Three Essays in Monetary Economics and Banking

by

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I would like to dedicate my dissertation to my beloved parents. With much love, I thank you for seeing me through this.

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ABSTRACT

Banks play a major role in all the economic and financial activities in modern society. In this dissertation, I explore three separate, yet closely hinged topics in banking. In the first chapter, I investigate how banks respond to monetary policy changes and translate them into real-economy consequences. Utilizes the adjustment of reserve requirements due to the phase-in program of the 1980 Monetary Control Act and annual updates of reserve regulations as a natural experiment, I find that the reduction in the reserve requirement increases new loans extended by banks. Moreover, the reduction in required reserve leads to employment growth at the county level. In the second chapter, I look into the nexus between bank networks and international trade. Using a novel dataset of the domestic and overseas expansions of Chinese banks and firm-level microdata, I find that bank networks promote trade by providing financial services that reduce general trade cost and information asymmetry. In the third chapter, I study the political economy of government-owned banks and reveal the micro-mechanism behind the low-efficiency of state-owned banks. I find that these banks are often encouraged to enter less profitable but politically needed locations that could help government officials to enhance their career prospects. This type of expansion pattern reduces financial prudence and increases risk. Also, using export decline during the Great Recession as an exogenous shock, I find that more geographically concentrated banks were more likely to perform poorly during the crisis, which implies that political intervention increases the financial risk.

CHAPTER 1

Introduction

1.1 Introduction

Whether and how much monetary policy can lead to real economic consequences is the subject of a long-running debate in macroeconomics, and a question that has attracted significant research effort. Some earlier papers, such as Gurley and Shaw (1955) and Kormendi and Meguire (1985), use macro time-series data to study the links between monetary supply and economic growth. However, empirical results based on macro data entail some potential issues: first, there is endogeneity issue since there might be common components behind monetary supply and growth; second, establishing causality can be difficult. The limitation of macro-data based research suggests that we turn to micro data for solutions. A series of studies have used microdata to delve into the transmission mechanism and the effect of monetary policy, such as Kashyap and Stein (1995), Kashyap and Stein (2000) (Fed fund rate and bank lending), Jiménez et al. (2014) (Spanish overnight rate and loan composition), and Liebig et al. (2007) (bank capital adequacy). In recent years, another stream of literature, represented by Ivashina and Scharfstein (2010), Khwaja and Mian (2008), Rodnyansky and Darmouni (2017), Chodorow-Reich and Falato (2017), and Carpinelli and Crosignani (2017), utilizes micro-level shocks to banks and unconventional monetary policy after the Great Recession, such as quantitative easing and bank assistance programs, to study the economic consequences of monetary policy.

While a large body of research has attempted to estimate the growth effect of monetary expansion using aggregate data and to analyze the effect of monetary policy on bank lending during the crisis, little work has been done to study how reserve requirements affect lending and local economic growth using microdata. The goal of the paper is to fill this gap by evaluating the effectiveness of a conventional monetary policy that has once again begun to play a vital role, the reserve requirement, and by documenting the real economic effect it generates.

This paper exploits regional variations in changes to reserve requirements induced by the Monetary Control act of 1980, coupled with detailed county-level micro-data, to provide a novel evidence on the whether and how the relaxation of monetary policy impacts real economic activity. The milestone Monetary Control Act of 1980 (henceforth MCA 1980) provides us with a good natural experiment. In MCA 1980, non-member banks, defined as banks that are not members of the Federal Reserve System, and thus were not bound by the Federal reserve requirements, are required to increase their reserves within a specific time frame. Meanwhile, member banks can gradually reduce their reserve burden. MCA 1980 also allows the Federal Reserve to adjust the required reserve criteria annually. Since banks in different places have different capital structures and deposit compositions, their available liquidity is reduced/increased to different degrees when reserve requirement regulations are updated. I address the institutional changes in detail in Section 1.2.2.

In Section 1.3, I propose a theoretical framework to justify the use of the natural experiment. I demonstrate that relaxing reserve requirement has stronger local effect when banks operate locally and face liquidity constraint, which were true for the period of time when the natural experiment took place. Also, the model suggests that the relaxation of reserve requirement leads to greater expansion of smaller firms and firms that are more dependent on external finance, suggesting that regressions should be ran separately for firms of different size and different level of external-finance dependence.

The empirical analysis in this paper is undertaken in two stages. In the first stage, I calculate annual reserve changes for individual banks and link them to other bank traits to construct a bank-level panel dataset. I use this panel data to examine whether banks extend more (less) loans when relaxing the reserve requirement are relaxed (tightened). I find that indeed there is a significant impact of changes in reserve requirement on loans extended, with the relaxation of reserves leading to more loans. In the second stage, I explore whether reserve requirements impacted local economic outcomes. In the baseline analysis, I regress local employment growth on a measure of local changes in reserve requirement. I find that a decrease in the required level of reserves is associated with greater local employment growth. This finding is robust to plausible variations in methodology, such as adding more control variables, including fixed effects, weighting by county size and adding lag terms at the county level. Additional robustness checks are done to eliminate concerns that (1) the estimates could be polluted by 1982-1984 data with a large employment fluctuation; (2) Employment growth was resulted from contemporaneous financial deregulations. Based on the average level of employment and monetary statistics in this period, my baseline estimates suggest that a 1% reduction in required reserve as the percentage of total deposit increases job growth by 1.09%.

This paper contributes to three strands of literature. First, it contributes to the monetary policy literature by providing evidence for one of the most frequently discussed questions in macroeconomics - whether and how monetary policy affects real economic outcomes. Second, the paper contributes to the recent research on shocks and financial sufficiency of banks after the Great Recession. Although the paper uses a different setting, it shares common theoretical support and channeling mechanisms between banks and the real economy. Last, this paper also complements the ongoing pool of literature studying the synergy between finance and development. While geographical expansion of financial institutions (Burgess et al. (2005) and Kendall (2012)), the increased value of real estate as mortgages to obtain higher ceiling loans (Flannery and Lin (2015)), the legal and financial system (DemirgüçKunt and Maksimovic (1998)), financial deregulation (Aghion et al. (2007)), and small business lending programs (Nguyen et al. (2015) and Keeton (2009)) are shown to significantly impact economic growth, less progress has been made in understanding how reserve requirement as a monetary policy tool translates to local economic outcomes. Moreover, the results provide useful information to policymakers. Internationally, many countries, such as China and India (Liu and Spiegel (2017)), still use reserve requirement as a basic monetary tool. The evidence on the relationship between the amount of loanable money in the banking sector and regional economic growth suggests that changing reserve requirements could indeed be effective as a monetary policy tool. In the US, in the wake of the surge of excess reserves after the Federal Reserve began paying interest on excess reserves following the 2008 financial crisis and possible future policy revamps (Taylor (2017)), the role of required reserve policy as a monetary policy tool became more substantial. Moreover, the paper shows that the effect of monetary policy varies across firm size and external finance dependency. Confirming related findings in the literature, this paper suggests that policies impacting the bank credit channel could be used specifically to encourage the development of small businesses or finance-dependent industries.

The remainder of the paper is organized as follows. Section 1.2 introduces background information pertaining to the expansion of the paper and clarifies some points made in Section 1.1. Section 1.3 proposes a theoretical framework to discuss and justify the empirical strategy that I use in Section 1.4. Section 4 discusses the econometric methodology. Section 1.5 presents the construction of the data and summary statistics. Section 1.6.1 presents the main results. Section 1.6.2 shows robustness checks to supplement the results in Section 1.6.1. Section 1.7 offers some final thoughts on the ramifications of my findings.

1.2 Background

1.2.1 Localness of Banking

A sizable body of previous research concludes that credit supply and demand has strong locality, viz., most firms obtain loans from local banks. Because this paper primarily examines the regional employment effect, this kind of locality is important. If any firm can borrow money from any bank at any location, associating the local variations in loanable credit with regional growth will not be feasible. Previous research shows that credit and banking have strong locality, especially for small businesses that rely heavily on bank lending. For example, using data from the 1993 Survey of Small Business Finances, Kwast et al. (1997) find that 92.4% of small businesses use a depository institution within 30 miles of their main office. Data from the 2001 Credit, Banks, and Small Business Survey, conducted by the National Federation of Independent Businesses indicate that the average travel time between a small business and its primary financial institution was 9.5 minutes and 90% of small businesses look for banking services within 14.8 miles of a firm's location (Brevoort et al. (2010)). DeYoung et al. (2008) finds that the median borrower-lender distance is approximately 17 miles for medium-upper income tracts, and 35 miles for low-moderate income tracts. Petersen and Rajan (2002) documents that even in the United States, the distance between small business borrowers and their banks is less than 20 miles (35 km) for over 75% of loans made to these firms. Such localness of banking, plus the fact that US banks are often scattered geographically because of banking regulations, create variation that we can utilize to test if changes in reserve requirements could lead to different local development outcomes, if such an effect does not extend beyond a certain radius. It is expected that localness of banking is more acute for smaller firms and less so for larger firms, which suggests the importance of running separate regressions for different size groups.

1.2.2 The US Reserve Requirement Regulations

As discussed in Section 1.1, utilizing reserve requirement changes is the essence of this paper. Therefore, understanding the US reserve system, especially how it works after MCA 1980, is essential. To be specific, in my research design, there are three sources of reserve requirement changes.

(1) <u>Variation across "member" and "non-member" banks</u>. By membership at the Federal Reserve, banks can be classified into two broad categories – member banks (including past member banks that abandoned membership before a certain date), and non-members (including non-member banks that acquired membership before a certain date). Before the MCA of 1980, the former were subject to the Federal Reserve requirements, which were

generally more stringent than the new rules stipulated in the MCA of 1980. The percentage reserve requirement for each type of deposit was much lower, and banks could exempt the reserve requirement using certain types of asset. For the latter, they only needed to comply with state reserve requirements prior to the MCA of 1980, which were much more lenient than Federal requirements (Gilbert et al. (1978)). Some states required banks to maintain reserve at a very low percentage of deposit. Most states allowed banks to satisfy reserve requirements using demand balance dues and securities they held[1]. This led a number of banks to relinquish membership of the Federal Reserve System, inter alia to reduce their reserve burden. By the end of 1976, the percentage of commercial banks belonging to the Federal Reserve System had declined to 39 percent, from 45 percent at the end of 1966 (Gilbert et al. (1978)). The Monetary Control Act of 1980 was aimed at stopping the divestiture of membership and harmonizing regulation of banks. When the Monetary Control Act went into effect, it put all banks under uniform regulation: non-member banks were asked to maintain higher level of reserves, while member banks faced reduced reserve obligations in most cases. To ensure a smooth transition, a phase-in program was designed to give banks additional time to meet the revised reserve requirements. Under this program, past member banks were given six years to gradually reduce the excess between the old and the new requirements, while non-member banks had to raise their reserve level to meet the new regulations within eight years (transition period was twelve years for foreign banks). Thus this policy generates a natural experiment: throughout the transition period, the amount of loanable money becomes smaller for past nonmember banks and larger for member banks. Because the extent of membership varied across regions, this difference translates into variations in geographical dimension if we aggregate the reserve changes to the regional level.

(2) Annual change of reserve low-reserve tranche and exemption amount. The Federal Reserve sets three amounts that together determine a banks total reserve requirement: (i) “low-exemption amount, below which banks do not need to maintain reserve; (ii) a “low reserve tranche amount, such that for transaction deposits between this cutoff amount and the low exemption amount banks only need to maintain a discounted (i.e., lower) reserve ratio; (iii) and reserve ratio, which is a percentage that banks need to maintain for deposits beyond the “low reserve tranche amount. If there has been a decrease in the total transaction accounts of all depository institutions, the Federal adjusts the low reserve tranche and exemption value to relax the reserve requirement.[2] At the same time, time deposit is subject to a uniform 3% reserve ratio (0% after 1990). The calculation of the reserve requirement

[1] Some states were particularly lenient, e.g., Illinois did not have any reserve requirement.

[2] The Monetary Control Act of 1980 stated that the increase in transaction accounts (subject to reserve requirements) is determined by subtracting the amount of such accounts on June 30 of the preceding calendar year from the amount of such accounts on June 30 of the calendar year involved (Reserve Maintenance Manual, Federal Reserve Board).

is summarized by the formula below:

$$RequiredReserve = \begin{cases} (TD-L)\times RR + (L-E)\times LR + TM\times TR, & \text{for } TD \geq L \\ (TD-E)\times LR + TM\times TR, & \text{for } TD < L \text{ and } TD > E \end{cases}$$

Where:

$TD = Transaction\ deposit$

$TM = Time\ deposit$

$L = Low\ reserve\ tranche$

$RR = Regular\ reserve\ ratio$

$E = Exemption\ amount$

$LR = Low\ reserve\ ratio$

$TR = Time\ deposit\ reserve\ ratio$

From the description above, it is clear that the amount of released liquidity is determined by the total amount of deposits at an individual bank (with no consideration for any regional aggregates). However, because the distribution of banks is not uniform cross regions, and because banks have different deposit compositions, the consequence of such adjustment is not evenly distributed at all locations. This kind of unevenness creates utilizable variation.

(3) Changes in bank branch locations. Besides the above two factors, changes in the distribution of bank branch locations also contribute to the pattern of changes in required reserves. When banks begin to operate new branches or close old branches, the availability of the loanable amount of credit in corresponding regions will be affected. When calculating the required level of reserves at the bank level and attributing the changes to local regions, the computation of the measure I use also captures this type of variation. [3]

For the time span of this research, I choose the years between 1982 and 1992, which is a full credit cycle according to NBER US Business Cycle Expansions and Contractions, to eliminate significant changes of other aspects of monetary policy. Further, the year 1981 marks the first year that MCA went into effect and the onset of the phase-in program stipulated in the MCA. Therefore, 1982 is the first year for which I can calculate "clean" reserve changes. Another reason for choosing 1992 as the terminal point is that the Federal Reserve allowed so-called "sweeping of transaction deposits, i.e., transferring money from transaction accounts that are subject to Federal Reserve requirements to non-transaction accounts for which a reserve was no longer required after 1992. Banks have the incentive to maintain as little reserve as possible to maximize profit. To this end, banks usually manage to circumvent the reserve requirement, which is mainly imposed on more liquid transaction

[3] This also raises a potential concern that growth might be attributed to bank consolidation instead of to the reserve requirement. To eliminate this possibility, subsample regressions are conducted to eliminate this concern. The details are presented in Section 1.6.2.3 .

accounts after 1990. Bennett Paul and Peristian (2002) concludes that the reserve requirement was no longer binding after sweeping was no longer prohibited. The actual level of reserves became so low that adjusting low reserve tranche and exemption amounts does not significantly change banks' loanable liquidity.[4]

1.3 Theoretical Framework

In this section, a theoretical framework is constructed to illustrate the impact of the above-mentioned regulatory changes and to discuss other variables at work. This also helps to justify the use of the policy of the natural experiment that serves as the core of the paper.

Views about the effect of monetary policy on economic outcomes can be summarized under two heads: the "money view" and the "credit view". If the "money view" is correct and monetary policy works only by changing the aggregate demand and supply of money to shift the user cost of capital, it is not possible to attribute the regional variation of growth to the policy change. In contrast, the credit view holds that monetary policy shifts the assets and liabilities of banks to change the supply of bank loans extended to firms which could vary across banks and hence across regions. In Kashyap and Stein (1994), the two authors summarize the two conditions for the bank lending view to hold: (a) banks cannot shield their loan portfolios from changes in monetary policy; and (b) borrowers cannot fully insulate their real spending from changes in the availability of bank credit. In the later part of this section, I show that the bank lending view is the functioning mechanism when (1) firms bank locally, and (2) banks face liquidity constraints. The intuition here is quite straightforward: when banks already have enough money fully fund firms, to the point where the marginal benefit of lending equals the marginal cost of lending, additional liquidity will not encourage banks to extend more lending. They will instead allocate this additional liquidity to other investment channels, such as equity or bond markets. In contrast, if banks are short of liquidity to make the optimal level of loans, creating additional liquidity will shift the level of lending closer to the optimal point.

Another purpose of the theoretical framework is to show that changes in loanable funds have an uneven impact on firms at different positions on the size spectrum, due to the differences in funding sources, the size of demand for funding, and funding cost. The inflow into banks loanable fund reservoir mostly affects smaller firms who find it hard to access

[4]For banks, deciding the size of sweeping is purely technical– it is an optimization problem in which banks trade off revenue from investments and potential costs, such as management cost and overdue penalties imposed by the Federal Reserve. Tracing the size of sweeping and using it as a source of variation in liquidity injection is possible; however it is not practically feasible because of data limitations (the size of sweeping for each individual bank is confidential) and is outside the scope of this paper.

non-local sources; in contrast, larger firms that can access national-wide finance markets, such as by issuing corporate bonds, are less affected by this inflow.

Several assumptions are made to construct the theoretical framework, described below.

Production

(1) There are N regions in the country. N is sufficiently large such that no one single region is big enough to impact aggregate variables significantly (i.e., banks/firms in each region take aggregate variables as given).

(2) There are two types of firms, small firms and large firms. Each region has a representative large firm and a representative small firm. Large firms can fund their investments through either bank loans or issuing bonds in the bond market after paying a fixed entry cost γ. Small firms can only fund their projects through bank lending.

(3) There are two inputs (labor and capital) and one output. The labor market is fully competitive and is mobile, so wages equated cross regions. The output market is fully competitive and transportation cost is zero. Products are exchanged in a nation-wide market and the law of one price is achieved.

(4) Cobb-Douglas production function, with decreasing return to scale, i.e. $F(K, L) = (p + \eta_e)K^{\alpha_i}L^{\beta_i}$, with $\alpha_i + \beta_i < 1$ and $i \in \{s, l\}$, represents small and large firms respectively.p denotes price level and η_e denotes price adjustment.

(5) Assume $\dfrac{\partial F}{\partial E} > r_B$. The marginal product of new capital ∂E is higher than the Fed fund rate. This condition guarantees that the Fed rate is not prohibitively high so that firms will always have the incentive to invest.

Financial sector

(6) There is one bank in each region and firms cannot borrow from outside of the region in which they are located in. Banks serve as the rational, profit-maximizing intermediary between depositors and financial markets. Banks distribute loans to large firms (E_l) and small firms (E_s), at interest rates of r_l and r_s respectively. Banks can also invest money in the bond market at a risk-free rate r_B. This rate is set up by the Federal Reserve.

(7) Banks' expected probability of default for each type of firm are functions $\theta_l(.)$ and $\theta_s(.)$ of the volume of loan E_i, the firms' own capital $\overline{W}$, and the amount of deposit S. Ceteris paribus, the chance of default increases when the firm borrows more, owns less capital, and the bank has less liquidity, i.e. $\dfrac{\partial\theta(E, \overline{W}, S)}{\partial E} > 0$, $\dfrac{\partial\theta(.)}{\partial S} < 0$, $\dfrac{\partial\theta(.)}{\partial \overline{W}} < 0$.

(8) Banks' loss function is convex. $\dfrac{\partial^2\theta(.)}{\partial E^2} > 0.$. This can be explained from the perspective of banks' risk preference. Risk-averse banks' disinclination to risk increases with the amount of loans lent to firms.

(9) The rate of change in risk increases at a faster pace when the borrowing firm has less

owned-capital and the bank has fewer deposits. $\dfrac{\partial^2\theta(.)}{\partial E\partial\overline{W}} < 0$, $\dfrac{\partial^2\theta(.)}{\partial E\partial S} < 0$

Aggregate variables

(10) The price adjustment η_e is set at the aggregate level.

(11) The bond rate is determined by a nation-wide bond market. For simplicity, I assume the interest rate of corporate bond is equal to the treasury bond rate (r_B). The central bank (the Federal Reserve) can intervene by conducting open-market operations to withdraw or inject money into the market.

Given these assumptions, in the later part of this section, I will prove two arguments: (1) regional effects exist (bank lending channel argument) when bank credit is tight and firms are not fully-funded. (2) Larger firms, defined as firms with more self-owned capital, are less likely to be affected by the relaxation of liquidity constraints.

To do so, we need to examine the optimization conditions of the bank and the firms. The sequence of action is as follows: the large firm and the small firm decide their optimal levels of investment at each interest rate, $E_l(i_l)$ and $E_s(i_s)$. The banks then observe $E_l(i_l)$ and $E_s(i_s)$ to determine the supply of bank loans. Based on this timing assumption, we can set out the the maximization problem of a small firm in a representative region j and solve for the small firm's demand for bank loans. To keep notations succinct, I omit the region subscript j for all agents in the representative region. The profit function is defined as:

$$\pi_s = (p+\eta_e)K_{t,s}^{\alpha_s}L_s^{\beta_s} - i_sE_s - wL_s$$

where $K_{t,s} = (1-\delta)K_{t-1,s} + E_s$, δ is the depreciation rate.

