(3):897–932, 2012.

Steven A. Sharpe. Asymmetric Information, Bank Lending, and Implicit Contracts: A Stylized Model of Customer Relationships. *Journal of Finance*, 45(4):1069–1087, 1990.

Ernst-Ludwig von Thadden. Long-Term Contracts, Short-Term Investment and Monitoring. *Review of Economic Studies*, 62(4):557–575, 1995.

A Internet Appendix

A.1 Classification criterion

Table A.1 shows that the non-tradable sector includes 24 4-digit NAICS industries and employs 28.1% of the Mexican labour supply as per the 2009 Mexican census. Table A.2 shows a list of the 4-digit NAICS industries classified as belonging to the non-tradable sector for calculating the municipality level credit series of lending to the non-tradable sector. The classification criterion applied for all the 279 4-digit NAICS industries can be shared on request.

Table A.1: Summary statistics of sectors by classifying criterion

	Non-tradable	Tradable	Construction	Others
No. of 4-digit NAICS industries	24	81	22	171
Labour Share	28.1%	21.8%	8.7%	41.4%

Note: This table shows the number of 4-digit NAICS industries comprising the different sectors and their corresponding labour share. *Source - Census 2009.*

Table A.2: Industries comprising the non-tradable sector

Sector Description	NAICS Code	R-04C Code
Automobile Dealers	4411	46811
Other Motor Vehicle Dealers	4412	46831
Automotive Parts, Accessories, and Tire Stores	4413	46821
Furniture Stores	4421	46631
Home Furnishings Stores	4422	46611
Electronics and Appliance Stores	4431	46621
Grocery Stores	4451	46711
Specialty Food Stores	4452	46112-46119
Beer, Wine, and Liquor Stores	4453	46121
Health and Personal Care Stores	4461	46411,46412
Gasoline Stations	4471	46841
Clothing Stores	4481	46321
Shoe Stores	4482	46331
Jewelry, Luggage, and Leather Goods Stores	4483	46511
Sporting Goods, Hobby, and Musical Instrument Stores	4511	46521
Book, Periodical, and Music Stores	4512	46531
Department Stores	4521	46221
Office Supplies, Stationery, and Gift Stores	4532	46591
Used Merchandise Stores	4533	46641
Other Miscellaneous Store Retailers	4539	46122,46911
Full-Service Restaurants	7221	72211
Limited-Service Eating Places	7222	72221
Special Food Services	7223	72231-72233
Drinking Places (Alcoholic Beverages)	7224	72241

Note: 24 industries at the 4-digit NAICS level are classified into the non-tradable sector. This primarily includes all industries in the retail and restaurant sectors except 4441 (Building Material and Supplies Dealers) which is classified under the construction sector and 4541-4543 which includes firms engaged in electronic shopping, mail-order houses, vending machine operators and direct selling establishments. The industries classified as non-tradable are the same as the ones classified as non-tradable in Mian and Sufi (2014).

A.2 Empirical results using metropolitan area credit aggregates

As on 2012, officially Mexico had only 59 metropolitan areas which are aggregations of different municipalities. As a result, there is a significant loss in power when running regressions on credit series aggregated at the level of metropolitan areas. The distribution of the share of Spanish banks in the household credit market is not normally distributed across the metropolitan areas (figure A.1) and I do not find a contraction in lending to households or the non-tradable sector explained by exposure to Spanish banks (tables A.3 and A.4).

Figure A.1: Distribution of share of Spanish banks in the household credit market across Mexican metropolitan areas

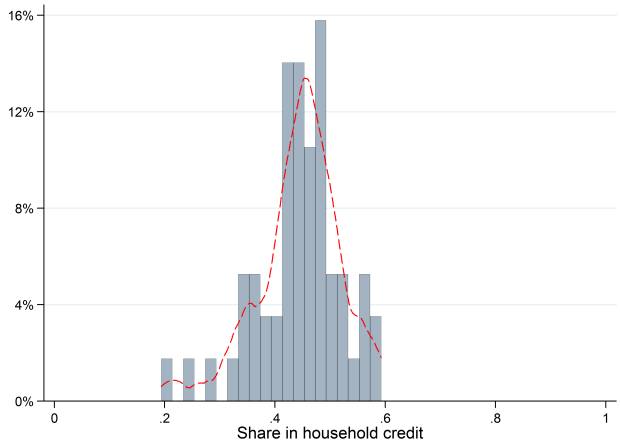


Table A.3: Effect of Spanish regulation on lending to households in metropolitan areas