Take derivate w.r.t to E and L in both sides:

$$\frac{\partial\pi_s}{\partial E_s} = (p+\eta_e)\alpha_s[(1-\delta)K_{t-1,s} + E_s]^{\alpha_s-1}L_s^{\beta_s} - i_s = 0 \tag{1.2a}$$

$$\frac{\partial\pi_s}{\partial L_s} = (p+\eta_e)(\beta_s)L_s^{\beta_s-1}K_{t,s}^{\alpha_s} - w = 0 \tag{1.2b}$$

Solving the optimization problem gives us the demand function for bank loans for the small firm:

$$E_s^* = \left(\frac{(p+\eta_e)\alpha_s}{i_s}\right)^{\dfrac{1-\beta_s}{1-\alpha_s-\beta_s}}\left(\frac{(p+\eta_e)\beta_s}{w}\right)^{\dfrac{\beta_s}{1-\alpha_s-\beta_s}} - (1-\delta)K_{t-1,s} \tag{1.3a}$$

$$L_s^* = \left(\frac{(p+\eta_e)\alpha_s}{i_s}\right)^{\dfrac{\alpha_s}{1-\alpha_s-\beta_s}}\left(\frac{(p+\eta_e)\beta_s}{w}\right)^{\dfrac{1-\alpha_s}{1-\alpha_s-\beta_s}} \tag{1.3b}$$

Next, let us consider the large firm's problem. As mentioned above, large firms can choose between bank lending or bond market financing, depending on which one is cheaper at the desired investment level. So the profit function is set up as:

$$\pi_l = (p+\eta_e)K_{t,l}^{\alpha_l}L_l^{\beta_l} - i_l E_l - wL_l - (r_B B + \gamma) * I(B>0)$$

where $K_{t,l} = (1-\delta)K_{t-1,l} + E_l + I(B>0)B$ and $I(B>0)$ is a binary indicator function. $I(B>0) = 1$ when $B>0$ and $I(B>0)=0$ when $B=0$.
Because there is a cost associated with bond issuance, the large firm will choose bond financing only when the investment level is large enough. The cut-off point of bond issuance, E^c , is marked by:

$$[(p+\eta_e)\alpha_l((1-\delta)K_{t-1,l}+E^c)^{\alpha_l-1}L_l^{*\beta_l}]K_{t,l} = r_B B + \gamma \tag{1.4a}$$
$$B = E^c \tag{1.4b}$$

Contingent on the cost of financing, there are two possible scenarios:
(1) When $i_l E_l < r_B B + \gamma$, i.e. $E_l < E^c = \dfrac{\gamma}{i_l - r_B}$, financing with bank loans is cheaper than issuing corporate bonds. Now the optimal choice of E_l^* of large firms is governed by the follwing first order conditions:

$$\frac{\partial \pi_l}{\partial E_l} = (p+\eta_e)\alpha_l[(1-\delta)K_{t-1,l}+E_l]^{\alpha_l-1}L_l^{\beta_l} - i_l = 0 \tag{1.5a}$$
$$\frac{\partial \pi_l}{\partial L_l} = (p+\eta_e)\beta_l L_l^{\beta_l-1}[(1-\delta)K_{t-1,l}+E_l]^{\alpha_l} - w = 0 \tag{1.5b}$$

Solve the equations:

$$E_l = \left(\frac{(p+\eta_e)\alpha_l}{i_l}\right)^{\dfrac{1-\beta_l}{1-\alpha_l-\beta_l}}\left(\frac{(p+\eta_e)\beta_l}{w}\right)^{\dfrac{\beta_l}{1-\alpha_l-\beta_l}} \tag{1.6a}$$
$$L_l = \left(\frac{(p+\eta_e)\alpha_l}{i_l}\right)^{\dfrac{\alpha_l}{1-\alpha_l-\beta_l}}\left(\frac{(p+\eta_e)\beta_l}{w}\right)^{\dfrac{1-\alpha_l}{1-\alpha_l-\beta_l}} \tag{1.6b}$$

(5a) can be also written as:

$$i_l = (p+\eta_e)^{\frac{1}{1-\beta_l}}\alpha_l \beta_l^{\frac{\beta_l}{1-\beta_l}} w^{\frac{-\beta_l}{1-\beta_l}} E_l^{\frac{-(1-\alpha_l-\beta_l)}{1-\beta_l}} \tag{1.7a}$$

These can be shown to yield:

$$(p+\eta_e)^{\frac{1}{1-\beta}}\alpha_l\beta_l^{\frac{\beta_l}{1-\beta_l}}w^{\frac{-\beta_l}{1-\beta_l}}E_l^{\frac{1}{1-\beta_l}} = r_B E_l + \gamma \tag{1.8a}$$

(2) When $i_l E_l > r_B B + \gamma$, it is more economical to finance from the bond market. Firm will invest until marginal return to capital equals to the corporate bond rate r_B:

$$E_l = (\frac{(p+\eta_e)\alpha_l}{r_B})^{\frac{1-\beta_l}{1-\alpha_l-\beta_l}}(\frac{(p+\eta_e)\beta_l}{w})^{\frac{\beta_l}{1-\alpha_l-\beta_l}} - (1-\delta_l)K_{t-1,l} \tag{1.9a}$$

$$L_l = (\frac{(p+\eta_e)\alpha_l}{r_B})^{\frac{\alpha_l}{1-\alpha_l-\beta_l}}(\frac{(p+\eta_e)\beta_l}{w})^{\frac{1-\alpha_l}{1-\alpha_l-\beta_l}} \tag{1.9b}$$

Therefore, large firms' demand for bank loan is:

$$E_l = \begin{cases} 0, & \text{if } E_l > E^c \\ (\frac{(p+\eta_e)\alpha_l}{i_s})^{\frac{1-\beta_l}{1-\alpha_l-\beta_l}}(\frac{(p+\eta)\beta_l}{w})^{\frac{\beta_l}{1-\alpha_l-\beta_l}} - (1-\delta)K_{t-1,l}, & \text{if } 0 < E_l < E^c \end{cases} \tag{1.10}$$

The two "global" variables, bond market rate and expected price change, are determined by general equilibrium conditions marked by the summation of all regional markets. The price level is determined by the gap between saving and investment. Here we assume that the expected price change is proportional to the investment/saving gap (Takahashi (1971)), i.e.

$$\eta = \Omega(I-S)/K$$

where I, S, K are aggregate investment, savings, and capital stock of all regions.

$$I = \sum_j (E_{s,i} + E_{l,i}), S = \sum_j [(1-\delta_1) - (1-\delta_2)]S_j, K = \sum_j (K_{l,t-1} + K_{s,t-1})$$

The bond market rate is determined by:

$$\frac{B_c}{r_B} + \sum_j Q_j(r_B, \bar{W}) = \sum_j \Lambda_j(r_B)$$

where B_c is the amount of treasury bonds issued by the Federal Reserve, $\sum_j Q_j$ is the aggregate demand for corporate bond by all large firms, and $\sum_j \Lambda_j$ is the amount invested in the bond market by all banks.

Now consider banks' optimization problem. By assumption, the bank is a monopoly supplier of loans. Thus, it will observe firms' demand functions for credit at each interest rate level and decide the amount of lending to large firms and small firms accordingly. The profit maximization problem can be written as:

$$\pi = i_s E_s + i_l E_l - \theta_s(E_s, \overline{W}, S)E_s - \theta_l(E_l, \overline{W}, S)E_l + r_B B$$

s.t. $E_s + E_l + B \leq (1-\sigma)\overline{S_{t-1}}$, where σ is the required reserve ratio.
Substitute the large firm's and the small firm's demand functions for bank credit into the profit function, and the bank's optimization problem becomes a piecewise function. To ease the discussion, I first consider the optimal solution when $E_l < E^c$ and $\tilde{S} > E_l + E_s$, and then later discuss other scenarios.
Set up Lagrangian:
$\mathcal{L} = i_s^*(E_s)E_s + i_l^*(E_l)E_l - \theta_s(E_s, \overline{W}, S)E_s - \theta_l(E_l, \overline{W}, S)E_l + r_B B - \lambda[E_s + E_l + B - \tilde{S}]$
For banks, the marginal revenue of lending (MRL) is:

$$MRL_i = (p+\eta_e)^{\frac{1}{1-\beta_i}} \alpha \beta_i^{\frac{\beta_i}{1-\beta}} w^{\frac{-\beta_i}{1-\beta_i}} (\frac{\alpha_i}{1-\beta_i}) E_i^{\frac{\alpha_i+\beta_i-1}{1-\beta_i}}, i \in \{s, l\}$$

Intuitively, banks will lend until the "net" marginal revenue of lending (NMRL, which is the marginal revenue of lending minus risk and opportunity cost of investing in the bond market), i.e.,

$$NMRL_i = MRL_i - \frac{\partial \theta_i}{\partial E_i} * E_i - \theta_i - r_B = 0, i \in \{s, l\}$$

Now consider what would happen when the required reserve ratio is relaxed. Differentiate E_s^* and E_l^*:

$$\Delta E_s^* = \frac{\partial E_s^*}{\partial r_B}\Delta r_B + \frac{\partial E_s^*}{\partial \eta_e}\Delta \eta_e + \frac{\partial E_s^*}{\partial \tilde{S}}\Delta \tilde{S}$$
$$\Delta E_l^* = \frac{\partial E_l^*}{\partial r_B}\Delta r_B + \frac{\partial E_l^*}{\partial \eta}\Delta \eta + \frac{\partial E_l^*}{\partial \tilde{S}}\Delta \tilde{S}$$

Since the price level change is determined by the aggregation of all regions and any single region is small enough compared to the national market by assumption, the price level and the bond market rate changes, i.e., $\Delta\eta_e$ and Δr_B, can be assumed to be very small. Also, because these two variables are global, they can be addressed by adding time fixed effects in the regression. Therefore, the changes in commercial loans only depend on $\Delta\tilde{S}$. Four possible scenarios may emerge and will be discussed one by one.
(1) When $S > E_s^* + E_l^*$ and $E_l^* < E'^*$, the constraint is now not binding and the loan demand of the large firm does not exceed the break-even point of issuing bond E'^*. Be-

cause the function of marginal revenue of loan is a decreasing function, the marginal revenue of loan is higher than purchasing bonds for $E < E_s^*$ and $E < E_l^*$. Now the bank will keep lending until the marginal revenue of commercial loan equals the cost of risk plus the bond market rate. Now the amount of loans lending to large firms and to small firms are functions of the levels of firm owned capital and price level change, i.e. $E_s = E_s^*(\eta, \overline{W}_s, r_B)$ and $E_l = E_l^*$, and the rest can be invested into the bond market, i.e., $B^* = S - E_s^* - E_l^*(\eta, \overline{W}_l, r_B)$. Now, if the reserve requirement is relaxed, the bank will not lend the newly available money to firms, since the marginal benefit of lending will be smaller than the marginal cost. This implies that $\frac{\partial E_s^*}{\partial \tilde{S}} = 0$, $\frac{\partial E_l^*}{\partial \tilde{S}} = 0$, therefore now E_s^* and E_l^* are only shifted by the changes in equilibrium inflation and bond rate, $\Delta \partial E_s^* \approx 0$ and $\Delta \partial E_l^* \approx 0$. Graphical illustration is shown in Figure 1.1.

(2) When $S > E_s^*$ and $E_l^* > E^{'*}$, it is now more economical for large firms to finance from the bond market. Now large firms will choose zero bank lending, $E_l^* = 0$, while small firms are still well-funded by banks. Also, as $E^{'*} = \frac{\gamma}{i_l - r_B}$ is not a function of $\tilde{S}$, relaxing the reserve requirement does not change the cut-off scale of bond-financing, we have $\frac{\partial E_l^*}{\partial \tilde{S}} = 0$, and the large firm still does not borrow from the bank. It is the same with the scenario in (1): since the bank already funds the small firm until MRL equals to the marginal cost, the bank will not further extend small firm lending. Graphical illustration is shown in Figure 1.2.

(3) When $S < E_s^*$ and $E_l^* > E^{'*}$, the bank is now facing liquidity constraints and large firms finance investment from the bond market. Because the function of marginal revenue of loan is decreasing in E, for the bank, the marginal revenue of lending is higher than investing in the bond market. Therefore, the bank will grant all loanable money to small firms. When the reserve requirement is relaxed, and the liquidity constraint is lifted, the bank will first allocate the additional liquidity to commercial loans to small firms and not to buying bonds until $E_s = E_s^*$. By the same logic in (2) , the large firm will still finance from the bond market, $\frac{\partial E_l^*}{\partial \tilde{S}} = 0$. A graphical illustration is shown in Figure 1.3.

(4) When $S < E_s^* + E_l^*$ and $E_l^* > E^{'*}$, the bank is now facing credit constraint and the large firm will finance from bank loans because the investment is not large enough to offset the cost of bond issuing fees. Now, since the marginal revenues of loans for both large and small firms are higher than the bond rate, the bank will prioritize commercial lending and again equalize net MRL of large firms and MRL of small firms, i.e., NMRL$_s$ =NMRL$_l$. In this case, the bank invests zero in the bond market, $B = 0$. It is easy to prove that E_s and E_l under this new equilibrium are larger: see Figure 1.4.

In the case when firms are facing credit constraint ((3) and (4)), if the reserve ratio is relaxed, banks will extend commercial lending. Therefore, this verifies the claim about the bank credit channel raised at the beginning of this section. Putting this conclusion into context, a remarkable feature associated with the period of 1982-1992 (which is during Paul Volcker's tenure as Chairman of the Federal Reserve and the first a few years of Alan Greenspan's tenure under the George HW Bush administration) is the very low level of excess reserve held by banks (less than 1/10000 of total deposit), banks' unwillingness to make new loans (Figure 1.6) and high interest rates (Figure 1.5). These three factors combined suggest that banks were liquidity-constrained and firms were more likely to be underfunded. In this context, the relaxation of the reserve policy is more likely to impact the real economy.

Now, I show that firms with more owned capital tend to finance from the bond market and are therefore less likely to benefit from banks' liquidity expansion, as they might be already funding their investments from the bond market. For this purpose I show (see Appendix A.1 for the detailed proof), that the cut-off point E^c is an increasing function of the firm's own capital $\overline{W}$.

To test this prediction, regressions will be run separately for firms of different size categories in the next part of the paper. If the prediction is true, relaxation of the reserve requirement will lead to greater expansion of smaller firms relative to larger firms. If we replace the large/small firm distinction with the level of dependence on external finance, we can reach a similar conclusion: high external finance dependent firms are more likely to benefit from liquidity expansion than are low external finance-dependent firms.

1.4 Methodology

1.4.1 Main Regression

The econometric strategy in this paper has two scaffolding steps. First, I regress the size of new bank loans on the increment of unleashed reserves to confirm that additional liquidity does lead to additional credit supply. This regression is performed at the bank-year level. The regression equation is:

$$\Delta log(TotLoan_{i,t}) = \beta_0 + \beta_1 \Delta log(Reserve_{i,t}) + \beta_2 \frac{TotLoan_{i,t}}{TotAsset_{i,t}} + \beta_3 \Delta log(Dep.) + I(InterStBk)_{i,t} + I(IntraStBk)_{i,t} + I(Year)_t + \epsilon_{i,t}$$

where i, t denote bank i in year t. $\Delta log(TotLoan_{i,t})$ is the log difference of the previous year loan and the current year loan, i.e., $\Delta log(TotLoan_{i,t}) = log(TotLoan_{i,t}) -$

$log(TotLoan_{i,t-1})$. $\Delta \log(Reserve_{i,t}) = \log(Reserve_{i,t}) - \log(Reserve_{i,t-1})$, calculated from a bank's balance sheet as of Dec 31 of year (t-1). $\Delta log(Dep.)$ is the log difference of deposit. $\frac{TotLoan_{i,t}}{TotAsset_{i,t}}$ is the ratio of a bank's total loan versus total assets. It measures bank's capacity to extend more lending. A higher loan/asset ratio indicates that the ability to extend new loans is limited. $I(InterStBk)_{i,t}$ is the dummy variable indicating whether the state where the bank is located allowed interstate banking in that year. $I(IntraStBk)_{i,t}$ is the dummy variable indicating whether the state where the bank is located allowed intrastate banking in year t.

The second set of regressions attempts to establish a link between regional employment growth by industry and credit supply. If the relationship established in the first regression is substantive, new investment owing to the relaxation of the reserve requirement should also generate growth in employment.

There are still some endogeneity concerns that the membership choice is not random. In deciding whether to acquire membership with the Federal Reserve, banks often trade off the costs (having to maintain more required reserve) and benefits (accessing to some services, such as check collection, discounts and credits, coin and currency pickup and delivery). After conducting a simple OLS regression using 1980 bank call report data, I find that two factors played a very important role in this process. First, the choice depended on the state the bank is located in. The additional cost tended to be relatively low when the headquarter state already had a strict reserve requirement. This issue can be addressed by adding headquarter state fixed effects in the regression. Second, member banks were generally bigger banks since the services provided by the Federal Reserve were more valuable to them. It could be that some other concurrent changes induced larger banks to lend more after MCA 1980 went into effect. This common effect on large banks could lead to a bias in the direction of what is found in this paper. To address this concern, I classify banks into three even categories using the asset level in 1980 and generate three dummy variables: $I(Large)$, $I(Medium)$, $I(Small)$, and add the year $\times$ bank size dummies interaction fixed effects into the equation.

In the second set of regressions, the scope of analysis is on the county level (using County Business Pattern data). The reason behind choosing the county as our analytic unit is twofold. Aside from the fact that the county is usually the smallest unit measured by government-published economic statistics, the average size of a US county is approximately 1200 square miles: if a county were circular, it would have a 34-mile radius, which would serve most of a bank branch's clients if it were located in the county's geographical center.

First, I provide some simple non-parametric evidence. I group counties by the extent of decrease in reserve requirements. In Figure 1.8, I document the year-by-year employment growth of the top 25% of areas and the bottom 25% of areas. This non-parametric evidence is consistent with the main proposed idea that areas with more reduction in required reserve saw greater employment growth. To confirm the result parametrically, I conduct the regression below. Starting from the generic production function (the derivation process is shown in Appendix A.4), the regression equation is set as:

$$log(REmpChg_{i,t}+1) = \beta_0 + \beta_1 log(RResChg_{i,t}+1) + \beta_2 log(\frac{TotLoan}{TotDep}_{i,t}) + \beta_3 \overrightarrow{X}_{i,t} + I(Year_t) + I(County_i) + \epsilon_{i,t}$$

i, t denote county i in year t. $REmpChg_{i,t}$ is the relative change of employment, defined as $\frac{Emp_{i,t} - Emp_{i,t-1}}{0.5Emp_{i,t} + 0.5Emp_{i,t-1}}$. $\frac{TotLoan}{TotDep}_{i,t}$ is the total loan/deposit ratio of all banks in county i and year t. $\overrightarrow{X}$ is the set of control variables. Referring to regional growth literature, such as Carlino and Mills (1987), county typology (urban/rural classification, dominant industry), crime rate, and population density are added as additional controls. $RResChg_{i,t}$ is the ratio of change in reserves as the fraction of total deposits in the area, defined as required reserve in year t minus required reserve in year (t-1) divided by $TotDep_{i,t}$, i.e., $\frac{Reserve_{i,t} - Reserve_{i,t-1}}{TotDep_{i,t}}$. There are two ways to distribute bank-level reserve changes and loans to county-level. First, I distribute them evenly across all affiliated branches and aggregate over all branches in the county. For example, if Bank A has two branches in total and one branch in County 1, Bank B has three branches in total and one branch in County 1, and required reserve changes for both banks are three million, then the reserve change for County 1 would be $\frac{1}{2} * 3$ (by Bank A)+ $\frac{1}{3} * 3$ (by Bank B) =2.5 million. Then I use an alternative method and distribute reserve to the county-level weighting by the volume of deposit in each branch to ensure the results are robust to distributing methods. $I(Year_t)$ and $I(County_i)$ denote year and county fixed effects.

Because growth rate regressions are often plagued by autocorrelation problems, and because my data are a dynamic panel with a short time horizon (T) and a large number of counties (N) (Nickell (1981)), the Wooldridge test for autocorrelation in panel data is conducted to determine an appropriate estimation strategy. From Table 1.1, the Wooldridge test confirms that the data are immune to this autocorrelation problem. To be on the safe side, I report first-differencing (FD) and fixed effect (FE) results and FE estimator with Driscoll-Kraay standard errors to allow for potential cross-sectional heteroskedasticity.

1.4.2 Heterogeneity by Firm and Industry Characteristics: Firm Size and External Finance Dependence

My theoretical model suggests heterogeneous effects by firm size. To test this, I undertake a third set of regressions to test whether the effect of changes in required reserves varies by firm size as predicted by the model. Therefore, I break down establishments into three categories: 1-19 employees, 20-100, and 100 or more.

Consistent with the assumptions in the model, data suggests smaller firms are more reliant on bank finance: In particular, according to the Quarterly Financial Report, bank debt composes 82.9% of a firm's total assets among small companies, while for large companies, that number is 22.8% (see Table 1.3). Similarly, it is reasonable to expect that firms in industries more dependent on external finance will benefit the most from financial expansion. To examine whether credit availability affects different industries, I generate an external finance dependence index for SIC-4 industries following the method proposed by Rajan and Zingales (2001) using Compustat.[5] Then I run the following specification for the industries for top and bottom 25% of industry groups (by index of external finance dependence) separately:

$$log(REmpChg_{i,t,j}+1) = \beta_0 + \beta_1 log(RResChg_{i,t}+1) + \beta_2 log(\frac{TotLoan}{TotDep}_{i,t}) + \\ + \beta_3 \overrightarrow{X}_{i,t} + I(Year_t) + I(County_i) + \epsilon_{i,j,t}$$

where i,t denote county i of year t. j=0 indicates summation of employment changes of the bottom 25% industry group, j=1 indicates summation of employment changes of the top 25% industry group. Financial sector is excluded from the sample.

1.4.3 Other Institutional Changes in This Period

In the wake of the 1973 oil crisis and the 1979 energy crisis, high inflation began to distress the economy. Per Meltzer (2014), public concerns about the inflation exceeded concerns about unemployment during this period. As a response, Paul Volcker initiated an aggressive anti-inflation monetary policy. The contractionary monetary policy is said to be one of the causes of the short early 1980s recession. US unemployment spiked in 1980, and

[5] Per Rajan and Zingales (2001), a firm's dependence on external finance is defined as capital expenditures (Compustat# 128) minus cash flow from operations (broadly defined as the sum of cash flow from operations plus decreases in inventories, decreases in receivables, and increases in payables) divided by capital expenditure. After aggregating capital expenditure and cash flow from operations for each company for the period from 1982-1992, I then take the median of all firms in the same industry to avoid over-representation of large firms. To exclude extreme values and industries with too few firms, I drop top 1% and bottom 1% of observations that are not comparable to the indices in the original paper in magnitude from the data.

gradually returned to the pre-recession level by 1984. Since the root of the recession was monetary, to ensure the cleanness of the experiment, I exclude the disinflation and subsequent recovery period between 1982-1984. The results are presented in Section 1.6.2.1

Another important regulatory change during this period is the deregulation of depository institutions. Besides the regulatory changes in reserve requirements, another purpose of the reform in 1980 was to gradually remove the interest rate ceiling, stipulated in Regulation Q of the Glass-Steagall Act, in the period between 1980 and 1986. The reform also allowed banks to operate new depository businesses, such as creating negotiable order of withdrawal (NOW) accounts. These concurrent institutional changes could impact our analysis in three ways: (1) It was possible that the deregulation created changes that could impact the availability of liquidity in the market. However, because the variation utilized in this paper is regional, as discussed in the theoretical analysis in Section 1.3, the changes in general equilibrium variables are unlikely to affect or analysis (which controls for common macroeconomic shocks using period fixed effects). (2) The financial deregulation may also have affected member and non-member banks differently and resulted in gains and losses of jobs in the financial sector at the same time. I undertake two robustness checks to address this concern. First, I exclude states in the northeast region and Illinois, which have higher percentages of employment in the financial sector than national average, and I run a sub-sample analysis. Second, the financial sector is excluded in the financial dependence and growth regressions in Section 1.6.1 to check if employment still grows. Results are discussed in Section 1.6.1. (3) One of the initial intentions of Regulation Q was to prevent small banks from depositing into big banks, instead of lending more locally (Gilbert, 1986). If the legislators' worries were true, small banks would withdraw money from big banks and extend more lending. However, as illustrated in Gilbert (1986), the percentage of deposits at large commercial banks from other banks was not changed due to the passing of Regulation Q, and there was also no abrupt growth in the level of inter-bank loans after the interest rate deregulation.

Finally, during this period, many states began relax bank branching restrictions. It has been documented in Jayaratne and Strahan (1996) that bank branch deregulation resulted in economic growth. Two robustness checks are performed to rule out the alternative explanation. First, I add the interaction term between state ID and year fixed effects. Because deregulation of branching is a decision made on the state-level, this term absorbs potential effects of state-level deregulation. Second, I run a sub-sample analysis using only county-year pairs with no new bank branch entry. The result is presented in Section 1.6.2.3

1.5 Data and Summary Statistics

1.5.1 Bank Balance Sheet Data

The balance sheet data of banks are taken from the quarterly Consolidated Report of Condition and Income filed by individual banks (rather than bank holding companies), often referred to as "call reports". Banks are required to file and submit call report forms four times each year : on 03/31, 06/30, 09/30, and 12/31. Because this paper examines the effect taking place across the year, I use 12/31 data of year (t-1) to calculate deposits, loans and reserve level for year t. Call reports contain detailed on- and off-balance sheet information, such as assets and liabilities, deposits by categories, amount of loans committed, income from each line of business, and costs incurred. Due to changes in reporting regulations, there are inconsistencies in definitions of some variables: what comprises variable name A in some years may be referred to as variable B in others. Some standardization is required to ensure consistency. The methodology used to standardize the data is presented in Appendix A. Table 1.4 shows descriptive statistics of some variables to be used in the first regression.

My analysis examines banks that existed for at least two years during the 1982 to 1992 sample period. The decline in the number of banks during this period was due mainly to bank consolidation and bank failures. To ensure the cleanness of the analysis, I exclude the bank-year pairs impacted by mergers or acquisitions in the previous year. After cleaning, the sample includes 157,896 bank-year observations for 18,539 unique banks.

1.5.2 Bank Location Data

Bank location information is taken from yearly Institution Directory data provided by the FDIC (Federal Deposit Insurance Corporation). The dataset includes geographical information for individual banks' affiliated branches (identified by RSSD ID) such as city, state, county, zip code, and GPS coordinates. The FDIC website provides available-to-download datasets starting in 1994. I obtained 1987-1993 datasets through an FOIA request directed to the FDIC. Since the data also record the dates of establishment and acquisition, I can infer the prior distribution of each banks' branches for covering the entire period of our interest by matching the dataset for year 1987 with bank mergers and acquisitions and failure data obtained from the Federal Reserve Bank of Chicago.