VARIABLES	(1) Gr(Household Credit)	(2) Gr(Housing Credit)	(3) Gr(Consumer Credit)
Post*Spanish Share$_{2011}$	-0.0770	-0.383*	0.0759
	(0.142)	(0.218)	(0.160)
Observations	114	114	114
Number of metropolitan areas	57	57	57
R-squared	0.593	0.732	0.499
Mun. Fixed-effects	Yes	Yes	Yes
Time Fixed-effects	Yes	Yes	Yes

Clustered standard errors at a metro. area

*** p<0.01, ** p<0.05, * p<0.1

Note: The table above shows regressions results of changes in log-levels of metropolitan area credit to households on the treatment variable $Post \cdot Spanish\ Share_{2011}$. Data from two periods are used - June 2012 and June 2013; variable *Post* indicates June 2013. Exposure to Spanish banks is measured by the metropolitan-level share of Spanish banks in the household credit market in June 2011.

Table A.4: Effect of Spanish regulation on sectoral credit in metropolitan areas

VARIABLES	(1) Δ log (Non-trad.)	(2) Δ log (Non-trad. + Const.)	(3) Δ log (Tradable)
Post*Spanish Share$_{2011}$	-0.877	0.836*	-0.818
	(0.737)	(0.467)	(0.896)
Observations	114	114	114
Number of metropolitan areas	57	57	57
R-squared	0.435	0.457	0.420
Mun. Fixed-effects	Yes	Yes	Yes
Time Fixed-effects	Yes	Yes	Yes

Clustered standard errors at a metro. area

*** p<0.01, ** p<0.05, * p<0.1

Note: The table above shows regression results of changes in log-levels of metropolitan area sectoral credit on the treatment variable $Post \cdot Spanish\ Share_{2011}$. Data from two periods are used - June 2012 and June 2013; variable *Post* indicates June 2013. Exposure to Spanish banks is measured by the metropolitan-level share of Spanish banks in the household credit market in June 2011.

A.3 Model of a Mexican Municipality

The unit of observation in the quasi-experiment I described in section 3.3 is a Mexican municipality. I model Mexican municipalities as small, open economies with free movement of capital and limited labour mobility between the municipalities. Firms operate in one of two sectors in the economy - a tradable sector producing a good traded across the municipalities and a non-tradable sector producing a good specifically meant for local demand. Households in the economy are financially constrained and rely on access to household credit periodically to finance consumption. The level of household credit depends on an exogenously determined, municipality-specific parameter. The quasi-experiment described in the earlier section is modeled as a shock to this particular parameter, leading to a variation in the changes to household credit across the municipalities. I use the model to share intuition on the demand channel - i.e., the effect of a shock to household credit on the composition of investment and production between the tradable and non-tradable sector in an economy through its effect on aggregate demand in an economy.

A.3.1 Model description

The representative Mexican municipality, identified by subscript 'j', is a small open-economy with two sectors and infinitely lived heterogeneous agents. The unit of decision making is a household and the terms agents and households are used interchangeably in what follows. The economy comprises of two types of households - capital owners who own the firms in the economy and workers who are endowed with labour and are engaged by the firms owned by the capital owners. The capital owners own firms in one of two possible sectors - a sector producing a tradable good and the other a non-tradable good. The tradable good can be traded across the municipalities for a given interest rate. The non-tradable good can not be traded between the municipalities. Hence the production for a non-tradable good must be met by the demand for the same within a municipality, and vice-versa.

I begin the presentation of the model with the consumption-saving decision of the capital owners, the optimal consumption path available to the workers and the resulting equilibrium in the infinite horizon problem of this economy. The decisions are made in the absence of any aggregate uncertainty though the economy may experience shocks periodically. I study the effect of shocks to ϕ_j on economic activity in the municipality.

A.3.2 Household problem

There are two types of households in the economy - capital owners and workers. Capital owners are not endowed with any labour and their per-period consumption and saving decisions are aimed at maximizing their life-time utility given by

$$U_0 = max \sum_{t=o}^{\infty} \beta^t log\{c_t\} \tag{5}$$

$$\text{for } c_t = (c_{Tt})^{\tau}(c_{Nt})^{1-\tau},$$

$$R_t a_t = c_t + a_{t+1}, \text{ given } a_o$$

The consumption in any given period, c_t, is a Cobb-Douglas aggregate of the tradable and non-tradable good. For a given starting value of asset holdings a_0 and interest rate R_t, the solution to the dynamic programming problem provides the optimal consumption , c_t^i, and saving, a_{t+1}^i function for the capital owners in this economy as

$$c_t = R_t(1-\beta)(\prod_{s=0}^{t-1} R_s\beta)a_o \text{ and } a_{t+1} = (\prod_{s=0}^{t} R_s\beta)a_o \tag{6}$$

The average interest rate R_t, for period 't', is an equilibrium outcome based on the optimal portfolio choice by the capital owners for their savings. The savings of the capital owners can either be invested domestically in the tradable or non-tradable industries or lent abroad for interest rate R^*. Since investments are made by risk-neutral agents under perfect foresight, capital owners invest in the two sectors until the marginal return to capital in either sector, $\{R_{Nt}, R_{Tt}\}$, equals the lending rate R^*, i.e. $R_t = R_{Tt} = R_{Nt} = R^*$.

The workers optimize their lifetime utility given by an infinite sum of a non-separable utility function per period that reflects utility from consumption and disutility from working. I use a specific form of Greenwood-Hercowitz-Hofman preferences as follows

$$U_0 = max \sum_{t=o}^{\infty} \beta log\{c_t - \eta\frac{(n_t)^{1+\psi}}{1+\psi}\} \tag{7}$$

$$\text{where } c_t = (c_{Tt})^{\tau}(c_{Nt})^{1-\tau} ,$$

$$R^* a_t + w_t n_t = c_t + a_{t+1} \text{ and } -a_{t+1} \leq \phi_t \frac{w_{t+1} n_{t+1}}{R^*}$$

While the workers must consume every period, their labour endowment is staggered over their lifetime. I assume that workers supply labour in alternate periods of their existence and belong to one of two categories, H_E and H_O, based on whether they supply labour during even-numbered or odd-numbered periods. I also assume that the workers are constrained and can borrow up to a fixed proportion of their next period income. This proportion, ϕ_j, is specific to municipalities and governs the maximum amount of household credit accessible by households in the municipality at time 't'.

I further assume that the workers are impatient (β is less than a threshold value $\bar{\beta}$) and financially constrained (borrowing constrained $\phi_j < \frac{1}{1+\beta} \cdot \frac{\psi}{1+\psi}$). Under these twin assumptions, workers in the economy behave as hand-to-mouth consumers. When not endowed with labour, the households borrow at the limit to finance their consumption. I call these households the 'Constrained Workers'. The remaining workers, whom I call the 'Employed Workers' clear their outstanding debts and consume what is left of their wages. Hence for a even time period 't', the consumption profile is given by,

$$c_t^i = \begin{cases} (1-\phi) \cdot w_t n_t & \text{if i} \in H_{even} \\ \phi \cdot \frac{w_{t+1} n_{t+1}}{R^*} & \text{if i} \in H_{odd} \end{cases}$$

where n_t is the labour supply given by the market wage $\{\frac{w_t}{\eta}\}^{\frac{1}{\psi}}$. In odd periods, the workers from the two different sets interchange their roles as constrained workers and employed workers. Thus, the total spending from the two types of workers in any period 't' is given by $(1-\phi_{t-1}) \cdot w_t n_t + \phi_t \frac{w_{t+1} n_{t+1}}{R^*}$.