1.5.3 County-level Data

To focus on the impact of real estate market shocks, we control for local economic conditions in our estimations. County typology codes compiled and maintained by the USDA capture a range of economic and social characteristics. These codes include the following classifications: farming, mining, manufacturing, Federal/State government, recreation, retirement destinations, high poverty and nonspecialized. I also introduce two control variables that potentially affect county development– crime rate and population density– from the Census Bureau USA Counties database. The descriptive statistics are shown in Table 1.4.

County-level employment data with industry breakdowns are obtained from the County Business Patterns (CBP) released by the Census Bureau. The original CBP data contain the number of establishments by establishment size and industry. One issue with the CBP data is that, to protect the rights of employers to confidentiality, the U.S. Census Bureau has not disclosed the number of employees when identifying individual firms. Instead, it places a suppression flag, with each letter representing an employment range. In my estimation of employment size change, I employ the method of imputation in Autor et al. (2013) to generate the size of employment at the country-SIC 4 code level [6].

1.6 Results

1.6.1 Baseline Results

This section applies the methodology discussed above and presents results for each part. First, I present the estimates of how changes in reserve requirement affect growth in loans at the individual bank level. I then estimate the impact of reserve requirement changes on local employment growth. Next, I examine the effects of changes in reserve requirements separately for subsamples that differ on firm size and industry finance dependence level.

Table 1.5 reports the first regression in the twofold analysis, identifying whether changes in the required reserve affected new loans extended. Column (1) reports the baseline specification. Reserve change receives a negative and significant sign, implying that banks lend more when the obligation of keeping a reserve relaxes. The 0.306 coefficient suggests that banks lend out 30.6% of the reduced reserve. Column (2) controls county fixed effects. Column (3) adds state*year FEs to the regression. This specification helps to eliminate

[6] A fixed point algorithm is implemented to estimate employment numbers within the indicated brackets. The algorithm also imputes employment which is only reported at aggregate industry levels to 4-digit SIC industries.

the endogeneity concern that states with more member banks happened to grow faster in bank lending, as discussed in Section 1.4.1. Column (4) adds the 1980 bank size category dummies (small, medium, and large) and year interaction fixed effects. It eliminates the concern that large banks, which tended to be member banks, started lending more after the reform. The coefficient on the required reserve change slightly shrinks, but remains negatively signed and statistically significant. These results are supportive of the existence of the lending channel that bridges reserve requirement changes and local economic growth. The results remain stable and statistically significant. The result remains stable and statistically significant. These results are supportive of the existence of the lending channel that bridges reserve requirement changes and local economic growth.

In Table 1.6, I link reserve requirement changes with local employment data to examine whether changes in the required reserve have an impact on the local real economy. The first 2 columns in Table 1.6 report first-differencing estimates, before and after adding more local characteristics such as demographic controls. Column (3) reports estimates after including county fixed effects. The coefficient is larger than in Column (1) but the sign and significance level remain the same. Column (4) reports results using the Driscoll-Kraay standard error (Driscoll and Kraay (1998)). The sign and the magnitude are in tandem with FD and FE estimates. All four estimation methods obtain estimates in support of the argument that relaxing the reserve requirement boosts local employment growth: the results are invariant to the estimation strategies selected, as reported in the last row of the table, and are also robust after adding county characteristics as control variables.

One concern could be that the employment growth might be mainly driven by small counties. To address this, I run a population-weighted regression in Column (5). The coefficient shrinks slightly but not too much, implying that small counties are not over-weighted in the results. I add region*year and state*year fixed effects in Column (6) and Column (7). The interaction terms help to control region-year and state-year specific unobservables. Adding state*year fixed effects also helps to control the effect of intrastate banking deregulation. The addition reduces the magnitude of the coefficient, but the direction and significance are still preserved. Based on the coefficient of the last column, 1% of reduction in required reserve as a percentage of total deposit increases employment growth by 1.03%. The number is comparable with Lee (2016) using US Small Business Loan program and is slightly on the big side. However, as discussed in Section 1.3, since the US banks were facing liquidity constraint, it is not surprising that the supply of extra credit generated a larger effect.

Table 1.7 reports the results when distributing bank-level required reserve to the county-level weighted by the amount of deposit in each branch. Only the main variable of interest, log(RResChg+1), and the two saturated fixed effects specifications with lagged terms in

Column (8) and (9) of Table 6, are reported to make the output succinct. The main variable of interest remains negatively signed and significant, suggesting that the results are robust to the alternative distributing method.

Table 1.8 summarizes the coefficients obtained from the same regression strategy as in Table 1.6 separately by firm size groups. To keep the output succinct, I only report coefficients for the main independent variable of interest in the table. The coefficient for reserve level change becomes insignificant for the firm group with more than 100 employees (which represents the top 0.75% in US firm size distribution according to Axtell (2001)). The results suggest that large firms with over 100 employees tend to benefit less from banks' credit expansion, which is consistent with my model and the fact that larger firms have more diversified ways to finance themselves other than obtaining bank credit (Hancock et al. (2007)).

Table 1.9 reports the results after partitioning industries by dependence on external finance. Column (1) and (2) show the top 25% and bottom 25% of industry groups by external finance dependence index. Column (1) and (3) report the specification with region*year fixed effects. Column (2) and (4) report the specification with state*year fixed effects. The comparison suggests that the impact of reserve changes is stronger for firms that are more dependent on external finance.

1.6.2 Robustness Checks

1.6.2.1 Subsample Analysis: Excluding 1982-1984

The study period of the natural experiment covers the year of 1982, which is the peak of the recession that began in 1981, and subsequent recovery until 1984, as shown by Figure 1.7. To ensure the cleanness of the experiment, I excluded this time period and reran the regressions in the previous section. The results are presented in Table 1.10. Column (1) reports the fixed effect model estimates. Column (2) and (3) add region*year and state*year fixed effects. Column (4) adds lag terms of employment. The estimates are slightly larger than the baseline, but remain negative and significant. The results show that the baseline results are robust in this sub-sample.

1.6.2.2 Excluding Northeastern US and Illinois

As argued in Section 1.4.3, one concern is that the financial deregulation that occurred at the same time as the natural experiment created new jobs in financial sector. Although regression in Table 1.9 which excludes finance sector shows that sectors other than financial service (SIC 6000-6799) also grow in employment, to further eliminate this concern, I removed northeastern states and Illinois, which have larger percentages of employment in the financial sector, and re-conducted the regressions specified in Table 1.6 in the subsample analysis. In Table 1.11, Column (1) reports fixed effect model estimates. Column (2) and (3) add region*year and state*year fixed effects. Column (4) adds lag terms of employment. As shown in Table 1.11, the main results still hold, suggesting that the job gains due to the financial deregulation did not account for the employment changes during this period.

1.6.2.3 Including Only County-year with No New Bank Branch

As mentioned in Section 1.2.3, one important institutional change that occurred during the period of interest is bank branch deregulation. As documented in Jayaratne and Strahan (1996), the relaxation of bank branch restrictions led to observed changes in growth. Also, since the methodology used in this paper allocates reserve change to all branches of multi-branch banks when they enter a new location, the county-level reserve changes too. It is of concern that the employment growth might be attributable to new bank entry after the deregulation, rather than reserve changes. Although Column (7) in Table 1.6 confirms that the result is still significant after adding state*Year fixed effects, which controls for state-level deregulation effects. To further address this the concern, I check robustness using a sub-sample where I retain only county-year pairs with no new bank branches established. The results are presented in Table 1.11. Column (1) reports fixed effect model estimates. Column (2) and (3) add region*year and state*year fixed effects. Column (4) adds lag terms of employment. Again, the significance and sign of point estimates are not drastically changed, suggesting that bank branch deregulation does not account for all employment growth.

1.6.2.4 Addressing Spillover Effects on Neighboring Counties

In this section, I create an index to capture possible spillover effects to/from adjacent regions. The index weights reserve change from all proximate counties with their pairwise distances. Based on the evidence that 90% of firms are located within 100 miles of banks with which they do business, I first set this radius at 100 miles, and then at 150 miles. Assuming that impact decays exponentially with distance, the index of credit expansion, total deposit and reserve change is defined as:

$$\Delta ReserveIndex_{i,t} = \sum_k \Delta ReserveChg_{i,t} e^{\frac{-D}{D - Distance_{i,k}}}$$

$$TotDepositIndex_{i,t} = \sum_k TotDeposit_{i,t} e^{\frac{-D}{D-Distance_{i,k}}}$$

$$TotLoanIndex_{i,t} = \sum_k TotLoan_{i,t} e^{\frac{-D}{D-Distance_{i,k}}}$$

$$RWtdResChg_{i,t} = \frac{\Delta ReserveIndex_{i,t}}{TotDepositIndex_{i,t-1}}$$

$$WtdLoanDepoRatio_{i,t} = \frac{TotLoanIndex_{i,t}}{TotDepositIndex_{i,t}}$$

where D=100 or 150. i,k,t denote zip code i, bank k, and year t. $Distance_{i,k}$ is the distance between zip code i and bank k.

After constructing the index, I then regress:

$$log(REmpChg_{i,t}+1) = \beta_0+\beta_1 log(RWtdResChg_{i,t}+1)+\beta_2 log(WtdLoanDepoRatio_{i,t})+ \beta_3 \overrightarrow{X}_{i,t} + I(Year_t) + I(County_i) + \epsilon_{i,j,t}$$

The results are presented in Table 1.13. Column (1) reports fixed effect model estimates. Column (2) and (3) add region*year and state*year fixed effects. Column (4) adds lag terms of employment. The coefficients have the same sign as the baseline results, suggesting that the growth effect is significant even after considering neighboring counties. Because the reserve and deposit indexes are artificially weighted numbers, here the magnitude of coefficients does not indicate the size of the employment growth effect.

1.7 Conclusion

The relationship between monetary policy and economic growth is a long-standing topic of interest in finance and macroeconomics, with important policy implications. Potential neutrality of money, and hence the effectiveness of monetary policy in affecting real outcomes, is topic of ongoing debate among banking scholars and macro-economists. From the micro perspective, the interaction between development and finance represents a research area that continues to draws a great deal of research interest.

Utilizing reserve requirement changes as a natural experiment, I conduct regression analyses to examine whether changes in loanable money affect bank lending and have an impact on local growth. The results suggest that banks increase lending when the reserve requirement is relaxed and that lowering the required reserve also boosts local employment growth. Robustness checks suggest that the employment growth was not caused by contemporaneous financial deregulations. Additional analyses are conducted for different employee size brackets and for industries with different levels of dependence on external finance. The results suggest that the reduction in required reserve leads to a higher growth rate for smaller firms than for larger (100+ employees) firms, and for high external-finance-dependent industries than low external-finance-dependent sectors.

This paper's findings impact on three different areas of current research. First, they explores the real economic consequences of a conventional monetary policy tool, reserve requirement, using a natural experiment and micro-level data. This approach avoids endogeneity concerns in previous macro-data based papers and contributes to recent research on the effect of non-conventional monetary policy after the Great Recession. Second, in the context of the literature on financial constraints, this paper provides new evidence that an increase in loanable money generates business growth. Finally, although the study was established using data from an earlier time period, because many countries still use the reserve requirement as a major monetary policy tool, the methodology and the conclusions still carry lessons for researchers and policymakers in these countries. In the wake of the surge of excess reserve after 2008 and possible future regulatory revisions, this research could also contribute to future research about the reserve requirement as a monetary policy tool in the US.

Table 1.1: Wooldridge Test for Autocorrelation in Panel Data

VARIABLES	Dep. Var. and Explanatory Vars. Only	With Control Vars.
F Value	0.136	0.01
P-Value	0.7121	0.9719

H0: no first-order autocorrelation

Table 1.2: Summary Statistics, Bank-level Regression

Variable	Obs.	Mean	Std. dev	10%	25%	50%	75%	90%
$\Delta Log(Res.)$	149,167	0.026	0.678	-0.523	-0.105	0.154	0.287	0.693
$\Delta Log(Loan)$	160,213	0.086	0.923	-0.104	-0.014	0.066	0.154	0.279
$\Delta Log(Depo.)$	164,792	0.090	0.378	-0.039	0.014	0.065	0.126	0.224
Loan/Depo ratio	166,713	0.618	0.560	0.370	0.481	0.594	0.692	0.770
Intra. Banking	188,197	0.455	0.498	0	0	0	1	1
Inter. Banking	188,197	0.269	0.444	0	0	0	1	1

This table describes the variables in the first regression (reserve change-new bank loan). $\Delta Log(Res.)$ is the log difference of required reserves of time t from (t-1), i.e. $Log(Reserve_t) - Log(Reserve_{t-1})$. $\Delta Log(Loan)$ denotes the log difference of loans. $\Delta Log(Depo.)$ denotes the log difference of deposits. Intra. Banking denotes whether the state relaxed intra-state banking regulation (=1 regulation relaxed). Inter. Banking denotes whether the state relaxed inter-state banking regulation.

Table 1.3: Bank and Nonbank Sources of Debt for Manufacturing Corporations

	1973:4				1991:4			
	Total	Large	Medium	Small	Total	Large	Medium	Small
Bank debt/Total debt								
Short-term	78.8%	64.9%	93.1%	84.0%	44.9%	22.8%	77.0%	82.9%
Long-term	24.6%	17.1%	36.1%	43.3%	31.2%	21.1%	51.7%	59.3%
Total	34.4%	23.4%	49.8%	55.3%	33.0%	21.3%	54.9%	65.5%
Commercial paper as % of								
Short-term debt	12.7%	26.1%	2.1%	1.7%	N.A.	62.8%	6.9%	N.A.
Non-bank short-term debt	59.7%	74.3%	31.0%	10.4%	N.A	81.3%	30.1%	N.A.
Total debt	2.3%	3.4%	0.5%	0.5%	N.A.	7.5%	0.9%	N.A.
Total nonbank debt	3.5%	4.5%	1.0%	1.1%	N.A.	9.6%	1.9%	N.A.

Source: Quarterly Financial Report. Replicated from Kashyap and Stein (1994). This table shows the sources of debt for manufacturing corporations. Medium and small firms have higher reliance on nonbank financing sources than large firms.

Table 1.4: County-level Summary Statistics: the Second Sets of Regressions

Statistics	Ratio Res. Chg.	Ratio Emp. Chg.	Pop. Density	Crime rate	Rural-Urban Contin.
Mean	-.007008	.041	223.731	.00232	5.836
Standard Derivation	.0844	0.183	1603.553	.00289	2.538
p10	-.0497	-0.218	4.621	.0000426	2
p25	-.00744	-0.133	16.481	.00059	4
p75	.0034	0.194	92.063	.0031	8
p90	.019	0.246	278.947	.0055	9

Statistics	Agri. Dep.	Manufact Dep.	Mining Dep.	Govt Dep.	Retire. County	High Poverty
Mean	.232	.194	.051	.073	.157	.078
Standard Derivation	.422	.395	.219	.260	.363	.268
p10	0	0	0	0	0	0
p25	0	0	0	0	0	0
p75	0	0	0	0	0	0
p90	1	1	0	0	1	0

This table describes the variables in the second set of regressions (reserve change-employment change). Ratio Res. Chg. denotes the ratio of change in required reserve as total deposit of the county. and Ratio Emp. Chg. denotes the ratio of employment change from the last year. Urban-Rural Contin. denotes urban-rural continuum. A higher value means the county is more rural. FarmingDep, ManufactDep, MiningDep, GovDep denote whether the county is farming, manufacturing, mining, or government dependent. Retire denotes whether the county is a retirement county. High poverty denotes that the county has a high poverty rate.

Table 1.5: Response of Bank Loans to Reserve Change

	(1)	(2)	(3)	(4)
Dep. Var	$\Delta Log(Loan)$	$\Delta Log(Loan)$	$\Delta Log(Loan)$	$\Delta Log(Loan)$
$\Delta Log(Res.)$	-0.306***	-0.304***	-0.368***	-0.251***
	(0.0219)	(0.0222)	(0.0223)	(0.0204)
Intra-state Banking	0.0873***	0.0342		0.0342
	(0.0191)	(0.0269)		(0.0268)
Inter-state Banking	0.0309**	0.0201		0.0235
	(0.0155)	(0.0258)		(0.0257)
$\Delta Log(Deposit)$	0.401***	0.387***	0.434***	0.364***
	(0.0273)	(0.0278)	(0.0273)	(0.0268)
Loan/Depo Ratio	-5.50e-05	-0.000101	-0.000114	-0.000243
	(8.47e-05)	(8.40e-05)	(7.94e-05)	(5.45e-05)
Year FE	X	X	X	X
County FE		X	X	X
State*Year FE			X	
Size Dummy*Year FE				X
Constant	0.0505**	0.119***	-0.214	0.132***
	(0.0239)	(0.0263)	(0.815)	(0.0265)
Observations	129,336	129,336	129,336	129,461
R-squared	0.353	0.378	0.447	0.403

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

This table reports the response of bank lending to reserve changes. $\Delta Log(Loan)$ denotes the log difference of total loans between year t and year (t-1). $\Delta Log(Deposit)$ denotes the log difference of total deposit between year t and year (t-1). Intra-state Banking denotes whether the state relaxed intra-state banking regulation (=1 regulation relaxed). Inter-state Banking denotes whether the state relaxed inter-state banking regulation. $\Delta Log(Res)$ denotes the log difference of total required reserve between year t and year (t-1). A minus sign on $\Delta Log(Res)$ indicates that the reserve requirement of the bank decreases compared to last year.

Table 1.6: The Effect of Reserve Changes on Local Employment

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Dep. Var.	log(REmpChg+1)	log(REmpChg+1)	log(REmpChg+1)	log(REmpChg+1)	log(REmpChg+1)	log(REmpChg+1)	log(REmpChg+1)	log(REmpChg+1)	log(REmpChg+1)
log(RResChg+1)	-1.097***	-0.996***	-2.142***	-2.262*	–1.878***	-2.467***	-1.216**	-1.24**	-1.09**
	(0.278)	(0.278)	(0.463)	(1.048)	(0.426)	(0.466)	(0.537)	(0.528)	(0.519)
log(REmpChg+1), Lag=1					-0.0113**		-0.129***	-0.161***	-0.186***
					(0.00553)		(0.00555)	(0.00592)	(0.00596)
log(REmpChg+1), Lag=2									-0.127***
									(0.00580)
Log(Depo./Loan)	0.00764	0.00819	0.0100	0.00989***	0.0111*	0.0160**	0.00365	0.00490	0.00542
	(0.00651)	(0.00650)	(0.00686)	(0.00101)	(0.00501)	(0.00703)	(0.00747)	(0.00727)	(0.00727)
Crime Rate	-0.257	-0.0829	-0.793*	-0.872*	-0.101	-0.389	0.182	0.688	0.540
	(0.649)	(0.655)	(0.473)	(0.419)	(0.162)	(0.477)	(0.508)	(0.474)	(0.496)
Pop. Density	-6.74e-06	-4.16e-05	-0.000106***	-8.33e-05***	-2.81e-05***	-7.77e-05***	-3.76e-05**	-4.00e-05***	-4.84e-05***
	(5.78e-05)	(6.66e-05)	(2.00e-05)	(2.20e-05)	(2.68e-06)	(1.76e-05)	(1.77e-05)	(1.52e-05)	(1.72e-05)
Urban-Rural Cont.		0.000235							
		(0.000387)							
FarmingDep = 1		0.000873							
		(0.00228)							
ManufactDep = 1		0.00162							
		(0.00208)							
MiningDep = 1		-0.00485							
		(0.00364)							
GovtDep = 1		0.000764							
		(0.00302)							
Retire = 1		-0.000597							
		(0.00219)							
HighPoverty = 1		0.000330							
		(0.00288)							
Constant	-0.00936***	-0.00974***	14.42***	14.96**	13.27***	15.92***	10.15***	8.771***	11.55***
	(0.00261)	(0.00319)	(2.129)	(4.821)	(1.965)	(2.145)	(2.474)	(1.338)	(2.409)
Region*Year						X			
State*Year							X	X	X
FIPS FE			X	X	X	X	X	X	X
Year FE	X	X	X	X	X	X	X	X	X
Method	FD	FD	FE	FE, D-K s.e.	Pop. Weighted	FE	FE	FE	FE
Observations	33,672	33,189	33,310	33,310	33,310	33,310	33,310	33,310	33,310
R-squared	0.054	0.054	0.139		0.331	0.146	0.152	0.197	0.218

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

This table reports the effect of reserve requirement reduction on employment growth. log(REmpChg+1) denotes the growth of employment. log(RResChg+1) denotes the change of required reserve as the ratio of local total deposit. Negative sign before log(RResChg+1) indicates that reserve reduction leads to employment growth. Urban-Rural Cont. denotes urban-rural continuum. A higher value means the county is more rural. FarmingDep, ManufactDep, MiningDep, GovDep denote whether the county is farming, manufacturing, mining, or government dependent. Retire denotes whether the county is a retirement county. Column (1)-(4) use different estimation method. Column (5) is weighted by population. Column (6)-(7) add region*year and state*year fixed effects. Column (8)-(9) add lag terms of employment growth. Errors are two-way-clustered on county ID.

Table 1.7: The Effect of Reserve Changes by Size– Distributing Reserve by Weighting Deposits of Each Branch

	(1)	(2)
Dep. Var.	log(REmpChg+1)	log(REmpChg+1)
log(RResChg+1)	-0.810***	-0.662**
	(0.312)	(0.311)
State*Year	X	X
FIPS FE	X	X
Year FE	X	X
Method	FE with with one lag terms	FE, with two lag terms
Observations	33,310	33,310
R-squared	0.152	0.197

This table reports the effect of reserve requirement reduction on employment growth when distributing required reserve to the county level by weighting the amount of deposit in each branch. Only the main variable of interest, log(RResChg+1), is reported to make the output succinct. Column (1) and (2) have the same specifications as in Column (8) and (9) of Table 6, reporting saturated fixed effect model results with one- and two- period lagged employment growth terms.

Table 1.8: The Effect of Reserve Changes by Size

Size Category	1-19	1-19	20-100	20-100	100+	100+
log(RResChg+1)	-3.283***	-0.627*	–5.444***	-2.282**	4.245**	4.813**
	(0.309)	(0.352)	(0.993)	(1.166)	(1.685)	(2.086)
Region*Year	X		X		X	
State*Year		X		X		X
Year FE	X	X	X	X	X	X
County FE	X	X	X	X	X	X

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

This table reports the effect of reserve requirement reduction on employment growth by firm size (number of employees). The regression equation is the same with Table 6. I only report coefficient before Log(RResChg+1).

Table 1.9: The Effect of Reserve Changes by Dependence on External Finance. Top 25% vs Bottom 25%

Size Category	Bottom 25%	Bottom 25%	Top25%	Top25%
log(RResChg+1)	-2.481	0.523	-1.799**	-2.859**
	(1.787)	(2.103)	(0.872)	(1.164)
Region*Year	X		X	
State*Year		X		X
Year FE	X	X	X	X
County FE	X	X	X	X

Standard errors in parentheses

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

This table reports the effect of reserve requirement reduction on employment growth by the level of dependence on external finance (top 25% industries vs bottom 25% industries). The regression equation is the same with Table 6. Column (1) and (3) report the specification with region*year fixed effects. Column (2) and (4) report the specification with state*year fixed effects. To be succinct, I only report coefficient before Log(RResChg+1).