A.3.3 Production

Firms are perfectly competitive Cobb-Douglas aggregators of capital and labour which specialize in the production of a sector specific good. There is full depreciation of capital every period and the level of capital in a given sector is determined by the level of sector specific investments in the previous period. The production function for firms in the tradable sector is given by $F_T(K_{Tt}, L_{Tt}) = Z_{Tt} K_{Tt}^{\alpha_T} L_{Tt}^{1-\alpha_T}$ and for firms in the non-tradable sector by $F(K_{Nt}, L_{Nt}) = Z_{Nt} K_{Nt}^{\alpha_N} L_{Nt}^{1-\alpha_N}$, where $\{Z_{Tt}, Z_{Nt}\}$ are the sector-specific productivities,

$\{\alpha_T, \alpha_N\}$ the levels of capital intensities, $\{K_{Tt}, K_{Nt}\}$ the levels of capital and $\{L_{Tt}, L_{Nt}\}$ the labour allocated in time 't'.[23] The tradable good is the numeraire and the relative price of the non-tradable good is given by P_{Nt}.

The market clearing condition in the labour market entails that the demand for labour $\{L_{Nt} + L_{Tt}\}$ must equal the supply of labour. For wage rate w_t, the total supply of labour is given by $(\frac{w_t}{\eta})^{\frac{1}{\psi}}$. Hence the labour market clearing condition is given by,

$$L_{Nt} + L_{Tt} = (\frac{w_t}{\eta})^{\frac{1}{\psi}} \tag{8}$$

Risk neutral capital owners invest in the two sectors until the marginal return to capital in each sector equals R^* as summarized in the equation below,

$$R^* = \alpha_T \cdot Z_{Tt} \cdot (\frac{K_{Tt}}{L_{Tt}})^{\alpha_T - 1} = \alpha_N \cdot P_{Nt} \cdot Z_{Nt} \cdot (\frac{K_{Nt}}{L_{Nt}})^{\alpha_{N-1}} \tag{9}$$

Finally, the relative price of the non-tradable good is determined by the market clearing condition in equation 10, the *demand equation,* which equates the total spending on non-tradable goods by households in period t to the total value of production in the non-tradable sector as follows[24],

$$(1-\tau)\cdot\{\underbrace{R^* \cdot a_t \cdot (1-\beta)}_{Capital\ Owners} + \underbrace{(1-\phi_{t-1}) \cdot w_t n_t}_{Employed\ Workers} + \underbrace{\phi_t \cdot \frac{w_{t+1} n_{t+1}}{R^*}}_{Constrained\ Workers}\} = P_{Nt} \cdot Z_{Nt} \cdot K_{Nt}^{\alpha_N} \cdot L_{Nt}^{1-\alpha_N} \tag{10}$$

At time 't', for given values of $\{K_{Nt}, K_{Tt}\}$, the market clearing conditions discussed in

[23] The sector specific factor intensiveness and productivities can vary across the municipalities. In general, I assume that the preferences are the same for households across the Mexican municipalities and the differences across the municipalities stem from the parameter ϕ_j and sector specific production functions. Except for ϕ_j, I drop the municipality specific subscript 'j' to minimize notation since we restrict the discussion to a representative Mexican municipality in this section.

[24] Equation 10 is valid for the case when there is no shock experienced at period 't'. In the event of a shock the net wealth of the capital owners would be given by $\underbrace{R_{Nt} \cdot K_{Nt} + R_{Tt} \cdot K_{Tt} - R^* \cdot (K_{Nt} + K_{Tt} - a_t \cdot (1-\overline{\beta}))}$ since the eventual investment risk in the model is absorbed by capital owners and shocks may shift the return to investments away from R^*. The wealth of the households that supply labour during the period will be given by $\underbrace{w_t n_{t,} - \phi^h_{t-1} \cdot E_t(w_t n_t)}_{Employed\ Workers}$ instead of $\underbrace{(1-\phi_{t-1}) \cdot w_t n_t}_{Constrained\ Workers}$.

this section establish the equilibrium outcomes$\{L_{Tt}, L_{Nt}, R_{Tt}, R_{Nt}, P_{Nt}, w_t, K_{Nt+1}K_{Tt+1}\}$. In the next section I study how changes in the level of household spending driven by changes in $\phi_{j,t}$ affect economic activity in the two sectors.

A.3.4 Equilibrium

The workers in the economy rely on access to household credit for consumption during periods when they do not earn wages since their income is concentrated in alternate time periods. Changes in access to household credit, through shocks to parameter ϕ_j, are reflected in both the household credit accessed and the household debt repaid every period. I present the effect of a temporary and permanent shock to household on economic activity in the two sectors of the economy in *result 1* and *result 2* respectively.

Result 1: A temporary shock that leads to a drop in the level of household credit *always* leads to a drop in investment and production in the non-tradable sector of the economy.

Result 2: A permanent drop in the household constraint parameter ϕ_j leads to a permanent decrease in the level of investments and production in the non-tradable sector if and only if $R^* < (1+g)^{\frac{1}{1-\alpha_T}}$ where g is the growth rate of the productivity in the tradable sector.

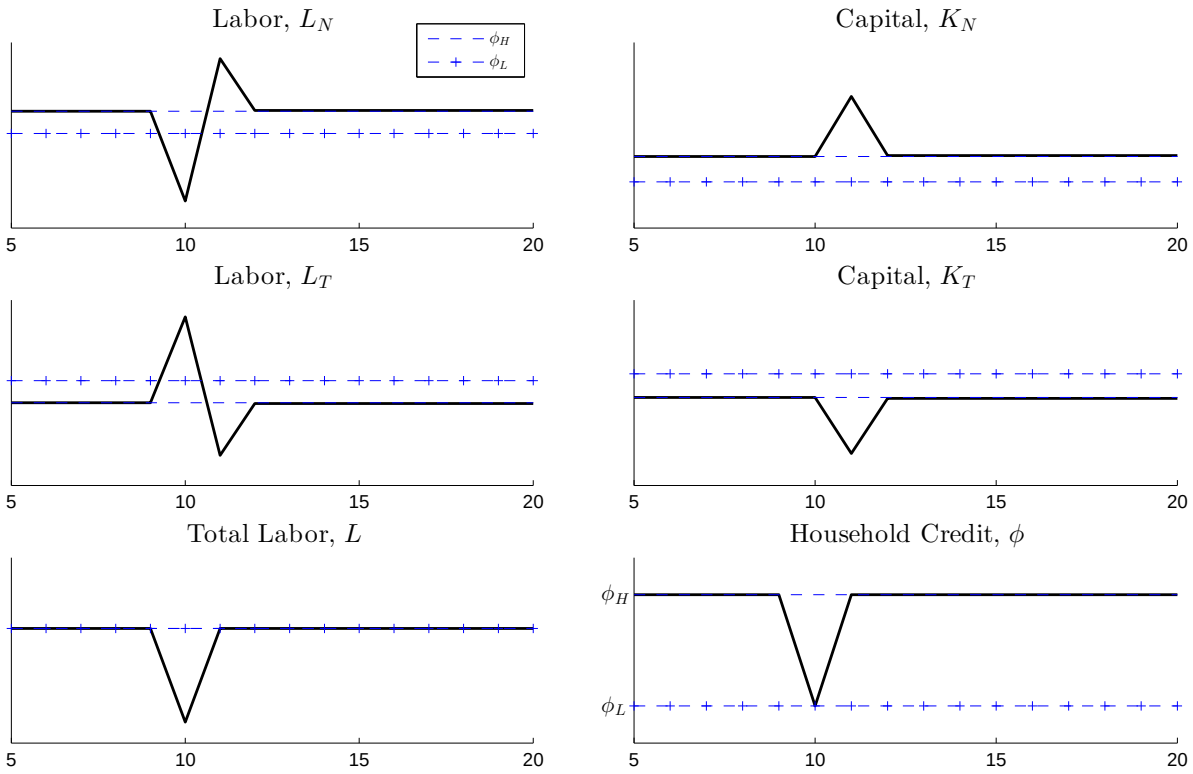
I refer to the demand equation (eq. 10) to provide an intuitive interpretation of these two results. A temporary contraction in the level of household credit leads to a drop in the spending on goods and services contemporaneously. This is because the shock leads to drop in the contemporaneous borrowing by the constrained workers, without affecting the outstanding household debt of the employed workers (*result 1*). A permanent change in the level of household credit ϕ_j affects both the contemporaneous household credit borrowing and the outstanding household debt in future periods. A permanent drop in household credit would lead to a drop in the total spending as long as the negative effect on current borrowing outweighs the rise in spending in the future after clearing the lower debt acquired in the previous period. If wages are constant (no productivity growth in the tradable sector), that can happen if and only if $R^* < 1$ and in case of productivity growth, if and only if, $R^* < (1+g)^{\frac{1}{1-\alpha_T}}$.