Table 1.10: Table 9: Robustness Test: Excluding 1982-1984

	(1)	(2)	(3)	(4)
Dep. Var	log(REmpChg+1)	log(REmpChg+1)	log(REmpChg+1)	log(REmpChg+1)
log(RResChg+1)	-5.816***	-5.439***	-1.873*	-1.639*
	(0.924)	(0.936)	(0.986)	(0.965)
log(REmpChg+1), Lag=1				-0.166***
				(0.00601)
log(REmpChg+1), Lag=2,				-0.0854***
				(0.00567)
Log(Depo./Loan)	0.382*	0.370*	-0.343	-0.550**
	(0.209)	(0.214)	(0.233)	(0.229)
Crime Rate	-0.0668	0.262	0.848*	0.961**
	(0.413)	(0.419)	(0.448)	(0.440)
Pop. Density	-0.000138***	-0.000141***	-7.43e-05***	-8.81e-05***
	(2.30e-05)	(2.29e-05)	(2.30e-05)	(2.24e-05)
Region*Year		X		
State*Year			X	X
Year FE	X	X	X	X
County FE	X	X	X	X
Observations	24,271	24,271	24,271	24,175

Standard errors in parentheses

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

This table reports the estimates after excluding observations between 1982-1984, as discussed in Section 1.6.2.1. In this period, there was a large fluctuation in employment rate due to the aggressive anti-inflationary monetary policy. Column (1) reports fixed effect model estimates. Column (2) and (3) add region*year and state*year fixed effects. Column (4) adds lag terms of employment.

Table 1.11: Robustness test: Excluding Northeast US and Illinois

	(1)	(2)	(3)	(4)
Dep. Var	log(REmpChg+1)	log(REmpChg+1)	log(REmpChg+1)	log(REmpChg+1)
log(RResChg+1)	-2.382***	-2.254***	-1.212**	-1.253**
	(0.492)	(0.492)	(0.567)	(0.558)
log(REmpChg+1), Lag=1				-0.185***
				(0.0063)
log(REmpChg+1), Lag=2,				-0.132***
				(0.0061)
Region*Year		X		
State*Year			X	X
Year FE	X	X	X	X
County FE	X	X	X	X
Observations	24,271	24,271	24,271	24,175

Standard errors in parentheses
*** $p<0.01$, ** $p<0.05$, * $p<0.1$

This table reports the estimates after excluding northeastern US and Illinois, which are states that have larger percentages of employment in the financial sector, as discussed in Section 1.6.2.2. The table confirms that the job gains due to the financial deregulation did not account for the employment changes during this period. Column (1) reports fixed effect model estimates. Column (2) and (3) add region*year and state*year fixed effects. Column (4) adds lag terms of employment. To keep the output succinct, some control variables are not reported.

Table 1.12: Robustness Test: Only Include County-year with No New Bank Entry

	(1)	(2)	(3)	(4)
Dep. Var	log(REmpChg+1)	log(REmpChg+1)	log(REmpChg+1)	log(REmpChg+1)
log(RResChg+1)	-2.204***	-2.485***	-2.485***	-1.157*
	(0.591)	(0.594)	(0.594)	(0.670)
log(REmpChg+1), Lag=1				-0.197***
				(0.00726)
log(REmpChg+1), Lag=2				-0.139***
				(0.00709)
Log(Depo./Loan)	0.00941	0.0173**	0.0173**	0.00402
	(0.00818)	(0.00843)	(0.00843)	(0.00926)
Crime Rate	-1.338**	-0.692	-0.692	0.284
	(0.679)	(0.688)	(0.688)	(0.705)
Pop. Density	-3.99e-05	-1.43e-05	-1.43e-05	8.16e-05
	(7.03e-05)	(7.03e-05)	(7.03e-05)	(6.87e-05)
Region*Year		X		
State*Year			X	X
Year FE	X	X	X	X
County FE	X	X	X	X
Observations	23,913	23,913	23,913	23,808

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

This table reports estimates after excluding counties with new bank entry in that year. It addresses the concern that the employment growth might attribute to new bank entry after the deregulation, rather than reserve changes, as discussed in Section 1.6.2.3. Column (1) reports fixed effect model estimates. Column (2) and (3) add region*year and state*year fixed effects. Column (4) adds lag terms of employment. To keep the output succinct, some control variables are not reported.

Table 1.13: Robustness Check- Using Distance-weighted Reserve Change Index

	(1)	(2)	(3)	(4)
Distance	100 miles	100 miles	150 miles	150 miles
Log(RWtdResChg+1)	-3.670***	-4.117***	-7.910***	-10.21***
	(0.717)	(0.728)	(1.313)	(1.368)
Region*Year	X		X	
State*Year		X		X
Year FE	X	X	X	X
County FE	X	X	X	X
Observations	24,271	24,271	24,271	24,175

Standard errors in parentheses
*** $p<0.01$, ** $p<0.05$, * $p<0.1$

This table reports results after replacing the local required reserve change in the second set of regressions with an index that weights in the required reserve changes of neighboring counties defined in Section 1.6.2.4. This modification captures possible spillover effects from adjacent regions. For brevity, I only report coefficients of the weighted reserve change.

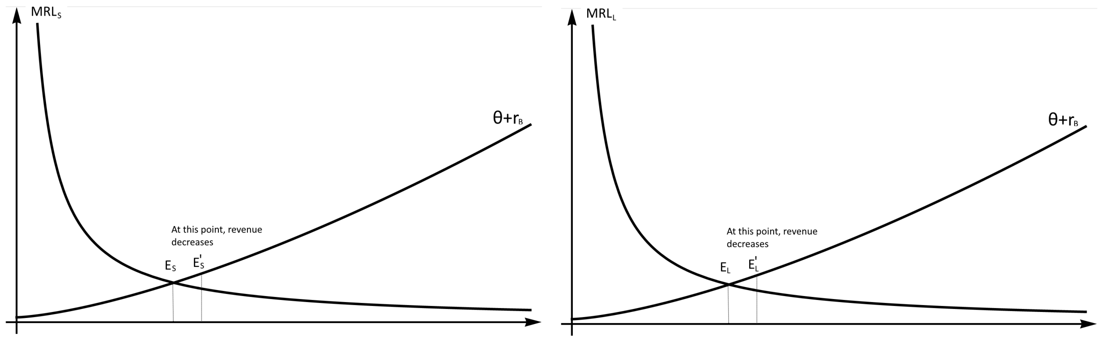

Figure 1.1: Theoretical Model: Scenario (1)

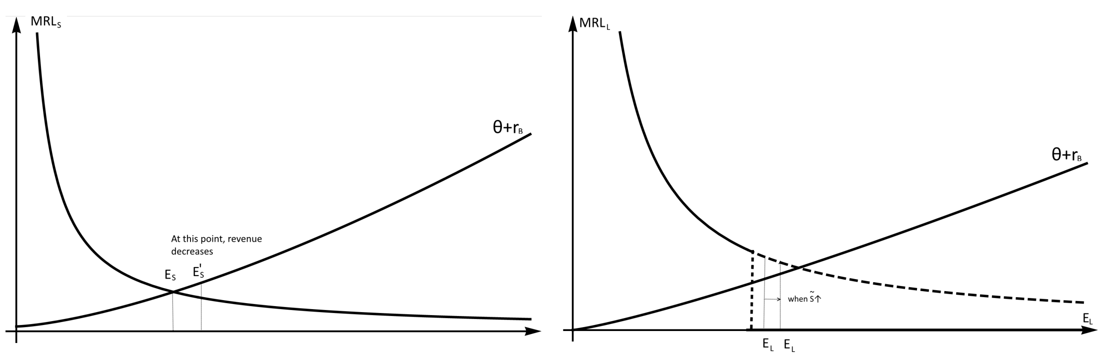

Figure 1.2: Theoretical Model: Scenario (2)

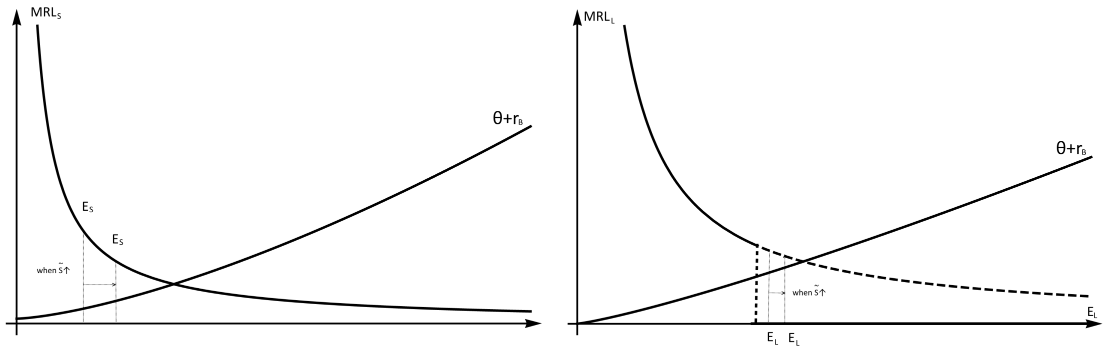

Figure 1.3: Theoretical Model: Scenario (3)

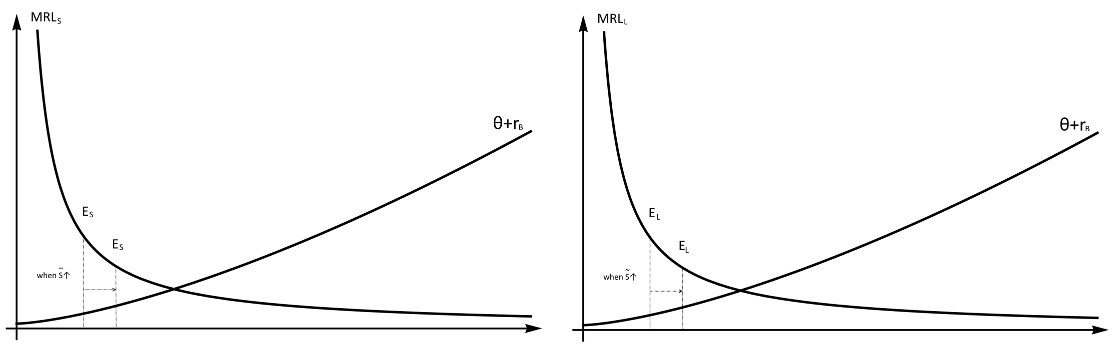

Figure 1.4: Theoretical Model: Scenario (4)

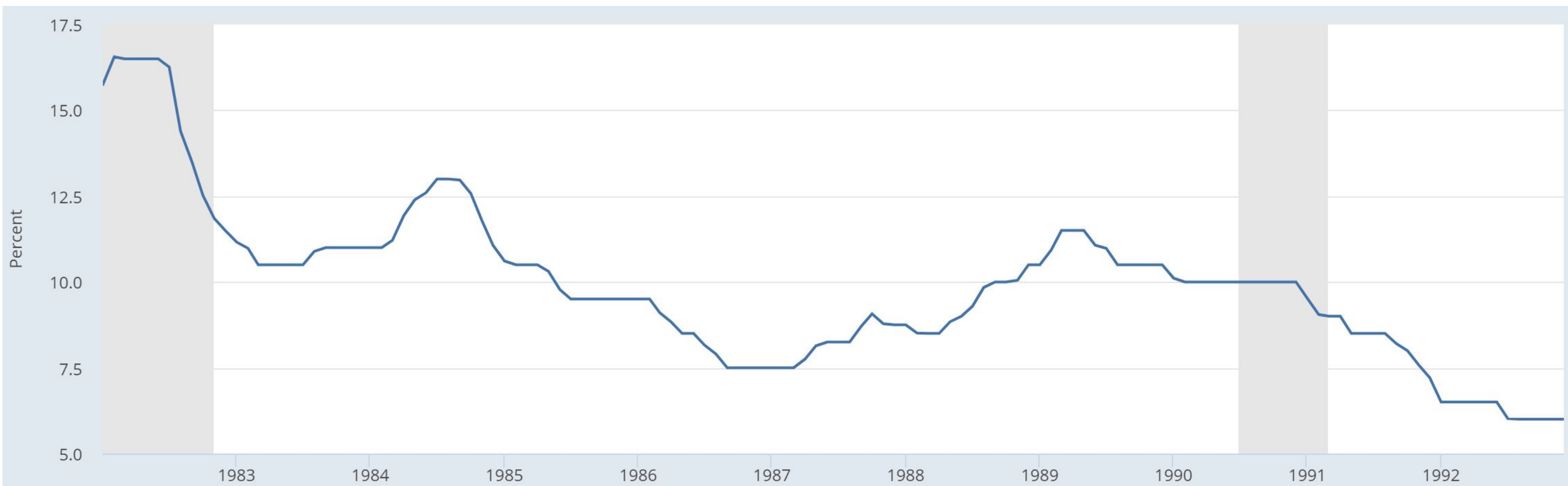

Figure 1.5: Prime Loan Rate 1982-1992. Source: FRED, St. Louis Fed

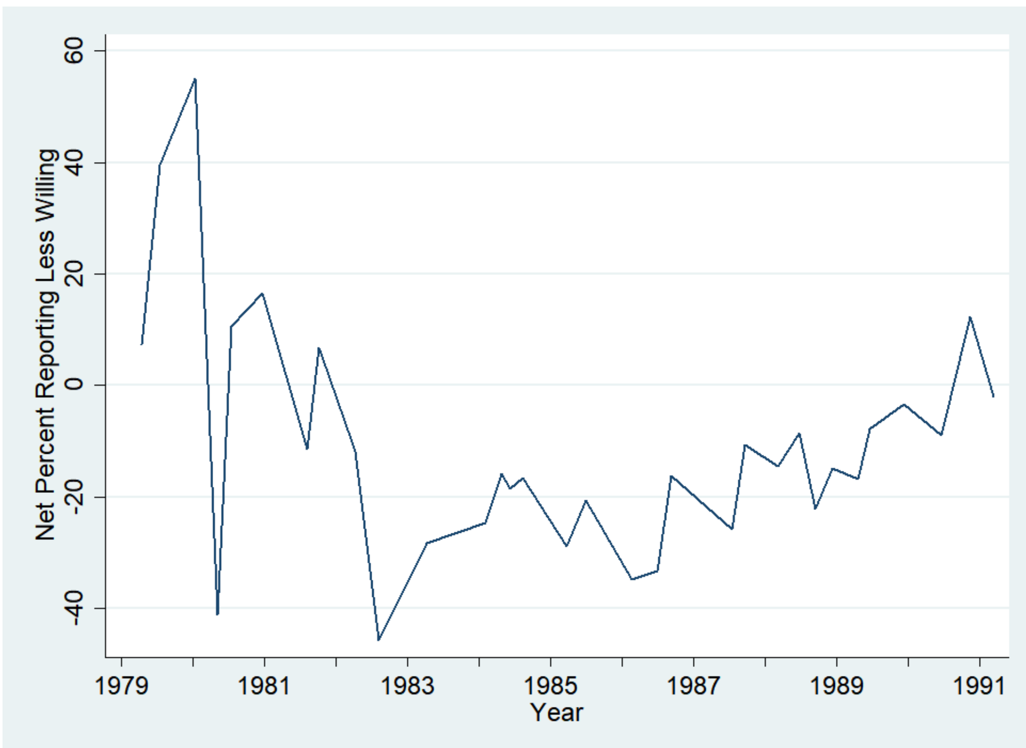

Figure 1.6: Net Percent of Loan Officers Reporting Less Willing to Lend.
Source: Federal Reserve Board Senior Loan Officer Opinion Survey. Surveys were conducted in February, May, August and November of each year. Figure replicated from Schreft and Owens (1991).

Figure 1.7: Unemployment rate 1982-1992. Source: Bureau of Labor Statistics

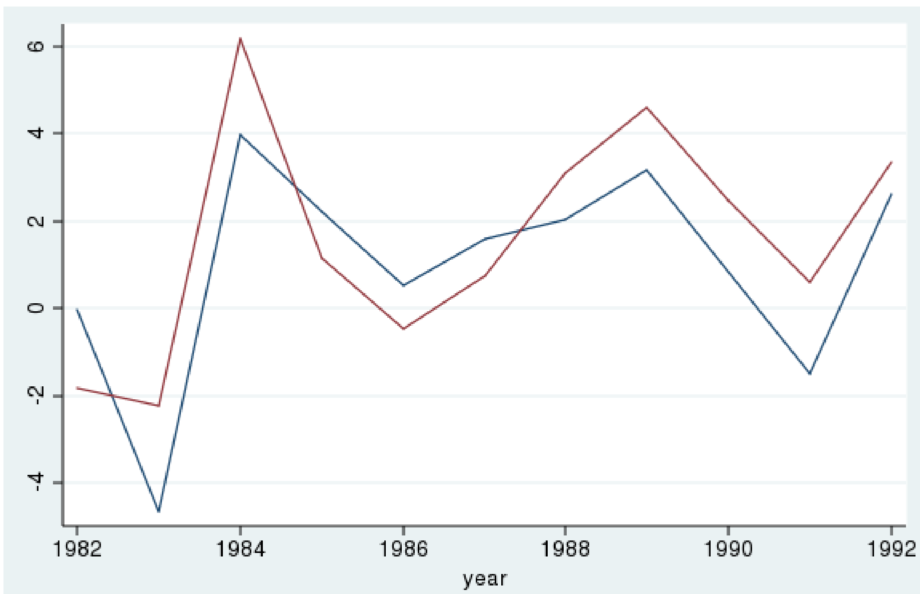

Figure 1.8: Nonparametric Evidence
Employment Growth in Top 25% (red) and Bottom 25% (blue) Reserve Reduction Regions. Percentage Employment Growth is on the Y-axis.

CHAPTER 2

International Bank Networks and Trade

2.1 Introduction

The relationship between trade and finance has been documented in the economic literature. A considerable body of literature suggests a strong and positive link between trade propagation and financial development. It attracts more scholastic attention since the avalanche of trade caused by the 2008 financial crisis: world trade flows dipped 15% following a series of bank failures. In this research, I focus on the effect of the expansion of the banking network on trade development. China used to be very financially reclusive. The burgeoning of the banking sector in China filled the market void of financial service and created new bank links between Chinese domestic subregions and foreign countries. To begin, I construct an augmented gravity model based on the framework outlined in Feenstra (2015). The model predicts that bank networks can promote trade by three ways banks could facilitate trade: (1) by removing financial constraint faced by firms. Firms with sufficient working capital are more likely to be involved in trade, which is the main effect to be discussed in this paper; (2) by reducing the "general" cost of trade not pertaining to any specific country. (3) I set up regression equations to verify which channels work. Channel (1) works if liquidity-constrained firms export more when the bank enters the market. Channel (2) works if export increases when more banks enter the market. Channel (3) works only if a bank with a foreign subsidiary in the specific country enters or a bank that has a branch in the location enters a specific country. Based on the model predictions, I hypothesize that bank network expansion could facilitate three ways: by easing financial transactions in specific countries within the bank's network coverage, by providing capital and removing financial constraints, and by reducing the cost of general trade-related financial services.

To confirm my surmises, I run two sets of regressions with dependent variables being the trade participation dummy and the export participation dummy variable and the volume of trade and with the number of bank links, the number of local bank branches, and the interaction term between bank branch number and firm financial constraint measure on the right-hand side. The dataset I utilize is a novel one of the domestic and foreign expansion of Chinese bank networks, combined with the linked Chinese Customs - Manufacturing Survey dataset with sufficient details of firms, destination countries, and export products. After controlling a full set of fixed effects, I find that export grows through these three channels, especially, when a local bank establishes a branch in country j or a bank branched in country j enters a county, export firms in that county increase by 9.9% percent in the subsequent year in the saturated model with year-, firm-, and the destination country-year fixed effects. The richness of the microdata allows me to trace the stretching of bank branches in each Chinese county and trade partner country and make statistical inferences. I also find that the trade promotion effect is uneven: The effect is sounder for large firms that have more access to bank finance, foreign-owned firms, riskier destination countries, and differentiated products. These implications are consistent with results obtained from some previous literature, such as Amiti and Weinstein (2011) and Hale et al. (2016), and Bordo and Rousseau (2012).

This research makes a number of contributions. From a larger perspective, this paper contributes to the ongoing pool of literature studying the synergy between finance and development. The role of international trade in promoting economic growth has been established by numerous theoretical and empirical corroboration (Aghion and Durlauf (2005)). In this background, exploring the mechanism that how financial network promotes trade does not only have scholastic value, but also has important policy implications. The results reveal and disentangle three effects brought by bank network expansion in trade promotion. I then conduct regressions and provide evidence to verify these hypotheses. Although the conclusion may be not be applicable to other countries at different levels of financial development, it suggests an implementable research approach and sheds light on the practice of trade promotion.

This results also contributes some findings to the growing field of inquiring into the role of financial network in global economy by reassessing this research question using a novel dataset on the expansion of Chinese banks. Per Contessi and de Nicola (2012), roughly speaking, previous literature measures access to finance in three ways: (i) indirect measurement through industry-level indicators of external financial vulnerability, (ii) subjective measures self-reported by firms, and (iii) a wide variety of objective measures constructed from balance sheet data. This paper uses the expansion of banks in a previously financially reclusive country and firm-level microdata. Methodologically, the rich source of variations in the data allows me to exploit and exclude endogeneity issues that are not sufficiently discussed in some previous papers. The estimations give results consistent with past literature and reconfirm the critical role of finance in international trade.

The remainder of the paper is organized as follows. Section 2.2 introduces some background information that is essential to understanding this paper but may not be familiar to readers, including an introduction to the Chinese banking system and the basics of trade regimes. Section 2.3 presents the framework that informs our research questions and lays out the regression equations employed in the statistical analyses. Section 2.4 presents the construction of the data and summary statistics. Section 2.5 presents the main results. Section 2.6 conducts robustness checks. Section 2.7 concludes the paper.

2.2 Background

2.2.1 Bank Networks and Trade Promotion

Banks are important for trade for several reasons. Banks can provide financial services that are essential to trade. The financial services can be roughly divided into two categories. First, potentially incomplete enforcement of contracts in an international setting adds uncertainty to financial transactions, especially for exporters. Therefore, banks can facilitate the process by providing financial assurance and by eliminating information asymmetry. For example, a well-documented channel by which bank links can boost trade risk is through the provision of (trustworthy) letters of credit, as examined in recent papers. Letters of credit (L/C) are issued by a bank to another bank to serve as a guarantee for payments made to a specified person under specified conditions. It relieves firms' concern that they will not be able to receive payment after the goods are shipped, and they cannot take action due to legal hurdles. However, there are still significant risks associated with letters of credit. Payment defaults can occur at any point in this cycle. Although there are good sources of data concerning the severity of L/C fraud, according to the remarks of an expert on LC cited by CheHashim and Mahdzan (2014), "All commercial centers will have about the same proportion of crooks that you would have anywhere else. So, in Dubai, London, and Hong Kong, there will be larger numbers because the volume is higher, but the proportion is exactly the same. In Malaysia too, there has been some major fraud in the past." For exporters, it would be easier for firms to eliminate trust issues if L/Cs are issued by overseas branches of banks within reach or even advising and issuing banks happen to be the same. It is also helpful for firms to facilitate the transaction and reduce administrative costs if the banks that they do business with have a foreign branch, as physical existence reduces certain information disadvantages and provides additional assurance.

For example, foreign subsidiaries of banks can help firms in their home countries reduce information asymmetries that hinder international trade through their social and other information networks. Second, banks can also offer other types of financial services that can reduce costs and risks not pertaining to a specific country, such as remittance, currency hedging, account management, and insurance against price fluctuations. These services are especially important for risky destination countries.

Moreover, besides trade-related financial services, banks can also boost trade by supplying working capital. Some previous literature, such as Manova (2013), confirms that financial constraint remains a barrier to export for many firms. Bank entry and bank competition could supply and reduce the cost of working capital for firms, making them more inclined to be involved in international trade. This is especially a problem confronted by many firms in developing economies, China is not an exception as well. According to the World Bank's Enterprise Survey data, 44.54% of surveyed Chinese firms reported that access to finance is a moderately/highly/very highly severe problem that impedes firms' development. In this context, I expect the trade promotion effect by supplementing capital would be more significant than in countries with financial constraint problems.