In figure A.2, I shock an economy at steady state with a temporary one-period drop in the level of household credit. As set down in *result 1,* the effect of a temporary drop in the level of household credit is independent of parameters governing the economy and always leads to a contemporaneous drop in economic activity in the non-tradable sector. In case

of a permanent drop in the level of household credit, in the short term the economy sees a drop in the level of economic activity in the non-tradable sector and the eventual transition to a new steady state marked by an expansion or contraction in the non-tradable sector depending on the condition laid down in *result 2*. In figure A.3 I show the transition in the event of a permanent shock to the level of household credit for an economy with $R^* < 1$.

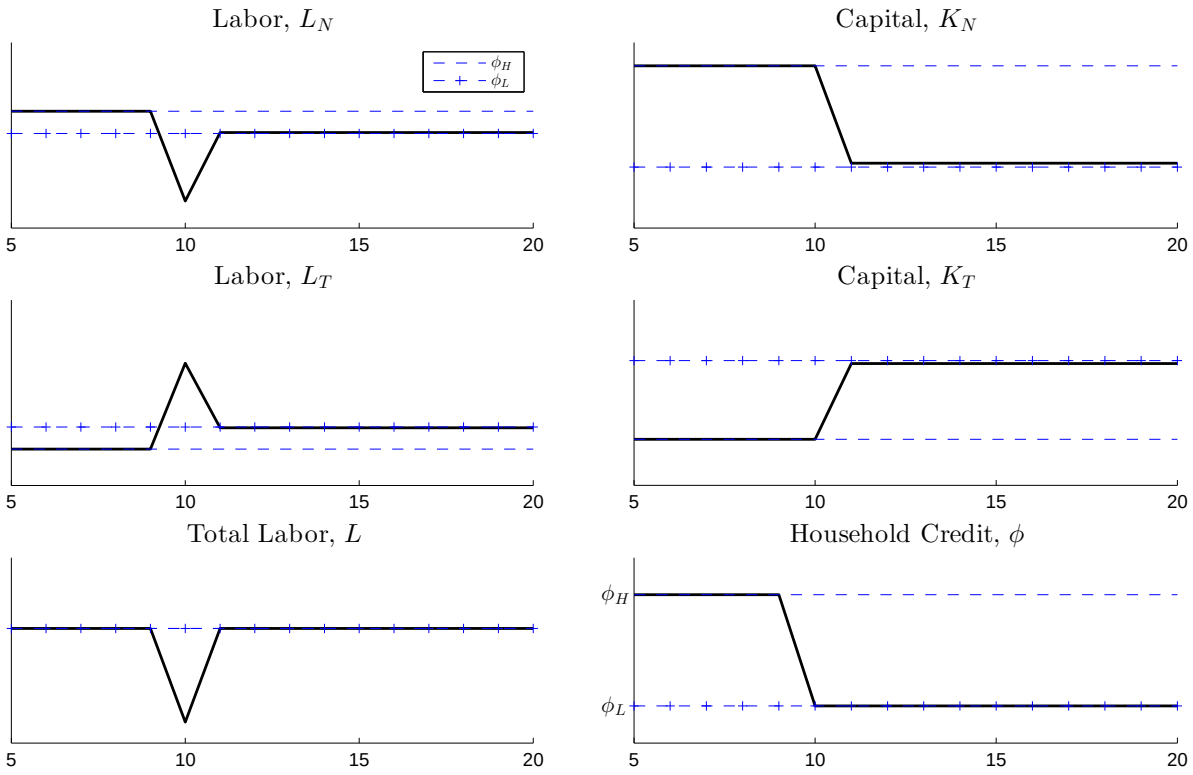
Figure A.4 shows the transition in an economy with a temporary, though persistent, shock to the level of household credit. The economy experiences a negative shock at time period $t = 10$ and experiences a drop in the level of household credit from $\phi_{H,j}$ to $\phi_{L,j}$. From $t = 12$, the level of household credit recovers based on the process $\phi_{j,t} = \phi_{j,t-1} + \theta \cdot (\phi_{H,j} - \phi_{j,t-1})$. The economy experiences an expansion in the non-tradable sector along the transition process since the gain in spending from better access to household credit outweighs the negative effect of the higher amount that must also be repaid very period. Figure A.5 highlights the exact opposite transition process in an economy with $R^* > 1$). In this economy, there is an increase in overall spending in response to a drop in access to household credit since the debt burden every period outweighs the additional demand from better access to credit.