Empirically, the above-mentioned mechanisms are verified by a series of papers. The stream of literature gained more popularity after the financial crisis began in 2008, which not only ushered an unprecedented recession since WW II in the US, but also was followed by the collapsing of trade, referred as the "great trade collapse" by Baldwin (2009). There are some relevant papers worth-noting. Hale et al. (2016) documents the bank linkage channel through which international finance is related to international trade. Using syndicated loans as a suitable proxy for bank links, they find that new bank links formed through bank lending in country i to country j in year t-1 are positively associated with exports from i to j in year t. Amiti and Weinstein (2011) uses a unique dataset covering the Japanese financial crises of the 1990s to examine the role of credit in international trade. They find that trade finance accounts for about one-third of the decline in Japanese exports in the financial crises of the 1990s. These results serve as essential references and cross-verification of the results in this paper.

2.2.2 Chinese Banking Sector and Its Internationalization

China has one of the largest banking systems in the world. The system is also a unique one that was formulated in the process of economic reform and transitioned from a central-planned soviet mode to a market economy. This section introduces some basic information about the sector to help the readers to understand the institutional background, including the internationalization process of domestic banks and the entry of foreign banks.

The banking system in China used to be very self-enclosed before the opening and reform policy. The internationalization of Chinese banks has embarked on since 1979 when the Bank of China established its first overseas branch in Luxembourg. Driven by the growth of foreign investment and trade, the process accelerated since 2002 after China regained WTO membership. By the end of 2006, Chinese banks had established 58 foreign subsidiaries in 24 countries.

The reform of the Chinese banking industry is a story of change amid continuity. Before 2001, when China committed to opening the financial sector in order to regain WTO membership, foreign banks were only allowed to set up representative offices and could only serve subsidiaries of foreign companies. As part of WTO negotiation commitment, China agreed to give foreign banks national treatment after the initial five-year phase-in period. In the phase-in period, foreign banks were only allowed to operate foreign currency business in the first two years. Foreign banks were only permitted to operate the Renminbi business in a few designated cities during the phase-in period. Table 2.12 summarizes the designated cities and the deregulation time line.

In summary, because the market penetration of foreign banks remained very limited, most new banking links were contributed by the internationalization and domestic expansion of Chinese banks during this period. The clean-slate status of the Chinese banking sector makes the study easier. Compared to countries with an open and well-developed banking system, it is easy to capture all banking ties with the database. There is still concern that entries of foreign banks could undermine the results since the desirable locations of entry are often main exporters. This issue will be addressed by conducting a robustness check in Section 2.6.2.

2.2.3 Localness of Banking

An underlying assumption of the paper is the localness of banking. In other words, firms mostly bank with local financial institutions. If firms can access financial services from any banks regardless of distance, it would be practically impossible to identify which bank link boosts trade growth with the absence of firm-bank branch level data. Therefore, there is a strong urge to validate the localness assumption. Banking industry has been undertaking rapid technological changes in the last a few decades, which makes soft information advantages less important in firm-bank relationships. As pointed out by Petersen and Rajan

(2002), technological and structural changes in banking industry is “breaking the tyranny of distance”. However, a sizable body of previous research still concludes that credit supply and demand has strong localness, viz., most firms obtain loans from local banks. Petersen and Rajan (2002) documents that even in the United States, the distance between small business borrowers and their banks is less than 20 miles (35 km) for over 75% of loans made to these firms. DeYoung et al. (2008) finds that the median borrower-lender distance is approximately 17 miles for medium-upper income tracts, and 35 miles for low-moderate income tracts. The same pattern can be observed for China as well. Using a unique loan-level dataset, Gao et al. (2018) reports that the median, 25th and 75th percentiles of the bank branch-firm distance are 2.4, 7, and 11.7 kilometers respectively, which are even smaller than the US counterparts. Although there is no information about other types of financial service, the bank loan data demonstrate that it is reasonable to assume that firms mainly reply on financial services provided by local branches.

2.3 Theoretical Background

Our empirical analyses rest on the general framework of the gravity model of trade. I first review the basic micro foundations of the model following the textbook presentation of Feenstra (2015) and integrate elements from Morales et al. (2014). Assuming that there are M countries in the world and each country j is populated by a representative consumer whose utility function is of constant elasticity of substitution (CES) type as below:

$$U^j = \sum_{i=1} N^i (c^{ij})^{\frac{\eta-1}{\eta}}$$

where i stands for variety, c^{ij} denotes the consumption of any product sent from country i to country j. N^i represents the number of available varieties, η is the elasticity of substitution between varieties in the sector, and q_{ijt} is the consumption of variety i. The representative consumer maximizes the utility function subject to the budget constraint:

$$Y^j = \sum_{i=1}^{M} N^i p^{ij} c^{ij}$$

where where Y^j is the aggregate expenditure and income in country j. The resulting demand function for each variety is:

$$q_{ij} = \frac{p_{ij}^{-\eta}}{P_j^{1-\eta}} \frac{Y_j}{P_j}$$

where C_j is the total consumption of country j in the sector to which variety i belongs, P_{jt} is the sectoral price index in country j.

Now consider the production side. For simplicity, I assume that variety i is supplied only by country i. There are two inputs: capital K and labor L. Firms face financial constraints such that they can only get a portion of the optimal level of capital they need. I introduce a new parameter, θ_i, to measure the magnitude of financial constraint and is determined exogenously. This is a somewhat stark way to introduce financial constraint faced by firms, but standard in the literature (Antràs and Caballero (2009)). Therefore, working capital for firm i is $\bar{K}_i = \theta_i K_i^*$, K_i^* is the optimal level of capital without financial constraint. $0 < \theta_i < 1$. Labor is fully mobile across regions. For simplicity, I assume that labor supply elasticity is infinite, so wage will remain unchanged when demand for labor shifts. This is somewhat reasonable in China in the 2000s as there was a huge pool of excessive labor force.

Production is of Cobb-Douglas type, i.e.

$$Y_i = Z_i K_i^a L_i^b$$

Solve the cost minimization problem. Because of the financial constraint, the firm views capital as given and only chooses the level of labor input:

$$C_i = wL_i + r\bar{K}_i = \mathrm{wY_i}^{\frac{1}{b}} Z_i^{-\frac{1}{b}} \bar{K}_i^{-\frac{a}{b}} + r\bar{K}_i$$

The marginal cost:

$$MC_i = \frac{w}{b} Y_i^{\frac{1}{b}-1} Z_i^{-\frac{1}{b}} \bar{K}_i^{-\frac{a}{b}}$$

Assume that financial costs take the form of iceberg costs and that banks can reduce them. The marginal cost of export can be expressed as:

$$MC_e = MC * f_i\left(B_i\right) * g_{j,t}\left(B_{i,j}\right) = \frac{w}{b} Y_i^{\frac{1}{b}-1} Z_i^{-\frac{1}{b}} \bar{K}_i^{-\frac{a}{b}} * f_i * g_{ij}$$

where f_i denotes the general financial cost of trade irrespective of any particular country, such as provision of trade financing, issuing letters of credit, etc.. The cost can be reduced by access to financial services and service quality improvement. g_{ij} denotes country-specific trade cost. As argued in Section 2.2, the cost can be reduced by direct bank link between trade origin and destination.

A continuum of varieties is supplied in every country. Therefore, each supplier takes the sectoral price index, P_j, as given when setting its price in country j. Firms set a fixed multiplicative markup over marginal cost. Given the demand function, the price of variety i in market j is:

$$p_{ij} = \frac{\eta}{\eta - 1} MC_e$$

Substitute into the demand function for each variety. The gross profit (also the value of export) from i to j is expressed as:

$$\pi_{ij} = \frac{\eta}{\eta - 1} MC_e * \frac{\left(\frac{\eta}{\eta-1} MC_e\right)^{-\eta}}{P_{jt}^{-\eta}} \frac{Y_j}{P_j} = \frac{1}{\eta} \left(\frac{\eta}{\eta - 1} \frac{MC_e}{P_j}\right)^{1-\eta} \frac{Y_j}{P_j}$$

Take log in both sides:

$$\begin{aligned} log(\pi_{ij}) &= log(\frac{1}{\eta}) + (1-\eta) log(\frac{\eta}{\eta - 1}) + log(Y_j) + log(P_j) \\ +(1-\eta)[log(\frac{w}{b}) &+ (\frac{1}{b} - 1) log(Y_i) - \frac{1}{b} log(Z_i) - \frac{a}{b} log(\theta_i K_i^*) + log(f_i) + log(g_{ij})] \end{aligned} \quad (2.1)$$

From this equation, I can identify three channels through which bank expansion boosts trade: (1) bank entry expanding financial network and reducing firm's export cost to a specific country where the bank has established existence (g_{ij}), (2) bank reducing firm's general cost of export (f_i), and (3) new bank entry removing liquidity constraint θ_i.

Respectively, I develop three testable hypotheses about how banks can facilitate trade:
(1) (destination specific cost) by establishing the financial network. Banks incorporate a place into their financial networks by setting up new domestic or foreign branches. If this is true, two effects will be observed: when a bank which has existed in country A but not in country B sets up a branch in county C, firms in C increase export to A but not to B; when a bank establishes branch in country A, firms in counties within the bank's network coverage increase exports to A.
(2) (general trade cost) by providing general financial services that reduce general trade costs. Here general means not pertaining to any specific country. If this is true, when a bank enters a county, the export of local firms to all countries should increase.
(3) (liquidity) by lifting financial constraints faced by firms. If this is true, financially constrained firms should export more when a new bank enters.

Note that the basic unit of analysis in this paper is firm-country export, not the volume of a country's trade. From the benchmark model, we estimate the following equation:

$$\begin{aligned} Log(Export_{ijt} + 1) = \beta_0 + \beta_1(BankLink_{ij,t-1}) + \beta_2(NumBank_{i,t-1}) + \\ \beta_3(NumBank_{i,t-1}) * FinConst_{i,t-1} + log(GDP_{j,t}) + \gamma X_{j,t} + \epsilon_{ijt} \end{aligned} \quad (2.2)$$

where $Export_{ijt}$ denotes the value of firm i's export to country j in year t. $NumBank_i$ is the number of bank branches in county i. $FinConst_{i,t-1}$ denotes the measure of liquidity constraint of the firm. $log(GDP_{j,t})$ is the logarithm of GDP of country j. $X_{j,t}$ denotes other control variables on destination country-level. $BankLink_{ij,t-1}$ represents bank link between county i and destination country j in year $t-1$. In other words, it is the number of edges between the county and the trade partner country. Mathematically, it is defined as:

$$BankLink_{i,j,t-1} = \Sigma_l I(Bank\ l\ has\ branch\ in\ i) * NumBranch_{l,j}$$

where I denotes the Boolean function and $NumBranch_{l,j}$ denotes the number of subsidiaries of bank l in country j. Per this definition, there are two things worth noting. First, new bank links between County 1 and Country A can be established in two ways: (1) when the bank has a branch or more than one branches in County 1 and newly establishes a foreign subsidiary in County A; (2) when the bank has an existing foreign subsidiary and newly establishes a domestic branch in County 1. The process is graphically illustrated in Figure 2.1. Secondly, by this definition, if the bank has two domestic branches in County 1, one domestic branch in County 2, one foreign subsidiary in Country A,and two foreign subsidiary in Country B, then $BankLink_{1,A,t}$ is 1, while $BankLink_{2,B,t}$ is 2. The calculation is illustrated graphically in Figure 2.2. The definition is intuitively reasonable: a Chinese county is usually much smaller than a foreign country, therefore an additional foreign subsidiary offers more coverage than a domestic branch. The coefficients $\beta_1 - \beta_3$ correspond to the three hypotheses, respectively. ϵ_{ijt} is the error term. If the effect in Hypothesis (1) exists, β_1 should be positive and significant. Similarly, if β_2 should be positive and significant, one can confirm Hypothesis (2). Hypothesis (3) can be confirmed if β_3 is negative and significant.

The richness of observation in the dataset allow me to insert a vector of fixed effects: year fixed effects, destination country fixed effects, firm fixed effects, and a destination country-year interaction term in a saturated model. Adding these fixed effects helps to address many endogeneity issues.

A practical question is how to measure financial constraint. The trail-blazing work by Kaplan and Zingales (1997) distills the financial constraint status by parsing the financial reports of public firms, and runs a regression on a set of financial and operational variables. A financial constraint index is then constructed on the basis of the regression results. The methodology is refined and improved by a series of subsequent papers. Elsas and Klepsch (2015) surveys Kaplan and Zingales (1997) and three other commonly used methods to measure financial constraint, namely Cleary (2002), Whited and Wu (2006), and Hadlock and Pierce (2010). Based on German private firm data, they propose a new index (henceforce referred to as the FCP index) as below:

$$FCP_t = -0.123 Size_{t-1} - 2.128 Cash_{t-1} - 4.374 ROA_{t-1} - 0.021 Int.\, Coverage_{t-1}$$

where $Size_{t-1}$ is the natural logarithm of total assets, $Cash_{t-1}$ is cash holdings over beginning-of-year total assets, ROA_{t-1} is the net income over total assets and $Int.\, coverage$ is EBIT over interest expenses. The sample in Elsas and Klepsch (2015) shares more resemblances with the Chinese Manufacturing Survey data in terms of size distribution and the nature of firms (mostly non-public firms, instead of listed companies in Kaplan and Zingales (1997)). Therefore, I adopt their methodology in this paper as it is more applicable to the Chinese Manufacturing Survey data. To obtain more readable results, the index is normalized to [0,1] using the following formula:

$$FCP\ normalized = \frac{FCP - FCP_{min}}{FCP + FCP_{max}}$$

Similarly, the representative firm export to country j when net profit of export minus fixed cost of entry is positive:

$$\pi_{ijt} - [sc_{i,j,t} + sc_{i,t}] > 0$$

where $sc_{i,j,t}$ and $sc_{i,t}$ are country-specific and general cost of export for the firm that can be reduced by bank link and bank presence. Therefore, I estimate an equation akin to (1) with the dependent variable being replaced to a binary variable indicating whether the firm i exports to country j in year t:

$$\begin{aligned} I(Export)_{i,j,t} = \beta_0 + \beta_1(BankLink_{ij,t-1}) + \beta_2(NumBank_{i,t-1}) + \\ \beta_3(NumBank_{i,t-1}) * FinConst_{i,t-1} + log(GDP_{j,t}) + \gamma X_{j,t} + \epsilon_{ijt} \end{aligned} \tag{2.3}$$

The estimation strategy in this paper is as follows. I first estimate Equation (2.3) at an extensive margin, i.e., for all firms in the sample. Then, I estimate Equation (2.2) at an intensive margin, i.e., for firms that have exported at least once over the period. The results are reported in Section 2.5 .

2.4 Data

In this section, I describe the sources of the constituent datasets and how they are linked together. I also provide some descriptive statistics in addition to what is presented in the main body of the paper.

2.4.1 Bank Data

Bank-level data are obtained from CSMAR and CNRDS, which are both reputed research data service providers in China. I supplemented some missing observations in CSMAR with CNRDS. Cross-verification is performed to ensure the consistency of information from the two datasets. Bank-level data contain three subsets: (1) basic information, including officially registered name, bank type, headquarter location, year of incorporation, whether the bank is listed and the date of going public; (2) balance sheet information, including various types of debts, assets, equities and cash flow terms; (3) bank ownership information, including the names and percentages of the top 10 individual/institutional shareholders. Shareholder names are matched with the government Business Registry to determine who are the ultimate owners and whether the owners are governments or private businesses; (4) key regulatory indicators that are used by regulators to monitor the financial health of banks.

Our Chinese Bank Branches dataset is mainly obtained from the CBRC (China Banking Regulatory Commission). The dataset includes name, street address, date of establishment, and date of licensing of all 225,382 domestic branches by 2016.

To define "entry into a market," it is necessary to first define a market. In this paper, each domestic market is defined as a county-level administrative division, which is the third level of the administrative hierarchy. The county-level division includes counties, districts in municipal regions, autonomous counties, and banners in designated Mongolian autonomous areas[1]. A Chinese county is comparable to its American counterpart in size and population. There were 2,953 counties as of 2006. After parsing the geographical information in the CBRC bank branch data, bank branch locations are geocoded to map with county divisions.

A foreign market is defined as an economy other than mainland China. The foreign subsidiary data of Chinese banks are partially obtained from BankFocus (previously known as BankScope), which is a product of Bureau van Dijk. I find that BankScope is not quite complete in coverage. Therefore, I supplement the data with hand-collected foreign subsidiary information of banks that are known to have overseas presence. There are two types of foreign subsidiaries: representative offices, which are set up to handle marketing, commu-

[1]Districts in direct-controlled municipalities are officially classified as prefecture-level divisions, as they are affiliated to provincial level direct-controlled municipalities. However, the distinction is mostly political: districts in direct-controlled municipalities are generally comparable with ordinary districts in size and function, except they are higher in administrative level. In this paper, I do not distinguish between the two types of districts for research simplicity.

nications, and other non-transactional operations; and subsidiaries, which are full-fledged banks that run at the command of the headquarter. Since representative offices perform very limited functions, they are not counted in calculating the number of bank links in this paper. As of 2006, there had been 88 overseas subsidiaries from seven banks. Meanwhile, the number of branches at home of Chinese domestic banks grew from 89,278 to 140,702. Banks with at least one overseas branch account for 20.35% of the increment. The number of cross-country bank links increased from 82,731 to 118,130 in the six-year period. The growth of local bank branches and bank links is illustrated in Figure 2.3.

2.4.2 Chinese Customs-Manufacturing Survey Linked Data

The firm-level data are the combination of two datasets: the Chinese Customs data that contain export-import information for firms, and the Chinese Manufacturing Survey. The former covers information about export and import of goods from mainland China. They are managed by the Statistics Department of China Customs. Variables available include importer/exporter name and HS code (HS 1992) of goods; export/import indicator; detailed time of export/import; country/region of origin/destination (where imported goods are finally delivered, consumed or further processed and where exported goods are originated or originally dispatched from); mode of transportation; port of declaration; consignment for import/export; value (expressed in CNY. Goods priced in foreign currencies are converted into CNY using official exchange rate published by the State Administration of Foreign Exchange [2]).

The latter is also known as the China Annual Survey of Industrial Firms or Chinese Industrial Enterprises Database. It is a survey conducted by the China National Bureau of Statistics on a yearly basis, although there are often gaps of several years between data collection and publication. It is similar to the Longitudinal Research Database (LRD) maintained by the U.S. Bureau of the Census. As Brandt et al. (2014) agrees, compared to many other countries, the set of available variables in the Chinese data set is unusually extensive. Available information can be roughly classified into four sets: (1) identifying information with the detailed sector and geographic codes (province, county, street, administrative and postal codes. A sector is defined by GB /T4754 2002, which is the industrial classification code published as the Chinese national standard. (2) Firm ownership can be identified through shares of official registration type or from the share in paid-up capital of different groups. (3) Stock variables include various subsets of assets, debts, and equities. (4) Flow

[2] Exchange rate between 2000-2006 was a rather flat curve. Renminbi exchange rate (USDCNY) only slightly appreciated from 8.27 to 8.19 in 2005, and from 8.19 to 7.97 in 2006.

variables, such as various types of incomes and expenditures.

The basic unit of observation is a firm, rather than an establishment as defined in LRD data. If an enterprise has multiple subsidiaries, it will only show up once in its headquarters. Each firm is uniquely identified by the company name and the name of the legal representative. The dataset only includes annual firm-level data for industrial firms above a certain size threshold. The threshold was defined as all state-owned firms as well as non-state firms with sales exceeding 5 million RMB. The threshold was elevated from 5 million to 20 million RMB in 2011. However, since the data employed in this paper only cover 2001-2006, there is no need to take the change in standard into consideration. In addition, in census years, all industrial firms, irrespective of size, are sampled. In a census year, new firms and firms not present in previous years are sampled with a probability proportional to their size, and they remain in the sample until the next census year. The only census year in data coverage of this paper is 2004.

Two practical issues arise in the process of data cleaning: (1) how to identify entry and exit. Since the Manufacturing Survey data are not the universe of all firms and do not have the year of exit as in the US Census LBD Data, it is impossible to tell whether the firm shuts down or is dropped from the sample when it disappeared from the panel.The year of establishment can show whether a firm is newly founded or was just selected into the sample. (2) how to determine the value of export when an observation in the Manufacturing Survey fails to match the China Customs data. Since the China Customs Data broadly trace all trade activities, I assume the value of exports to be zero when this scenario happens.

The two datasets are merged by company name, geographical location, and telephone number and website address, if available, on a year-year basis. Fuzzy matching is implemented to ensure the maximum amount of correspondence. Appending the linked data of all years creates a large firm-year panel. The linked data have 506,877 firms. Out of all the firms, 86,905 firms that had exported in at least one year during the data period. These firms had exported to 224 countries and regions. The summary statistics are displayed in the first two sections in Table 2.1.

2.4.3 Other Data

Following the standard practice of the past literature, besides GDP, the following country-level variables are added to the regression: distance, population and land mass. GDP data are obtained from IMF World Economic Outlook. Distance, population and land area are obtained through the website of CEPII (Head et al. (2010), Head and Mayer (2014)). The country-level summary statistics are reported in the last section of Table 2.1.

2.5 Results

2.5.1 County-level Trade Participation Regressions

Table 2.2 reports the main results non-parametrically on county level. In the first row, I calculate the change in the ratio of exporting firms from 2000 to 2006, separately for counties with the highest increase in BankLink (above the 75th percentile) and for counties with the lowest increase (below the 25th percentile). One can note that high-growth counties in BankLink witness a higher increase in trade participation ratio. Similarly, in Row (2), I average the percentage of change in the value of exports for always-exporters, i.e. those firms exported every year between 2000 and 2006. The numbers show that high-growth counties in BankLink have a higher growth rate in the export value. The results illustrate the main results in this paper intuitively.

It is noticeable that the data are featured with a large number of zeros in trade participation and the trade volume. It raises concern that any positive results might be driven by the failure to address the zero-inflation problem. A non-standard, but effective solution is to aggregate data on coarser levels[3], which gets rid of a large portion of zeros. In this subsection, I run regressions on aggregated county-destination-year level data. The dependent variable is the fraction of firms exporting to another country within a county. The results are reported in Table 2.3. Column (1) reports estimates after controlling year and county fixed effects. Column (2) adds destination country fixed effects to the equation. Column (3) estimates a saturated model with destination country-year interaction fixed effects. Column (4) has the same specification as in Column (4) but removes countries whose 2000 total trade volumes are below the 75th percentile[4]. Removing these countries greatly reduces the number of zeros. The results remain positively signed and significant under 0.01 level, confirming that the trade promotion effects of bank network expansion on trade participation are not driven by the zero-inflation issue.

[3]For the value of export regression, zero-inflated negative binomial model is adopted. See Section 2.6.1 for details.

[4]In 2002, aggregate trade volume of countries below the median represented only 1.07% of the world's total trade.

2.5.2 Baseline Results

Table 2.4 presents the estimates obtained from regression Equation (2.3), which examines the relationship between bank expansion and trade participation using the linear probability model. Because the original data have more than 250 million observations, estimating the full sample is not feasible given available research computational capacity. Therefore, I randomly select 20% of all the firms and run the regression on the subsample with all firm-country-year pairs. Column (1) reports the baseline estimates when firm and year fixed effects are added to the regression. The year fixed effects are added to control time trend. Firm fixed effects are inserted to control firm characteristics that do not vary from year to year. The coefficient on I(Entry) is positively signed and significant, suggesting that every extra bank link between the county where the firm is located and the destination country could increase the chances to export to that country by 0.82%. The magnitude is smaller than the county-level regression estimate, but roughly of the same order. The larger number is likely to be caused by zero-inflation problem. Column (2) adds the destination country fixed effects to control time-invariant, country-specific factors that could lead to both trade growth and the establishment of new foreign subsidiaries of banks. The coefficients remain identically signed and significant, although the one on the number of foreign bank links is lower. Column (3) estimates a more saturated model adding country and year interaction fixed effects. The results are still robust.