Figure A.2: Effect of a shock leading to a temporary change in ϕ



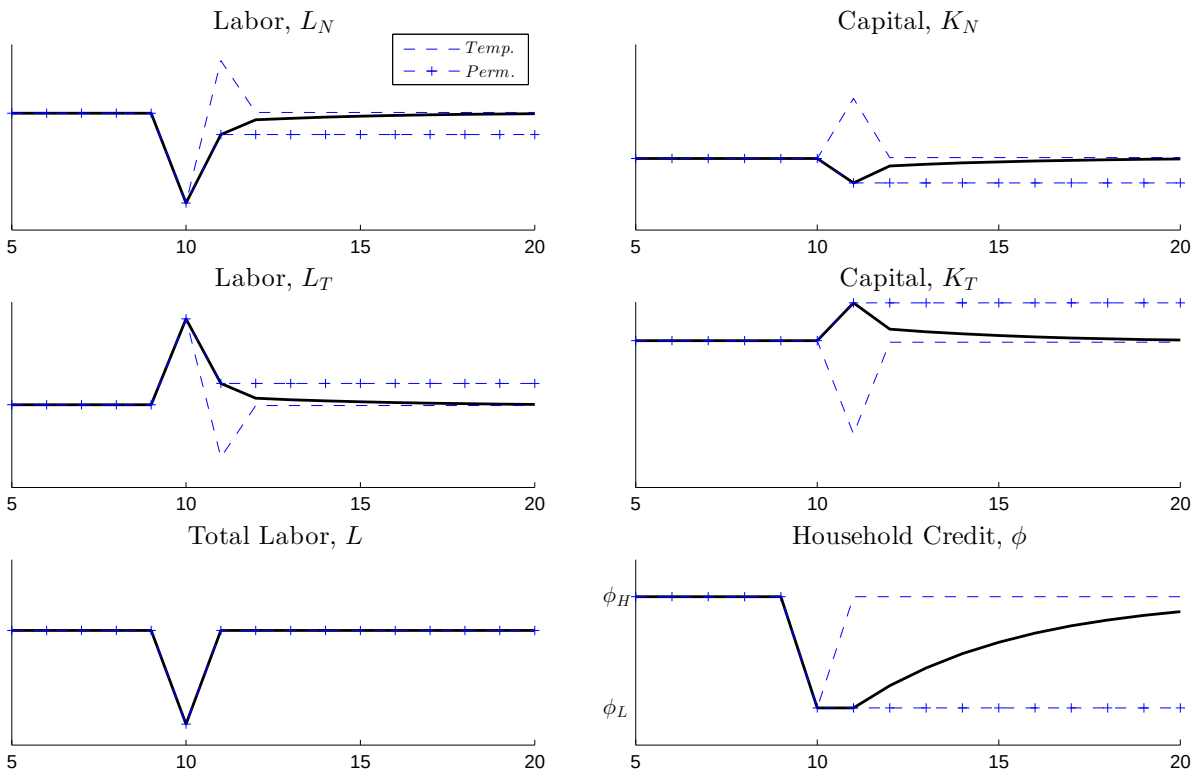
Note - This figure plots the effect of a temporary negative shock to household credit at $t = 10$ (bottom right panel). $\{L_T, L_N$ and $\{K_T, K_N\}$ refer to the labour and capital absorbed in the tradable and non-tradable sectors respectively in the municipality represented in the above simulation.