The main intensive margin results are presented in Table 2.5, where I test the three hypotheses in Section 2.2. Table 2.5 presents the estimates when the dependent variables are the logarithm of the export value. In Table 2.5, Column (1) reports the baseline estimates when firm and year fixed effects are added to the regression. The year fixed effects are added to control time trend. Firm fixed effects are inserted to control firm characteristics that do not vary across years. The coefficient on BankLink is positively signed and significant under 0.05 level. The coefficient on the number of the local bank branches is positively signed and significant under 0.05 level. The interaction term between the FCP index and the number of local branches is negative and significant, suggesting that the effect of local bank branches increase is smaller for firms facing fewer financial constraints.

Hale (2012) shows that bank linkages are less likely to form if a country is experiencing a recession or a banking crisis. I am concerned that the general economic and financial conditions in each country could be an important potential source of spurious correlation. In Column (2), I add the year-destination country cross-term fixed effects to estimate a saturated model. These fixed effects capture any time-invariant country-pair characteristics that could lead to both higher trade volumes and more bank links between these countries as well as any time-varying country-specific dynamics that could account for target countries attracting both trade and bank lending and for source countries exporting both goods and bank funds. The coefficient on BankLink slightly drops, but the sign and the level of significance remain unchanged. The significance levels of the coefficients on the number of local branches and the interaction term between the FCP index and the number of banks also diminishes, but the signs remain the same as in (1). In Column (3), destination country fixed effect are added to control country-specific characteristics that do not vary from year to year. Column (4) estimates a saturated model with country and year fixed effects controlled. The coefficient on BankLink drops to 0.099, but remains positively signed and significant, implying that a foreign bank branch established by a Chinese bank in the destination country could increase the export value by 9.99%. These results jointly suggest that the three effects due to bank expansion all exist.

2.5.3 Heterogeneous Effects

If bank expansions do affect the development of trade, one should expect to see certain kinds of heterogeneous effects, i.e., the effect is stronger for some firms, some countries, and some products. In this subsection, I explore variations in three dimensions. First, it is possible that bank links impact domestic firms and foreign-owned firms differently. Domestic firms may rely more on the banking channel than foreign firms to export or import, as a significant portion of trade happens between subsidiaries of MNCs so they face less export risk. On the other hand, the effect on foreign-owned firms might be stronger as they are more exposed to international trade: the mean value of export/profit before tax is 4.13 for foreign-owned firms compared with 2.48 for domestic firms. Foreign firms may have to rely on Chinese banks to conduct trade in many regions with the absence of partner banks of their parent companies as well. To examine this, I re-run the regressions for the subsample that only include foreign invested firms and compare results in Table 2.6. The results are reported in Column (3) and (4). As one can see from the results, the coefficient on BankLink remains positive and significant. The magnitude is larger than the full-sample estimate, implying that trade promotion due to bank linkage has a stronger effect for foreign firms.

Secondly, it is possible that the risk level of the destination country also matters for firms that use banks as the intermediary of trade. If the trade partner country is risky, banks are more likely to use banks for additional assurance. As Niepmann and Schmidt-Eisenlohr (2017) points out, the 2007/2008 financial crisis affected firms' payment choices, pushing them to use more letters of credit. To test whether the effect exists, I interact the number of local banks with the risk level of the trade partner countries. The country risk measures are obtained from the widely used International Country Risk Guide (ICRG) country risk database, which is a product of the PRS group. The ICRG risk measure is a weighted index of political, financial, and economic risks. I reverse the original indicator using the formula $Risk_{new} = 100 - Risk_{origin}$ so that countries with higher country risk have higher values of this measure [5]. Because all the three are often highly correlated and affect trade, I simply use the aggregated index instead of each subcategory. The results are presented in Column (5) and (6), with destination country and the cross term between destination country and year fixed effects added respectively. All variables remain statistically significant and identically signed as in the baseline estimation. The interaction term between risk and BankLink is positive, suggesting that bank linkage is more important for riskier export destinations. This is consistent with the prior expectation that bank links help reduce export risk and result in more export activity.

Thirdly, it is possible that the effect of bank network expansion is uneven for firms of different sizes. It is commonly recognized that small firms are more reliant on bank finance. However, the situation is the opposite in China as smalls firms often struggle to get bank credit due to lack of political connections, and large firms also rely heavily on bank financing because capital markets were underdeveloped. According to World Bank's Enterprise Surveys conducted in 2005 and 2012, the proportion of investments financed by banks and the percent of firms using banks to finance working capital is much larger for large firms (100+ employees) than small and medium-size firms. Therefore, whether large or small firms benefit more from banks' financial services is an open question. I run a regression for the subsample with firms of more than 100 employees (which corresponds roughly to 50% percentile in the size distribution of all firms). The coefficients on the number of bank links remain positive and significant and are inflated compared to the baseline. Meanwhile, the coefficients on the number of banks become insignificant. A reasonable guess is that large firms have embedded many financial functions within their corporate organizations. For example, small firms have to rely on bank services to offset currency fluctuation risks, while a large corporate can set up a team to operate currency hedging. The coefficients on the FCP index and the interaction term between FCP and the number of banks become insignificant, which is not surprising since large firms are less likely to be financially constrained.

Last, specialized products are produced for the needs of certain buyers, but the costs of production of specialized products are non-contractible and relationship specific. Therefore,

[5] Refer to the official website for details of the methodology: https://www.prsgroup.com/wp-content/uploads/2012/11/icrgmethodology.pdf

compared to commodities sold on organized exchanges, exporting differentiated products involves higher risk. For example, if an exporter can sell its processed goods only to the particular importer, the exporter will suffer a greater loss when the importer does not honor the contract. To identify whether the exports are differentiated, I employ the product classification dataset compiled by Rauch (1999). The dataset classifies products into three categories: goods traded on an organized exchange, reference priced, and differentiated products. Goods traded on an organized exchange are standardized commodities transacted in bulk, while differentiated products are often manufactured specifically to the need of importers. Reference priced goods stand in the middle of the two. They refer to those products quoted in trade publications and are demanded by many downstream firms, such as Polyoxyethylene Sorbitan Monostearate is quoted weekly in Chemical Marketing Reporter and can be used in many food products. The product classification code used in the original dataset is SITC (rev. 2), while the products are indexed by the HS code in the Chinese Customs data. To address the inconsistency, I connect the two datasets using the HS-SITC correspondence table provided by the United Nations Statistics Division. I then run the saturated regression Equation (2.2) for each of the three categories. The estimates are presented in Table 2.7. To keep the output succinct, only the coefficient on BankLink is reported. It can be seen that the coefficient is largest for differentiated goods, less so for cross reference products, and not significant for commodities. The results endorse my surmise that formulation of bank links has significant effect in reducing the export of differentiated products that have higher risk because of the contract-specific nature.

2.6 Robustness Checks

In the last section, I find strong support for the main hypothesis that bank links promote trade and other two ancillary hypotheses. By estimating a fully saturated model with destination-year fixed effects, I eliminate the possibility that any time-invariant country-pair characteristics that could lead to both higher trade volumes and establishments of new bank subsidiaries. Yet, there are still some remaining concerns. First, although the county-level regression gives positive outcomes, one may still need a zero-inflated model to cross-verify the results in Table 2.5. Second, it is possible that the bank branch network data fail to capture all bank links due to foreign bank presence in large cities which are often export hubs as well. The overlapping may pollute the regression results. Third, the data show that Hong Kong and Macau are most popular destinations for Chinese banks' international expansion. Meanwhile, the two free ports trans-ship huge amount of Chinese export. One would concern that the bank link effect could be solely contributed by the concurrent transshipment increase and Chinese bank subsidiary growth. The causal linkage would be tampered if trade is the major motivation for banks to establish subsidiaries in destination countries. Finally, it is probable that banks may follow the needs of large exporting firms and establish foreign subsidiaries in these firms' desirable locations. In this section, I conduct additional robustness tests to demonstrate that the results are not driven by endogeneity.

2.6.1 Addressing Zero-inflation Problem

It can be noticed that zero export values are abundant in the data. It is not surprising since trade does not happen between most firm-country pairs for two reasons: first, the extremely small value of trade between China and small and distant countries (Frankel et al. (1997)); second, there is a large number of non-exporting firms. This could cause several potential problems. As Burger et al. (2009) summarizes, regressing log-normal gravity model by a small positive constant for zero-inflated data can lead to the following issues: (1) the choice of the constant be added (one in this case) when export value is zero is usually arbitrary and lacks both theoretical and empirical justification; (2) even small differences in the selected constant can result in decline of the values of the regression coefficients. Simply deleting all zero-valued pairs is not favorably viewed either because that will lead to loss of important information on low levels of trade. To fix this, trade literature suggests using a class of zero-inflated models, such as zero-inflated Poisson and zero-inflated negative binomial. In this subsection, I adopt the zero-inflated negative binomial model to reassess the estimates in Table 2.8, since the standard Poisson model is vulnerable for problems of overdispersion (Burger et al. (2009)). The basic rationale is to classify the observations into two categories: those are always zero, and those are not always zero. Then, first regress a "participation" Logistic model . After that, run another model for those "not always zero" observations. In this subsection, I adopt the zero-inflated negative binomial model to reassess the estimates in Table 2.5, which uses negative binomial in the second step, since the standard Poisson model is vulnerable for problems of overdispersion (Burger et al. (2009)). Mathematically, the model is specified as below. The probability of export value equals to k is:

$$Pr(ExpValue_{i,j,t} = k) = \begin{cases} \pi_{i,j,t} + (1 - \pi_{i,j,t})g(y_{i,j,t} = 0), \ if \ k = 0 \\ (1 - \pi_{i,j,t})g(y_{i,j,t} = 0), \ if \ k > 0 \end{cases} \tag{2.4}$$

where the Logistic link function defined below:

$$\pi_{i,j,t} = \frac{exp(\gamma_1 z_1 + \gamma_2 z_2 + ...)}{1 + exp(\gamma_1 z_1 + \gamma_2 z_2 + ...)} \tag{2.5}$$

z_1 to z_m are variables that determine whether the export value is "inherently" zero. The "not-always-zero" values follow a negative binomial distribution given by:

$$g(y_{i,j,t}) = Pr(Export = y_{i,j,t}|\mu, \alpha) = \frac{\Gamma(y_{i,j,t} + \alpha^{-1})}{\Gamma(\alpha^{-1})\Gamma(y_{i,j,t} + 1)}(\frac{1}{1 + \alpha\mu_{i,j,t}})^{\alpha^{-1}}(\frac{\alpha\mu_{i,j,t}}{1 + \alpha\mu_i})^{y_{i,j,t}} \tag{2.6}$$

where $\mu_{i,j,t} = exp(\beta_1 x_{1,i,j,t} + \beta_2 x_{2,i,j,t} + ... + \beta_k x_{k,i,j,t})$. $x_{1,i,j,t}$ to $x_{k,i,j,t}$ are variables that govern the non-zero export value. I select country-specific characteristics and key firm characteristics (size and financial constraint) into the first stage and put the other variables in Equation (2.3) in the second stage regression. The results are presented in Table 2.6. The regressors in the link function are reported in the "inflate" section, while $x_{1,i,j,t}$ to $x_{k,i,j,t}$ are reported in the "value" section. It can be seen that BankLink remains positively signed and significant, suggesting that the result is immune to zero-inflation problem.

2.6.2 Excluding "Financially Open Cities"

As mentioned in Section 2.2.1, although foreign banks still face strict restrictions, they can operate in some cities assigned by the Chinese government. As Claessens et al. (2017) points out, foreign banks are effective in promoting export of the host countries. One could be concerned about the possibility that the growth of trade is created by firms in these locations where both domestic and foreign bank branches sprout. To eliminate the concern, I exclude these "financially open cities", including their core urban districts and affiliated counties[6], and re-run the regressions. The estimates are presented in Table 2.9, which has the same layout as Table 2.5. The results are consistent with the baseline results in signs and the levels of significance. The estimates on BankLink are inflated compared to Table 2.5. The result is intuitive, because the marginal bank link effect is stronger as access to finance in non-open cities is more limited.

2.6.3 Excluding Hong Kong and Macau

Hong Kong, Macau, and mainland China have maintained close trading relationships with each other for many years. Because of Hong Kong and Macau's geographical proximity, the free port status, and special partnership, they distributes a large fraction of China's

[6]These "financially open cities" are prefectural level cities that govern several districts and counties.

exports to the rest of the world. Meanwhile, because of the political and cultural ties, Hong Kong and Macau are favorable foreign destinations to test the waters in the internationalization process of Chinese banks. Therefore, I am concerned that the effect of cross-country bank links might be contributed by concurrent growth of trade and new subsidiaries of the two locations. Figure 2.4 shows the value of China's total export and transshipment through Hong Kong. One can see from the graph that the growth rate of re-export is rather slow compared to that of total export. To further eliminate the concern, I re-run regressions in Table 2.5 after excluding Hong Kong and Macau. The results are presented in Table 2.10. The estimates are consistent with Table 2.5, suggesting that the main results are robust to this scenario.

2.6.4 Excluding Largest Firms

A potential endogeneity concern about the methodology of this paper is that the bank link effect might be driven by "banks following the firm": it is possible that some large firms can urge banks to enter certain countries they plan to export in large amounts. To eliminate this concern, I run the export value equation again on a sub-sample after excluding the largest 50% of firms in the full sample and the largest 50% in each county, since overseas location choice is unlikely to be dictated by the demand of small firms. The results are displayed in Table 2.11. To keep the output succinct, only the coefficient on BankLink is reported. One can see that BankLink remains positively signed and significant for all specifications. The results assure that the bank link effect is not merely caused by large exporters leveraging new bank entries.

2.7 Conclusion

This paper pinpoints the underlying mechanisms how finance is related to trade by constructing a succinct theoretical framework and exploiting a novel dataset. It identifies and verifies three channels that bank network expansion leads to export growth: (1) establishing bank links between domestic locations and foreign destinations and reducing financial cost of trade related to the specific country; (2) providing financial services that curtail the general financial cost of trade; (3) lifting financial constraints by proving working capital. I find the results robust after controlling more gravity variables and various fixed effects and adopting zero-inflated negative binomial model. I also conduct robustness checks to rule out the possibility that the statistical significance is driven by foreign bank entrance and contemporaneous export growth in a few "open-up cities". Moreover, I find that direct bank links are more important for firms in locations where foreign banks are absent, for foreign firms and large firms (with 100+ employees) and for differentiated products. I conjecture that the effect of bank links is stronger for frequent users of banks' financial services and that they are related to the role banks play in reducing export risks.

This paper has a number of implications for future research. First, it points to important links between the often separate fields of banking and international trade. Besides, the paper uses the individual bank- and firm-level micro data instead of country-level aggregate measures. It is methodologically meaningful since the endogeneity concern about the contemporaneous growth of trade and financial associations can be better addressed. Finally, the estimates also have substantial policy implications for banking regulators and trade promoters. This is especially important for previous financially reclusive countries and developing countries that aim to develop trade.

Table 2.1: Summary Statistics

Variable	Obs.	Mean	Median	Std. Dev.	P25	P75
Firm Attributes–Exporting Firms						
Log(1+Value of export) (by firm by country)	1,907,833	10.76	10.69	2.23	9.38	12.17
FCP Index	86,905	0.062	0.031	0.096	0.022	0.056
# Employees	86,905	490.22	185	1932.925	90	406
Firm Attributes–All Firms						
FCP Index	506,877	0.066	0.035	0.098	0.023	0.063
# Employees	506,877	278.15	106	1291.01	52	231
Partner Country Attributes						
Log(GDP)	224	23.499	23.220	5.441	21.910	25.203
log(Dist.)	224	9.011	9.078	0.557	8.818	9.415
Log(Pop.)	224	2.134	2.024	1.495	0.871	3.144
Log(Area)	224	11.089	11.627	8.509	9.916	13.148
Risk Index	224	66.213	67.25	13.662	58.28	76.33
Bank Network Attributes						
Num. of Bank Branches (by county-year)	27,261	35.35	23	41.11	9	47
Num. of Bank Links (by county-destination-year)	2,797,750	0.177	0	0.72	0	0

This table reports the mean values, medians, P25 and P75 of key characteristics on firm-level, destination country-level, and bank-level. The characteristics reported are log(value of export), FCP index used to measure financial constraint, and number of employees, logarithm of GDP, distance, population and area of destination countries, the number of local branches and overseas bank links of counties.

Table 2.2: Nonparametric Result

	Counties with an increase in BankLink >75th	Counties with an increase in BankLink <25th
% change in the fraction of exporting firms	11.19%	5.93%
% change in the value of exports	14.93%	2.72%

Notes: This table reports the change in the fraction of exporting firms and the percentage of change in the value of export (for firms that exported every year) from 2000 to 2006.

Table 2.3: County-level Regression: Trade Participation

	(1)	(2)	(3)	4)
Dep. Var: log(Exp. Value+1)	Baseline	Destination FE	Saturated	Major countries only
BankLink	0.00461***	0.00358***	0.00370***	0.00332***
	(1.28e-05)	(2.78e-05)	(2.98e-05)	(-5.79E-05)
NumBranch	1.53e-05***	1.55e-05***	1.54e-05***	4.58e-05***
	(8.95e-07)	(8.73e-07)	(8.66e-07)	(-3.04E-06)
Log(GDP)	0.00145***	-0.000317***		
	(5.95e-06)	(6.37e-05)		
Log(Pop.)	-7.16e-05***	-0.00704***		
	(9.31e-06)	(0.000318)		
Log(Dist.)	-0.000587***			
	(1.80e-05)			
Log(Area)	-6.92e-05***			
	(5.89e-06)			
Year FE	X	X	X	X
County FE	X	X	X	X
Country FE		X	X	X
Country × Year FE			X	X
Observations	2,276,730	2,276,730	2,276,730	526,470
R-squared	0.228	0.267	0.279	0.392

Standard errors in parentheses
*** $p<0.01$, ** $p<0.05$, * $p<0.1$

Notes: Standard errors are in parentheses. This table reports the county level regression results. The dependent variable is the fraction of exporting firms between 2000-2006. BankLink is the number of bank links between the county where the firm is located and the export destination country. NumBranch is the number of bank branches in the county. Fin. Constraint is a measure of financial constraint. Log(GDP), Log(Pop.), Log(Area), Log(Dist.) are logarithm of GDP, population, area and distance to the county of origin of the destination country. Column (1)-(3) report results using the full sample. Column (4) only includes countries whose 2000 total volumes of trade are above the 75th percentile.

Table 2.4: Bank Network and Export: Export or Not

Dep. Var: I(Export)	(1) Baseline	(2) More controls	(3) County FE	(4) Saturated
BankLink	0.00822***	0.00805***	0.00865***	0.00967***
	(0.0000676)	(0.0000678)	(0.0002057)	(.0002555)
Demean Fin. Constraint	1.22e-10	1.22e-10	1.22e-10	1.23e-10
	(2.51e-10)	(2.51e-10)	(2.50e-10)	(2.50e-10)
NumBranch	0.0000135***	0.0000135***	0.0000135***	0.0000133***
	(3.34e-06)	(3.34e-06)	(3.34e-06)	(3.33e-06)
Demean Fin. Constraint×NumBranch	-5.99e-14	-6.12e-14	-6.54e-14	-7.42e-14
	(2.07e-12)	(2.08e-12)	(2.07e-12)	2.06e-12
Log(GDP)	0.00254***	0.00257***	-0.00061***	
	(0.000028)	(3.18e-05)	(0.0001015)	
Log(Dist.)		-2.01e-05	-0.00304***	
		(4.14e-05)	(0.00065)	
Log(Pop.)		0.000416***		
		(2.37e-05)		
Log(Area)		-0.000339***		
		(7.55e-06)		
Year FE	X	X	X	X
Firm FE	X	X	X	X
Country FE			X	X
Country × Year FE				X
Observations	49,530,859	49,530,859	49,530,859	49,530,859
R-squared	0.121	0.121	0.125	0.126

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

Notes: Standard errors are clustered on firm ID. This table reports the effect of bank network expansion on firms' export choice from 2000-2006. The estimation is conducted on a 20% subsample of all firms. The dependent variable is a dummy variable that equals 1 when the firm exports. BankLink is the number of bank links between the county where the firm is located and the export destination country. Demean Fin. Constraint is the demeaned measure of financial constraint (demeaning to make the output more readable). Log(GDP), Log(Pop.), Log(Area), Log(Dist.) are logarithm of GDP, population, area and distance to the county of origin of the destination country.

Table 2.5: Bank Network and Export: Value of Export

Dep. Var: log(Exp. Value+1)	(1) Baseline	(2) More controls	(3) Country FE	(4) Saturated
BankLink	0.359***	0.350***	0.120***	0.0999***
	(0.000252)	(0.000267)	(0.000793)	(0.000928)
Fin. Constraint Index	3.983***	3.982***	3.974***	3.959***
	(0.136)	(0.136)	(0.135)	(0.134)
NumBranch	0.000924***	0.000924***	0.000935***	0.000956***
	(0.000238)	(0.000238)	(0.000235)	(0.000234)
Fin. Constraint × NumBranch	-0.00245***	-0.00244***	-0.00242***	-0.00248***
	(0.000739)	(0.000739)	(0.000730)	(0.000728)
Log(GDP)	0.122***	0.122***	-0.0282***	
	(0.000105)	(0.000147)	(0.00169)	
Log(Dist.)		-0.00490***		
		(0.000456)		
Log(Pop.)		0.0246***	-0.184***	
		(0.000295)	(0.0105)	
Log(Area)		-0.0176***		
		(0.000134)		
Year FE	X	X	X	X
Firm FE	X	X	X	X
Country FE			X	X
Country × Year				X
Observations	57,461,452	57,461,452	57,461,452	57,461,452
R-squared	0.149	0.149	0.170	0.174

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

Notes: Standard errors are in parentheses. This table reports the effect of bank network expansion on the value of export. The dependent variable is yearly log(export value) from 2000-2006. BankLink is the number of bank links between the county where the firm is located and the export destination country. NumBranch is the number of bank branches in the county. Fin. Constraint is a measure of financial constraint. Log(GDP), Log(Pop.), Log(Area), Log(Dist.) are logarithm of GDP, population, area and distance to the county of origin of the destination country.

Table 2.6: Heterogeneous Effects (1) - Firm Size, Ownership, Destination Risk

Dep. Var: log(Exp. Value+1)	(1) Add Country-Year FE 100+ employees	(2) Only Firm ID 100+ employees	(3) Add Country-Year FE Foreign	(4) Only Firm ID Foreign	(5) Interaction w/ Risk Measure	(6) Interaction w/ Risk Measure
BankLink	0.394***	0.126***	0.430***	0.125***	0.889***	0.342***
	(0.000337)	(0.00116)	(0.000490)	(0.00182)	(0.00452)	(0.000310)
Fin. Constraint	3.694***	3.678***	7.154***	7.106***	4.946***	4.946***
	(0.147)	(0.145)	(0.223)	(0.218)	(0.181)	(0.181)
NumBranch	0.000894***	0.000937***	0.00539***	0.00539***	0.000581*	0.000588*
	(0.000260)	(0.000256)	(0.000337)	(0.000330)	(0.000315)	(0.000315)
Fin. Constraint×NumBranch	-0.00213***	-0.00220***	-0.0169***	-0.0169***	-0.00420***	-0.00418***
	(0.000807)	(0.000794)	(0.00105)	(0.00102)	(0.000981)	(0.000981)
Risk					-0.00991***	-0.0106***
					(5.77e-05)	(5.74e-05)
Risk X BankLink					1.32e-05***	1.31e-05***
					(1.40e-07)	(1.40e-07)
Log(GDP)	0.142***		0.129***	0.238***	0.203***	
	(0.000185)		(0.000276)	(0.000340)	(0.000346)	
Log(pop.)	0.0269***		0.0148***	0.0288***	-0.0414***	
	(0.000373)		(0.000554)	(0.000684)	(0.000519)	
Year FE	X	X	X	X	X	X
Firm FE	X	X	X	X	X	X
Country FE	X	X	X	X	X	X
Country × Year FE		X		X		X
Observations	41,365,878	41,365,877	17,008,680	17,008,680	42,260,327	42,260,327
R-squared	0.163	0.190	0.173	0.206	0.168	0.169

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

Notes: Standard errors are in parentheses. This table reports heterogeneous effects. Column (1) and (2) reports the results for firms with more than 100 employees. Column (3) and (4) reports the results for foreign-owned firms. Column (5) and (6) reports the results after adding country risk as an independent variable.

Table 2.7: Heterogeneous Effects (2) - Product Type

	(1) Goods traded on organized exchanges	(2) Reference priced	(3) Differentiated products
BankLink	-0.002	0.041***	0.0545***
	(0.0128)	(0.0068)	(0.0031)
Observations	49,195	332,447	1,375,475
R-squared	0.5411	0.5029	0.3461

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

Notes: Standard errors are in parentheses. The dependent variable is log(Exp. Value+1). This table reports export product heterogeneous effect. Column (1), (2) and (3) reports the results for goods traded on organized exchanges, reference priced goods, and differentiated products, respectively. Year FE, Firm FE, and Year*Destination country FE are controlled in all specifications.

Table 2.8: Robustness Checks: Zero-inflated Negative Binomial

Stage 2: Value		(1)	(2)
	Bank Link	0.252***	0.215***
		(0.0006)	(0.0007)
	Fin. Constraint	11.03***	11.528***
		(0.119)	(0.120)
	BN	-0.025***	-0.024***
		(0.0003)	(0.0003)
	Fin. Constraint*BN	0.079***	0.0767***
		(0.001)	(0.001)
	Log(GDP)	0.197***	0.182***
		(0.0007)	(0.001)
State 1: Inflate			
	Log(GDP)	-0.638***	-0.638***
		(0.0005)	(0.0005)
	Log(Dist)	0.152***	0.152***
		(0.0013)	(0.0013)
	Log(Pop.)	0.022***	0.022***
		(0.0011)	(0.0011)
	Log(Area)	0.097***	0.097***
		(0.0006)	(0.0006)
	# Employees	-0.00003***	-0.00003***
		(2.64e-07)	(2.64e-07)
	Fin. Constraint	-8.763***	-8.754***
		(0.1507)	(0.1504)
Num. Obs		57,461,452	57,461,452
Num. Non-zero obs		1,678,447	1,678,447
FEs		Year	Year, Destination country

Notes: Standard errors are in parentheses. This table reports the results using zero-inflated negative binomial model instead of log-normal specification. The dependent variable is the value of export of each firm-year-destination tuple. Column (1) reports the results when year FE is added. Year and destination country FEs are added in Column (2).

Table 2.9: Robustness Checks: Excluding Financially Open Cities

	(1)	(2)
Dep. Var: log(Exp. Value+1)		
BankLink	0.335***	0.147***
	(0.000354)	(0.00124)
Fin. Constraint	1.966***	1.973***
	(0.191)	(0.188)
NumBranch	0.000130	0.000231
	(0.000382)	(0.000376)
Fin. Constraint×NumBranch	0.000955	0.000708
	(0.00119)	(0.00117)
Log(GDP)	0.121***	
	(0.000191)	
Log(Pop)	0.0298***	
	(0.000384)	
Year FE	X	X
Firm FE	X	X
Country FE	X	X
Country × Year FE		X
Observations	34,206,292	34,206,292
R-squared	0.141	0.165

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

Notes: Standard errors are in parentheses. This table reports the robustness check results after removing Chinese cities with foreign bank presence from the dataset. The dependent variable is yearly log(export value) from 2000-2006.

Table 2.10: Robustness Checks: Excluding Hong Kong and Macau

	(1)	(2)	(3)
Dep. Var: log(Exp. Value+1)			
BankLink	0.341***	0.101***	0.0419***
	(0.000300)	(0.000924)	(0.00112)
Fin. Constraint	4.018***	4.017***	4.000***
	(0.134)	(0.132)	(0.132)
NumBranch	0.00114***	0.00116***	0.00117***
	(0.000233)	(0.000230)	(0.000230)
Fin. Constraint×NumBranch	-0.00308***	-0.00310***	-0.00314***
	(0.000725)	(0.000716)	(0.000714)
Log(GDP)	0.123***	-0.0219***	
	(0.000144)	(0.00166)	
Log(Pop)	0.0259***	-0.198***	
	(0.000288)	(0.0103)	
Year FE	X	X	X
Firm FE	X	X	X
Country FE		X	X
Country × Year FE			X
Observations	56,821,695	56,821,695	56,821,695
R-squared	0.143	0.164	0.169

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

Notes: Standard errors are in parentheses. This table reports the robustness check results after removing Chinese cities with foreign bank presence from the dataset. The dependent variable is yearly log(export value) from 2000-2006.

Table 2.11: Robustness Checks: Excluding Large Firms

Dep. Var: log(Exp. Value+1)	(1)	(2)	(3)	(4)
BankLink	0.272***	0.263***	0.0825***	0.0534***
	(0.000306)	(0.000325)	(0.000973)	(0.00114)
Fin. Constraint	22.35***	22.35***	22.46***	22.47***
	(1.638)	(1.638)	(1.621)	(1.617)
NumBranch	0.0131***	0.0131***	0.0131***	0.0131***
	(0.00122)	(0.00122)	(0.00120)	(0.00120)
Fin. Constraint×NumBranch	-0.0405***	-0.0405***	-0.0406***	-0.0406***
	(0.00380)	(0.00380)	(0.00376)	(0.00375)
Log(GDP)	0.0805***	0.0796***	-0.0337***	
	(0.000128)	(0.000179)	(0.00210)	
Log(Dist)		-0.0212***		
		(0.000556)		
Log(Pop)		0.0183***	-0.0252*	
		(0.000360)	(0.0130)	
Log(Area)		-0.0127***		
		(0.000163)		
Year FE	X	X	X	X
Firm FE	X	X	X	X
Country FE			X	X
Country X Year FE				X
Observations	25,853,050	25,853,050	25,853,050	25,853,050
R-squared	0.110	0.111	0.129	0.134

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

Notes: Standard errors are in parentheses. This table reports the robustness check results after removing the largest 50% of all firms in the full sample (by the number of employees) and the largest 50% in each county. The dependent variable is yearly log(export value+1) from 2000-2006.

Table 2.12: List of Financially Open Cities and Deregulation Timeline

Year	Restriction removed	Cities Restriction Lifted
1996	Foreign banks can operate Renminbi businesses for foreign companies and foreign nationals.	Pudong District of Shanghai
1998		Shenzhen
2001 (WTO Accession)	Foreign banks can provide foreign currency services to Chinese firms and residents.	Shanghai, Tianjin, Dalian
2002		Guangzhou, Qingdao, Nanjing, Wuhan
2004		Kunming, Zhuhai, Beijing, Xiamen
2005		Shantou, Ningbo, Harbin, Changchun, Lanzhou, Yinchuan, Nanning

This table summarizes the list of financially open cities cities and the opening-up timeline of the Chinese banking industry.

Figure 2.1: Formulation of Bank Links-1
Left: When the bank establishes a new subsidiary in B, BankLink(County 1, B) = 1, BankLink(County 1, A) = 0
Right: When the bank establishes a new subsidiary in Country 1, BankLink(County 1, B) = 1, BankLink(County 1, A) = 0

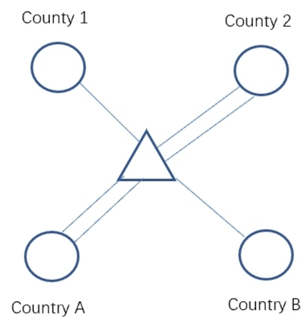

Figure 2.2: Formulation of Bank Links-2
Extra domestic branches do not change the number of bank links, but an additional foreign subsidiary does. In this graph, BankLink(1,A)=2, BankLink(2,B)=1

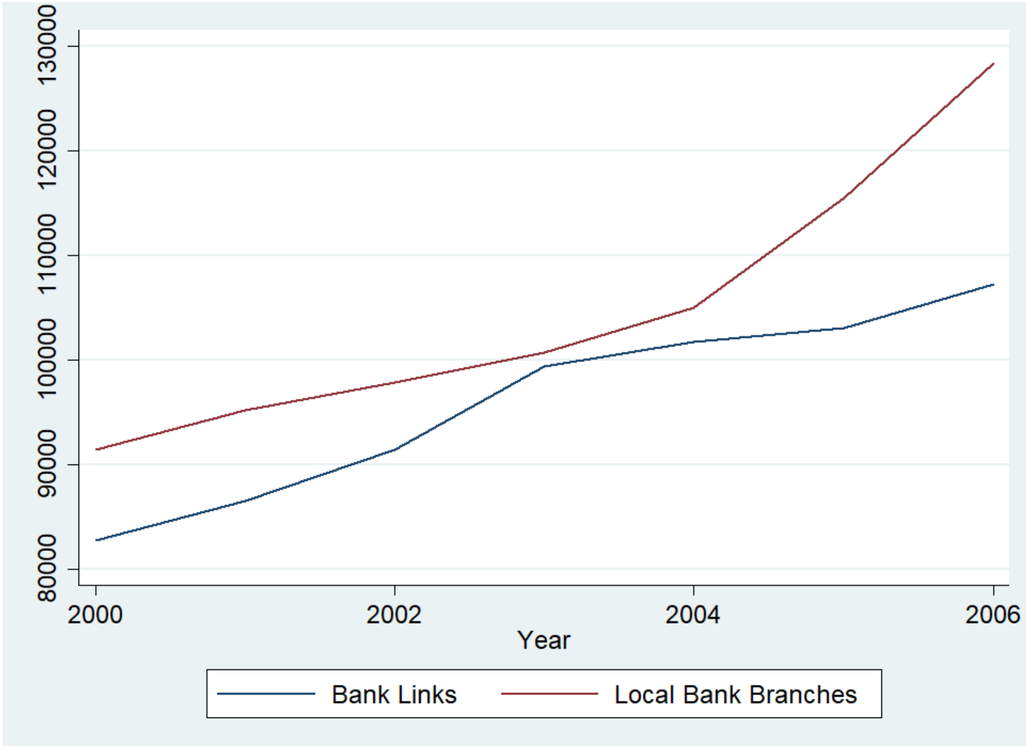

Figure 2.3: The Number of Local Bank Branches and Cross-country Bank Links. Source: Hong Kong Annual Digest of Statistics and China Customs Statistics.

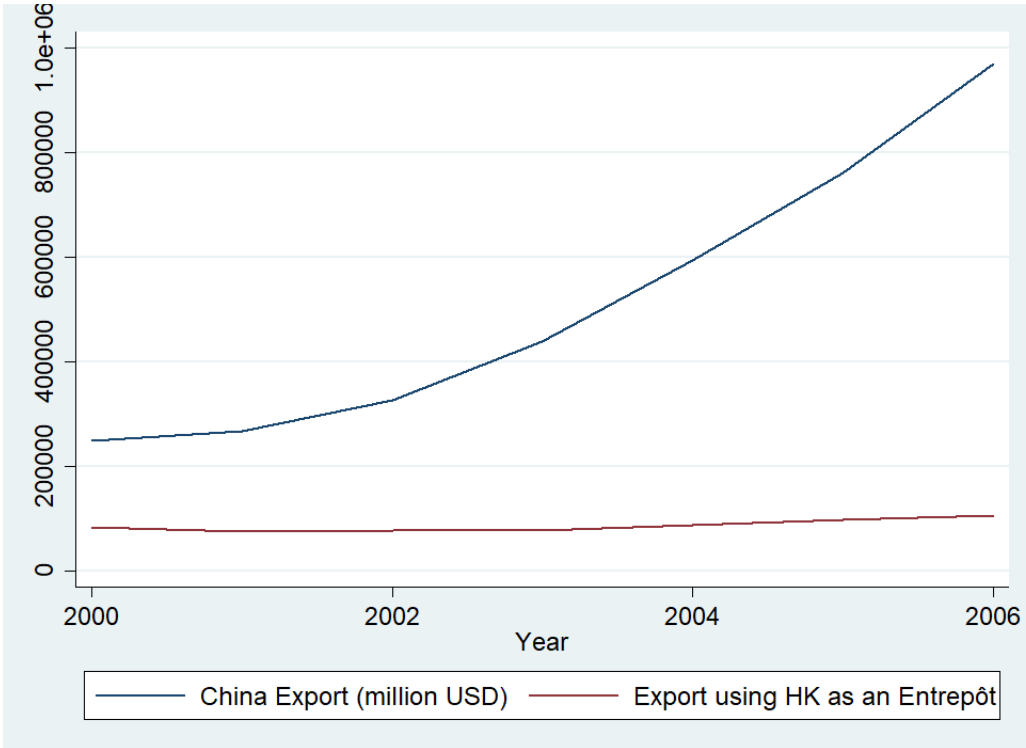

Figure 2.4: The Number of Local Bank Branches and Cross-country Bank Links

CHAPTER 3

Political Considerations, Geographical Expansion, and Performance of Public Banks

3.1 Introduction

According to the data presented in Gonzalez-Garcia et al. (2013), government ownership in the banking sector is large and pervasive. According to La Porta et al. (2002), although government ownership is higher in countries with low levels of per capita income, backward financial systems, interventionist and inefficient governments, and poor protection of property rights, exceptions still widely exist. Some high-income countries, such as Germany, Iceland, and the Republic of Korea, also have large public-sector banking [1]. Previous literature has confirmed that state-owned banks usually have bad performances. Compared to more market-oriented private counterparts, they tend to be more low-efficient (Boardman and Vining, 1989), have more non-performing loans, and have low return on assets (Bonin et al., 2005).

China is not an exception either. Lin and Zhang (2009) documents similar phenomena in the Chinese banking sector. However, the micro-mechanism why government owned banks underperform is still understudied. In this paper, utilizing Chinese banking sector data, I attempt to reveal one micro-mechanism behind the low efficiency of state-owned banks from bank operation perspective: the geographical expansion pattern. Banks establish physical presence and business involvement when it enters a market. Entering a high-quality market improves the profitability of banks and reduces risk, and vice versa. The public ownership opens the doors to opportunism and allows government officials to deviate the allocation of financial resources by intervening with the location choices of banks. Such intervention encourages banks to expand to politically needed, but not lucra-

[1] "Public-sector banks" and "state-owned banks" have almost the same meaning. However, in some contexts, "public-sector banks" refer specifically to banks owned by the government in India. I use the two terminologies interchangeably in this paper.

tive locations. This type of distortion is more powerful for city commercial banks, which is a type of bank owned by local governments, than any other types of banks in China. As a result of such distortion, lower profitability, less operating prudence and higher risk ensue. In this paper, I first confirm the existence and the negative consequence of such distortion with statistical analyses in the next a few sections.

Also, this paper tries to examine the risk implication of geographically concentrated banks due to the political influence that hinders bank from diversifying geographically. Whether financial institutions should be more focused or diversified is long-debated theoretically and empirically. Diamond (1997) suggests that banks should be as diversified as possible. This precludes any agency problem between bank owners and bank creditors. Wonton (1999) suggests a theoretical framework that incorporates a residual agency problem between bank owners and bank creditors and examines the merit of the proverbial wisdom of not putting all your eggs in one basket. It is also a long-standing issue in the regulatory practice that triggered debates in policy-making. There are several previous studies that focused on the economic benefit of bank branch deregulation, such as those of Jayaratne and Strahan (1996) and Beck et al. (2010). However, the issue has not been sufficiently addressed empirically (with the exception of Acharya et al. (2006) from the risk aversion perspective on whether more geographically diversified banks are more robust to external shocks). This paper fills the research void.

To be specific, the paper tries to answer four questions in the following sections: (1) Do political incentives affect the expansionary pattern of Chinese banks? (2) What determines the magnitude of the abovementioned political incentives (for example, ownership structure, corporate governance, and other political economy variables). (3) How does the pattern of expansion affect bank operations and outcomes? (4) Does the expansionary pattern driven by political incentives lead to higher banking risk?

To answer the questions above, I employ a panel data from 2006 to 2015 on Chinese banks. I find evidence of political interference in CCBs geographic expansion that encourages banks to expand to locations where their controlling government has interest. The distortion is weaker if banks have a lower degree of share concentration or foreign strategic investors. Moreover, banks' in-territory expansions reduce cost efficiency and financial prudence. Such results imply that banks become riskier under political economy dynamics that encourage internal expansion. Lastly, using the trade landslide after the Great Recession as an exogenous shock, I find that geographically concentrated banks suffered more from the negative impact, suggesting that the political incentive magnifies concentration risk.

The contribution of this research is twofold. First, it expands the understanding of the political economy behind the low efficiency of public-sector banks. The inefficiency enroots in the omission of profitability in the operation of banks: as confirmed by my empirical results, public bank tends to expand to places in the territory of the local government that owns it, where they are politically needed, instead of more profitable localities. My empirical results also demonstrate that, banks that expand inside territory tend to have reduced cost efficiency, asset turnover and the ratio allowance doubtful as the total deposit. The results also show that a higher percentage of loan extended to government-related projects is associated with in-territory expansion. This evidence reveals the existence and the consequence of one distortive force in public-sector banking.

The paper also attempts to answer the question that whether financial institutions and banks should be focused or diversified geographically. It has been widely debated both theoretically and in the practice of banking regulation. Using the Great Recession as an exogenous shock, I use the impact of the export avalanche on the banking sector as a natural experiment. The evidence suggests that, geographically diversified banks are better at dealing with shocks transmitted from the real economy.

The remainder of the paper is organized as follows. Section 3.2 introduces some background information that is essential to understand this paper but may not be familiar to readers, including an introduction to the Chinese banking system and the political considerations behind bank expansion. Section 3.3 presents the framework that informs our research questions and lays out the regression equations employed in the statistical analyses. Section 3.4 presents the construction of the data and summary statistics. Section 3.5 presents the main results. Section 3.6 concludes.

3.2 Background

3.2.1 State-owned Banks and Relevant Literature

Public-sector banks are prevalent in developing countries (Paraguay, India, China, Uganda, Pakistan, etc.) and some developed countries (e.g. Germany). Data show that this is more prevalent in developing countries. There are two conflicting attitudes towards state-owned banking. In a World Bank report published by Sherif et al. (2003), they argue that the presence of state banks has resulted in the deterrence of prime-rated foreign investment from the banking market and led to the distortion of resource allocation due to preferential treatment and patronage, putting a brake on economic growth. On the other hand, some economists, argue that state-owned banks do more good than harm. There are many aspects in this debate. There are two issues relevant to this research. First, there has been a long debate about whether state-ownership causes higher risks and crises. Barth et al. (2009) find little evidence of a causal link between state-owned banks and the likelihood of crises in an examination of 66 countries. La Porta et al. (2002) finds only a weak relationship between the level of government ownership of the banking system and measures of financial instability in their examination of 92 countries. In this paper, I will ask this question in a subtle way by examining the underlying micro-mechanism: because of government interference, some banks are more geographically concentrated than others; when a crisis hits the economy, do these banks perform worse than not so concentrated peers? This question is to be answered in Section 3.3.

Second, a plethora of research confirms that state-owned banks perform worse than private banks. Using Chinese data from 1994-2004, Lin and Zhang (2009) and Berger et al. (2009) find that the Big Four state-owned commercial banks are less profitable, less efficient, and have worse asset quality and lower efficiency than other types of banks. Yao et al. (2007) applies SFA to a panel of 22 banks (1995-2001) to estimate the effects of ownership structure and the implementation of a hard budget constraint on bank efficiency. Non-state banks are found to be 8%-18% more efficient than state banks, and banks facing a hard budget constraint tend to perform better than those relying on substantial government capital injections. Using Chinese data, Jia (2009) shows that lending by state-owned banks has been less prudent than lending by joint-equity banks but has improved over time. This question is also at the center of this paper.

3.2.2 Chinese Banking Sector

China has one of the largest banking systems by the volume of assets. The total assets of Chinese banks had overtaken those of US banks in 2010 and EU banks in 2016 to become the largest in the world. China also has a unique mixed banking system that was formulated in the process of economic reform and transition from central-planned Soviet mode to a market economy. The formulation of this unique system is a story of change amidst continuity. Prior to 1978, China had a mono-bank financial system (People's Bank of China) whereby all the countrys banks were parts of one administrative hierarchy. After four decades of financial reform, although the Chinese banking sector is still dominated by publicly owned institutions, different types of banks emerged. There are five types of banks:

(1) Five central-government owned banks (Industrial and Commercial Bank of China, Bank of China, China Construction Bank, Agricultural Bank of China, and Bank of Communi-

cations, known as the “big five”) . These banks are direct results of the first wave of Chinese banking system reform in the early 1970s and 1980s. When banking reform was put on the agenda in 1978, attention was focused on modifying the structure and operations of China's banking system. Bank credit gradually replaced state-owned enterprises' budgetary allocations and various banking functions were devolved from the central bank, Peoples Bank of China (PBOC). As a result of the reform, these banks were founded as specialized banks to provide depository service and funds to their respective sectors. For example, Agricultural Bank of China was established to support the farming sector and serve rural populations. After China had decided to reform its financial sector, the big five banks undertook a process of transformation and became nationwide, full-fledged, listed commercial banks. Since then they have grown astronomically in size and business involvement, making them constant seat-holders in Fortune Global 500. The “big five” banks are featured by a significant degree of centralization in the decision-making process at the headquarters, which is a result of banking sector reform to rein in corruption and irresponsible lending. For example, the recommendations of credit managers at the sub-branch level are passed on to the Lending Assessment and Approval Centers at the headquarters for final approval (Yeung, 2009). Therefore, it can be difficult for local governments to intervene branching decisions and operations of local branches of the “big five” banks.
(2) Market-oriented “stock” banks are sometimes also referred as “joint-stock” banks. In the mid- and late-1980s, banking reform turned to bank ownership. To decentralize the financial market and to infuse more competition, the government authorized the establishment of these banks as pioneers of financial reform. With greater emphasis on profit generation, although initial sponsors and promoters are often government entities, and the government still holds an unneglectable fraction of shares in these banks, the government usually takes a hands-off approach to the day-to-day running of the business. To enforce market principle in operation and to raise funds, all these banks are publicly listed at home or aboard. There are 12 such banks as of the end of 2015. They are: CITIC Bank, China Merchants Bank, Minsheng Banking Corp, Huaxia Bank, Shanghai Pudong Development Bank, China Everbright Bank, Shenzhen Development Bank, Guangdong Development Bank, Industrial Bank, Evergrowing Bank, China Zheshang Bank, and China Bohai Bank.
(3) Local-government owned banks, referred as city-commercial banks (CCBs). Many of them were founded on the basis of urban credit cooperatives. To increase competition and financial availability at the local and national level, starting from 1998, China began to allow past local credit cooperatives to merge and rebrand into full-fledged banks. Due to the historical origin, most city commercial banks have strong ties to the local governments of places where they incorporated and are mainly or wholly state-owned. The government

controllership without checks and balances leads to bad operations and corruption problems. To address this issue, the central government pushed a plan since 2005 some city commercial banks have diversified their shareholders, inviting international strategic investors to purchase stock and sit in the board, hoping to improve corporate governance by embracing market principles. However, government ownership is still prevailing in many CCBs. CCBs can be owned by different levels of local governments. There are CCBs owned by provincial governments (often a result of bank consolidations), by prefectural governments, and even by county-level governments.

Compared to banks owned by the central government, CCBs have higher combined standard error than other types of bank (except rural commercial) across different years within the same category (Figures 3.2 and 3.3). It is an indicative signal that CCBs are more likely to be affected by temporary or local negative shocks.

(4) Rural commercial banks. Rural commercial banks are established upon historical rural credit unions. In the word of the China Banking Regulatory Commission, the main purpose of this type of banks is to "support the development of agriculture, rural areas, and farmers and to promote the development of an inclusive finance strategically, and to improve the establishment of rural commercial banks actively and steadily in accordance with local conditions". The business operation of rural commercial banks is restricted to the administrative region of their headquarters: they are not allowed to operate outside their regions of incorporation.