Figure A.3: Effect of a shock leading to a permanent change in ϕ



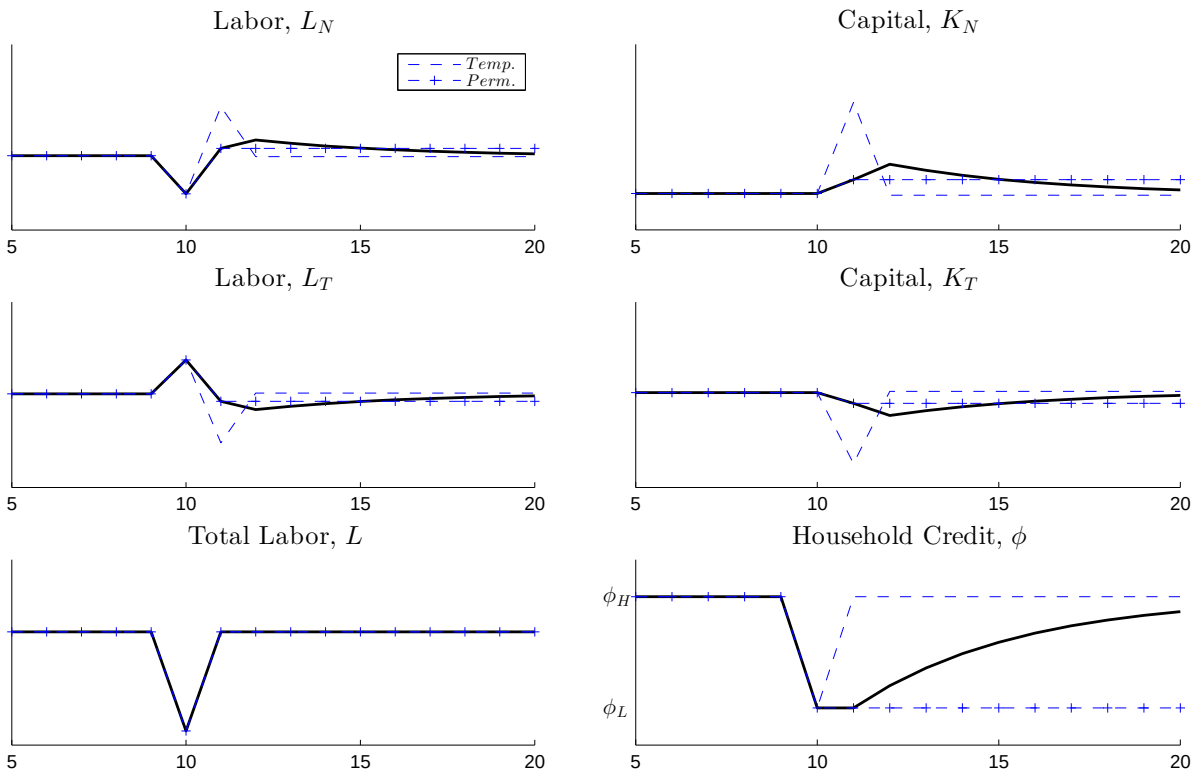
Note - This figure plots the effect of a permanent negative shock to household credit at $t = 10$ (bottom right panel). $\{L_T, L_N$ and $\{K_T, K_N\}$ refer to the labour and capital absorbed in the tradable and non-tradable sectors respectively in the municipality represented in the above simulation.

Figure A.4: Effect of a temporary change in ϕ with persistence



Note - This figure plots the effect of a temporary negative shock to household credit with persistence at $t = 10$ (bottom right panel). $\{L_T, L_N$ and $\{K_T, K_N\}$ refer to the labour and capital absorbed in the tradable and non-tradable sectors respectively in the municipality represented in the above simulation. There is a drop in investments and labour allocated in the non-tradable until the level of household credit recovers back to the pre-shock level since the interest rates are assumed to be low.

Figure A.5: Effect of a temporary change in ϕ with persistence (case $R^* > 1$)



Note - This figure plots the effect of the temporary negative shock in figure A.4 when interest rates are high. $\{L_T, L_N$ and $\{K_T, K_N\}$ refer to the labour and capital absorbed in the tradable and non-tradable sectors respectively in the municipality represented in the above simulation. There is an increase in investments and labour allocated in the non-tradable sector despite the fall in household credit since the low levels of household credit mean the employed workers have a higher spending power after clearing their debts from the previous period.