(5) Private and foreign banks. Private banks are still fledging, and only have a limited impact. The first private bank started operating in 2015 as a pure online bank without brick-and-mortar branches. Foreign banks were allowed to enter the Chinese market in 2006, but are still facing some restrictive policies. They are only allowed to set up branches in a few designated cities. They jointly represent only a small portion of the industry.

The unique ecosystem of Chinese banks allows us to benchmark the bank operations of banks on different spectrums of independence and market-orientation and eased the analysis and compare the market characteristics of entry, as political interference plays different roles in operations. The details are discussed in the next subsection.

3.2.3 Political Economy of Bank Entry

Due to the differences in ownership structure and business positioning, each type of bank has different motivations for expansion. For state-owned banks, political considerations often influence and distort the expansion decision. Sometimes they can override the profit-maximizing doctrine. The incentives to assert political influence can be the promotion of the general publics interest; for example, local governments often encourage banks to go to unbanked places or to offer discounted interest rates to strategic sectors. However, the public policy can also be utilized or even hijacked by personal interest extraction. With the absence of an electoral system, the career prospects of Chinese officials are determined by their superiors in the Department of Organization of the Chinese Communist Party based on their performance evaluations. The criteria of performance evaluation are referred by previous literature, such as Zhou (2004), as a "promotion tournament model". In this model, the Chinese central government creates a "tournament competition" among local mayors using relative performance as the guideline for promotion and demotion. Until now, economic growth is still at the center of the evaluation system. This incentive design is a double-edged sword: on one hand, promotion tournaments serve as an incentive system inducing Chinese local officials to boost economic growth; on the other hand, the system also induces opportunistic and short-term behavior. Government officials have incentive to boost local economic growth illicitly. This discrepancy is reflected in the financial sector too. It is reported that local governments often encourage local banks they owned to expand to locations that are not profitable but politically needed or to extend loans to firms with political ties at the cost of financial prudence. Because the misalignment of incentive enroots in government officials' desire of promotion, the distortion in geographical expansion decision is of a more serious problem for local government owned CCBs than central government-owned "big five" banks, as the central government's decision is unlikely to be diverted by any local government. In contrast, the geographical expansion decisions of market-oriented banks roughly follow profit maximization principle. Conditional on this explicit assumption, this feature allows me to use joint-stock banks and national banks as a gauge to evaluate the fitness of entry of CCBs. The details are discussed in Section 3.3.

3.3 Empirical Strategy

This section introduces what econometric strategies that are chosen to answer the questions raised in Section 3.1. First and foremost, the first regression is set up to estimate a simple model of CCBs' likelihood of expanding to other localities and to test whether banks tend to enter their own "territory". More specifically, I regress a binary variable indicating whether a bank establishes a branch at a certain place in a certain year on the dummy variable whether the location is within the bank's own territory. Each market is defined as a county-level administrative division, which is the third level of the administrative hierarchy. The county-level division includes counties, districts in municipal regions, autonomous counties, banners in designated Mongolian autonomous areas [2]. A Chinese county is comparable to its American counterpart in size and in population. There are 2,860 counties as of 2015. The regression is performed on year-county-bank level. Each left-hand side observation represents a bank's entry choice whether to enter this county in a certain year.

$$\begin{aligned} I(Entry)_{ijt} = \beta_0 + \beta_1 I(OwnRegion)_{ij} + \beta_2 NumBranch_{jt} + \beta_3 Depo_{jt} \\ +\gamma_1 I(OwnRegion)_{ij} PctOwnership_{ij} + \gamma_2 I(OwnRegion)_{ij} ShareCon_{ij} \\ +\gamma_3 I(OwnRegion)_{ij} ForeignInv_{ij} + \theta_0 BankChar_{ijt} \\ +YearDummies_t + epsilon_{ijt} \end{aligned} \tag{3.1}$$

where i,j,t represent bank i in county j of year t. Control variables that are believed to be relevant to bank's expansion decision are also added into the equation. They are:

(1) The number of existing branches in the region, i.e., the number of all bank branches of all types in the region. The variable is added to the regression equation as the control variable of competition.

(2) $PctOwnership_{ij}$ is the percentage of government ownership, i.e., the percentage of shares owned by the local government. Banks with a higher percentage of government shareholding are more likely to follow instructions when it comes to expansion decision. However, with the regulatory baton in hand, it is possible that local governments do not need to sit on the board to command the bank.

(3) $Distance$ refers to the distance between the headquarter and the branch. The variable is added as a proxy to managerial control and other losses due to remoteness. Previous literature in various academic fields, such as Kalnins and Lafontaine (2013), confirmed that distance matters in firm expansions.

(4) $ForeignInv_{ij}$. The dummy variable equals 1 if a foreign strategic investor is present in the bank's board of directors. Foreign strategic investors are usually foreign institutional stockholders. It is believed that having a foreigner in the board could add external monitoring, introduce advanced operating practices, limit opportunistic behaviors of local government and improve overall bank management. As cited in Berger et al. (2007), anecdotal evidence shows that one mechanism that may be employed by minority foreign owners is to take positions on the board and in the management of Chinese banks and leverage these positions to improve the corporate culture and management of these banks.

[2]Districts in direct-controlled municipalities are officially classified as prefecture-level divisions, as they are affiliated to provincial level direct-controlled municipalities. However, the distinction is largely political. Districts in direct-controlled municipalities are generally comparable with ordinary districts. In this paper, I do not distinguish the two types of districts.

The foreign board members/owners also appear to have convinced senior managers to be more aware of shareholders interests and to use more modern management techniques. For example, findings in Berger et al. (2009) suggest that minority foreign ownership of the national banks will likely improve performance significantly. Sun et al. (2013) also finds similar positive evidence. I add the interaction term between Foreign Strate. Inv and Own Territory. The interaction term detects whether having a strategic investor reduces banks impulse to expand within its territory.

(5) Share concentration: The percentage of shareholding of top 5 shareholders is employed to measure the concentration of shareholding. It is expected that check and balance of power in the board could reduce political incentives in operation.

(6) $I(OwnRegion)_(i,j)$ is the main variable of interest indicating whether region j is in bank i's "territory". I expect it to carry a positive sign if banks are more likely to grow inside their own territories.

(7) $I(DiffProv_(i,j))$ indicates whether region j is in bank i's "territory". The dummy variable equals 1 if the county is in a different province from bank i's headquarter. The variable captures the bureaucratic cost of the inter-provincial expansion, because setting up a branch across provincial border requires authorization from CRSB.

(8) Previous literature on bank entry, such as Aguirregabiria et al. (2016), identified some factors that attract banks to enter. Possible candidates include total deposit in a county, as well as other indicators of market capacity, such as population and GDP. In this paper, I only add total deposit in the county to the equation as the control variable, since the data show that total deposit are highly correlated.

(9) Vector of bank characteristics. This set of variables controls the effect of bank traits on deciding which market to enter. It controls for factors pertaining to the bank, such as Aguirregabiria et al. (2016)s own traits that affect banks entry decision, such as financial capacity and business strategy. Here, I choose log(asset), which is the logarithm of bank asset level and loan/deposit ratio.

The bank-specific fixed effects help us control for bank characteristics not captured in my specifications and do not change dramatically over time. The time dummies help us control things such as the changes in the macroeconomic condition.

To test the relationship between geographical expansion and bank operating outcomes, I regress the following equation to detect whether outside-territory expansion affects performance:

$$\begin{aligned} y_{it} = \beta_0 + \beta_1 NewBranchOutside_{i,t-1} + \beta_2 NewBranchInside_{i,t-1} \\ + YearDummies_{t-1} + \beta_3 Listed_{i,t-1} + \beta_4 Log(Asset)_{i,t-1} + BankFE_i + \epsilon_{it} \end{aligned} \tag{3.2}$$

y_{it} represents outcome variables, including the following: profit efficiency, cost efficiency, asset turnover, ROA, core capital adequacy.

Here, a question arises naturally: How is the efficiency of banks defined and measured? In this paper, I use a well-developed methodology known as SFA (stochastic frontier analysis) in economic modelling, which was independently developed by Aigner et al. (1977), Meeusen and van Den Broeck (1977) and refined by Berger et al. (1993) to estimate banking efficiency. By introducing explicit assumptions about the inefficiency component's distribution, it tries to decompose the residual of the frontier into inefficiency and noise. To implement SFA, following Berger et al. (2007) , I assume that cost function is of trans-log functional form:

$$\begin{aligned} ln(\frac{C}{w_2 z_1})_{it} = \delta_0 + \Sigma_j \delta_j ln(\frac{y_j}{z_1})_{it} + \frac{1}{2}\Sigma_j \Sigma_k \delta_{jk} ln(\frac{y_j}{z_1})_{it} ln(\frac{y_k}{z_1})_{it} + \\ \beta_1 ln(\frac{w_1}{w_2}) + \frac{1}{2}\beta_{11} ln(\frac{w_1}{w_2})_{it} ln(\frac{w_1}{w_2})_{it} + \Sigma_j \theta_j ln(\frac{y_j}{z_1})_{it} ln(\frac{w_1}{w_2})_{it} \\ + YearDummies_t + ln(u_{it}) + ln(v_{it}) \end{aligned} \tag{3.3}$$

where i, t index the bank and year, respectively, and k indicates the kth type of output. There are four outputs (y): total loans, total deposits, liquid assets, other earning assets; two input prices (w): interest expenses to total deposits, noninterest expenses to fixed assets; and one fixed input (z): total earning assets. C is the bank's total costs. The ln u term represents a bank's efficiency level. $ln(v)$ is a random error term. The normalization by bank's total earning assets (z_1) reduces heteroskedasticity and allows banks of any size to have comparable residual terms from which the efficiencies are calculated. The normalization by the last input price (w_2) ensures price homogeneity. Profit efficiency levels and ranks are estimated in a similar manner by replacing total costs with total profit. To avoid taking a log of a negative number, I add a minimal positive number to profit.

The rest of the outcome variables are defined as follows:

(1) Asset turnover. Asset turnover is a financial ratio that measures the efficiency of a company's use of its assets in generating sales revenue or sales income to the company. It is expected that outside-territory expansions will reduce asset turnover and deteriorate the efficiency of capital utilization.

(2) Return of Asset (ROA). ROA is an indicator of how profitable a company is relative to its total assets. On one hand, within-territory expansions tend to expose banks to political pressure and make them more inclined to finance less promising projects. On the other hand, bank branches that operate locally suffer less information disadvantage (Agarwal and Hauswald, 2010). Therefore, the overall effect is uncertain and needs empirical verifica-

tion.

(3) Core Capital Adequacy Ratio. Capital Adequacy Ratio (CAR), also known as Capital to Risk (Weighted) Assets Ratio (CRAR), is the ratio of a bank's capital to its risk. Chinese banking regulation requires that the required minimum ratios "shall be no less than 8% for capital adequacy and 4% for core capital adequacy" (Regulation Governing Capital Adequacy of Commercial Banks, Chapter 1). Throughout the period that the study covers, the requirement stays constant until the new regulation effective 12/31/2018 lifts CAP requirement to 7.5%. Therefore, I can eliminate the concern that changes in CAR might be attributed to regulatory overhaul.

In terms of independent variables, $NewBranchOutside_{i,t-1}$ and $NewBranchInside_{i,t-1}$ are the numbers of new branches established inside and outside the banks territory of the previous year, respectively. $Listed$ indicates whether the bank is publicly listed. $Log(Asset)$ is the logarithm of total asset of the bank.

Another way to evaluate the quality of entry is to run the following Equation (3.4) on the "big five"/market-oriented banks to obtain determinants of bank branch entry and use the coefficients to predict desirability score (predicted probability of entry) for each county-bank pair. Note that the underlying assumption behind this treatment is that, entry decisions of the "big five" and joint stock banks are not manipulated by local governments. As argued in Section 3.2, the "big five" banks are owned by the central government. Although political interference is not absent, it is unlikely for local governments to manipulate. Joint stock banks are operated by market principle. Therefore, it is sufficiently reasonable to use the "big five" and joint stock banks as a benchmark. It would be valuable to compare the "desirability" score between within-territory and outside-territory entries, as I will present in Section 3.5.

$$\begin{aligned} I(Entry)_{ijt} = \beta_0 + \beta_2 NumBranch_{j,t-1} + \beta_3 Depo_{j,t-1} + \\ \theta_0 log(Asset)_{i,t-1} + \theta_1 Depo/Loan_{i,t-1} \\ + \theta_2 ShareBadLoani, t-1 + \theta_3 Listedi, t-1 + YearDummies_t + \epsilon_{ijt} \end{aligned} \tag{3.4}$$

One purpose of this paper is to check whether more geographically diversified banks can handle shocks and times of adversity better. It helps us to assess the mechanism that induces more geographical concentration. My approach is to utilize a natural experiment, the Great Recession, which falls within the period of data availability, as an exogenous shock to China between 2008 and 2009. China had no major inherent economic problem during this time period but did not stay intact. China's foreign trade dependence, defined as (trade/GDP), reached a historical high of 67% in 2006. The basic idea is, different regions of China are exposed to trade with the US in varying degrees. When the recession hit the

US economy and demolished the demands for Chinese products, these regions suffered in varying degrees. Within the same region, if the argument that more diversified banks reduce risk is true, then it is expected that more geographically dispersed banks should perform better. Therefore, conditional on the impact of the export avalanche, and more geographically concentrated banks are expected to be hit harder. The equation is set up as:

$$\begin{aligned} OutCome_{i,t} = \beta_0 + \beta_1 TradeExposure_{i,2007} + \beta_2 HHI - G_{i,t-1} + \\ \beta_3 TradeExposure_{i,2007} * HHI - G_{i,t-1} \\ + \gamma X_{i,t-1} + YearDummies_t + \epsilon_{ijt} \end{aligned} \tag{3.5}$$

where $OutCome_{i,t}$ represents outcome variables, including the following risk measures: percentage of non-performing loan and percentage of special-mention loan [3]. The latter is added because there is anecdotal evidence that some banks intentionally delay treatment of non-performing loans and classify them as special-mention loan to avoid providing extra reserves. Trade exposure of bank i is measured by: $TradeExposure_i = \Sigma_j (Trade_j / GDP_j) * NumBranch_{i,j}$, where $NumBranch_{i,j}$ indicates the number of branches of bank i in county j in 2007 before the crisis. I look at trade exposure in 2007 because the study period is 2008 and 2009 before the recovery. The details are discussed in the next section. $X_{i,t}$ represents bank traits as control variables. The main variable of interest is the interaction term $TradeExposure_{i,t} * HHI - G_{i,t}$, as I expect that geographical diversification alleviates the negative shock. If my hypothesis is true, the coefficient should be positively signed.

3.4 Data

3.4.1 Bank and County Level Data

The Universe of Chinese Bank Branches dataset is mainly obtained from CBRC (China Banking Regulatory Commission). The dataset includes the name, street address, date of establishment, date of licensing of all 225,382 branches by 2016. The "big five" banks have

[3]Regulatory agency classifies loans into five categories. Pass: there is no reason to doubt their ability to repay principal and interest of loans in full and on a timely basis. Special-mention: borrowers are still able to service the loans currently, although the repayment of loans might be adversely affected by some factors. Substandard: borrowers' ability to service loans is apparently in question, cannot depend on their normal business revenues to pay back the principal and interest of loans and certain losses might incur even when guarantees are executed. Doubtful: borrowers cannot pay back principal and interest of loans in full and significant losses will incur even when guarantees are executed. Loss: principal and interest of loans cannot be recovered or only a small portion can be recovered after taking all possible measures and resorting to necessary legal procedures.

the most bank branches. Branches affiliated to the "big five" account for more than 50% of all bank branches. Each CCB has only 133 branches on average. The variation in the number of branches of CCBs is quite large. The largest CCB by the number of branches, Bank of Jiangsu, has 551 branches in 2016, while the smallest banks merely have one single branch. Bank branch locations are geocoded to map with administrative divisions. The distribution of bank branch is highly geographically unbalanced: top 10% counties have more than 113 branches on average, while there are still underbanked and unbanked areas. The number of banks is highly correlated with GDP of the county.

To capture market characteristics of each market, I obtained county-level statistics from the Statistical Bureau of China, which include the total deposit balance (of all bank branches in the county), total loan balance, GDP, sector composition, agricultural yield, population and demographic variables. Among them, the total deposit balance, total loan balance, and GDP are highly correlated (¿0.9). Therefore only total deposit balance will be included in the regression to measure market size to improve the parsimony of the model.

Bank-level data are obtained from CSMAR (the China Stock Market & Accounting Research) and CNRDS (Chinese Research Data Services Platform), which are both reputed research data service providers in China. I supplemented some missing observations in CSMAR with CNRDS. Cross-verification is performed to ensure the consistency of the information from the two datasets. Bank-level data contain three subsets:

(1) Basic information, including officially registered name, bank type, headquarter location, year of incorporation, whether the bank is listed and the date of going public.

(2) Balance sheet information, including the aggregate level of assets, liabilities and equity and by subcategory.

(3) Bank ownership information, including the names and percentages of top 10 individual/institutional shareholders. Shareholder names are matched with government Business Registry to determine who are the ultimate owners and whether the owners are governments or private businesses.

(4) Key regulatory indicators, which are used by regulators to monitor the financial health of banks. They include: the share of pass, special-mention, substandard, doubtful and loss loans, saving/loan ratio, ROE, ROA, cost/revenue ratio, and capital adequacy.

(5) Names of top 10 borrowers and top 10 sectors, which allow us to calculate loan concentration by borrower and industry. Sectors are defined by level-one codes in Chinese official standard industry classification (Chinese national standard code: GB/T 47542011). There are 20 level-one industries in GB/T 47542011: Farming, forestry, animal husbandry and fishery; Mining Industry; Manufacturing Industry; Production and supply of electric power, gas and water; Construction industry; Traffic, storage and mail business; Informa-

tion transfer, computer service and software industry; Wholesale and retail trade; Accommodation and food industry; Finance industry; Realty business; Leasehold and business service industry; Scientific research, technical service and geologic examination industry; Water conservancy, environment, and public institution management; Neighborhood services and other service industry; Education; Sanitation, social security and social welfare industry; Cultural, physical and entertainment industry; Public administration and social organization; and International organizations. Besides public administration and social organization, the government-related lending that I use in this paper also includes water conservancy, environment, and public institution management, since this sector is largely owned by local governments in China.

The three datasets are assembled as illustrated in Figure 3.1. Tables 3.1 and 3.2 provide summary statistics of some key financial indicators across different types of banks and within the CCB category. Consistent with the prior belief, the numbers show that CCBs are relatively small compared to national banks in terms of total assets and deposit level. The average net ROA for Chinese banks is 0.97%, while the number for US banks is 1.08%. Considering that China has a much larger net interest spread, the profitability of Chinese CCBs is quite low. The variation is also large among CCBs in almost all variables, suggesting a high diversity within this classification. In terms of ownership structure, the data show a significant presence of private shareholding for many CCBs. The percentage of private shareholding is highly correlated with the public listing status of the bank.

Regarding the geographical distribution of bank branches, CCBs have 55 branches on average. The mean distance from branch to headquarter is 45.5km, indicating that most CCBs are fairly local.

3.4.2 Construction of Herfindahl-Hirschman Indices

To measure the concentration of distribution, I define an indicator that resembles the Herfindahl Hirschman index (HHI) of market concentration. HHI is the summation of the squared exposures as a fraction of total exposure under a given classification. In this case, I construct three different kinds of HHIs, which consist of the HHI of lending composition by industry (hence force HHI-I) , the HHI of bank branch geographical distribution (HHI-G), and the HHI of top 10 borrowers (HHI-B).

Since I only have data for the top 10 industry exposures for each bank, I let i=10 in the formula above my measure of HHI of the lending composition. For most banks in our sample, the top 10 exposures cover over 70% to 80% of the total size of the loan portfolio. For this 11th exposure, I treat it as a separate hypothetical all-the-rest industry. Thus, if the proportional exposures to eleven industries are X1-X11, respectively, then HHI equals.

$$HHI - I = \sum (X_i/Q)^2, where\ Q = \Sigma X_i$$

Similar treatment also applies to HH-G. For HHI-G, unlike industry exposure, the number of bank branch data are available for each location. Unfortunately, I cannot weight branches by size (the volume of deposit or the number of employees) since information on individual bank branches is not available. Therefore, I use the sum of the squared share of branches as the ratio of all branches to construct HHI of bank branch geographical distribution. The average HHI-G for CCBs is 0.361, as opposed to 0.063 for joint-stock banks and 0.0017 for Big-5 banks, signaling that CCB branches are less dispersed location-wise.

Whether geographical concentration of bank branch correlates with lending concentration evokes my curiosity, the correlation coefficient between HHI-I and HHI-G is 0.3552, suggesting that the two might be related in some way. On the other hand, the correlation coefficient between HHI-B and HHI-G is 0.0248 and the correlation coefficient between HHI-B and HHI-I is -0.0085, suggesting that geographical concentration does not lead to borrower concentration, and vice versa.

3.4.3 Construction of Reliance on Export Index

Ideally, the reliance on trade can be measured by (Export+Import/GDP). However, trade statistics broken down by sub-provincial administrative divisions are not published in China. To measure the degree of reliance on export at the county level, I compile the linked Chinese Customs-Manufacturing Survey data and calculate the ratio of export value as sales of all firms within a province. The dataset is the combination of two datasets: Chinese Customs data that contain export-import information for firms and Chinese Manufacturing Survey. The former covers information about export and import of goods of mainland China. It is managed by the Statistics Department of China Customs. Variables available include: importer/exporter name and HS code (HS 1992) of goods; export/import indicator; detailed time of export/import; country/region of origin/destination (where imported goods are finally delivered, consumed or further processed and where exported goods are originated or originally dispatched); mode of transportation; port of declaration; consignment for import/import; and value (expressed in CNY. Goods priced in foreign currencies are converted into CNY using the official exchange rate published by the State Administration of Foreign Exchange). The latter is a survey data conducted by the China National Bureau of Statistics on yearly basis. It is similar to the Longitudinal Research Database (LRD) maintained by the U.S. Bureau of the Census. The basic unit of observation is a firm, rather than an establishment as defined in LRD data. The dataset only includes annual firm-level data for industrial firms above a certain size threshold. The threshold was defined as all state-owned firms as well as non-state firms with sales exceeding 5 million RMB. If an enterprise has multiple subsidiaries, it will only show up once as its headquarter. Available information can be roughly classified into three sets: (1) identifying information with the detailed sector and geographic codes (province, county, street, administrative and postal codes). Sector is defined by GB /T4754 2002, which is the industrial classification code published as Chinese national standard; (2) Firm ownership can be identified using the official registration type or from the share in paid-up capital of different groups. (3) Stock variables include various measures of assets and debts.

The two datasets are merged by company name, geographical location, and telephone number and website address if available on a year-to-year basis. Fuzzy matching is implemented to ensure the maximal number of correspondence. Appending the linked data of all years gives a large firm-year panel. By linking the two together, I can calculate the share of export as total sales for each county. Although the data cover only above-scale firms (defined as all state-owned firms as well as non-state firms with sales exceeding 5 million RMB during the time of the study), because they create the majority of export, it is acceptable to use the share of export as total sales to proxy of trade reliance of a county.

3.5 Results

Table 3.3 reports the key empirical results of Equation (3.1) based on the Logit baseline model and FE model for panel data. The own-territory indicator dummy variable, the main variable of interest, is positively signed and significant for specifications after controlling same province dummy and distance, suggesting that CCBs tend to expand within the territory. The coefficient on the interaction term between the own-territory indicator and foreign strategic investor dummy is positively signed and significant, indicating that CCBs with a foreign strategic investor sitting on the board are more likely to avoid government influence in their expansion decision. Similarly, the interaction term between the own-territory indicator and stock concentration carries a negative sign, signaling that CCBs with more check and balance from the board are less likely to be affected by local governments. The three coefficients confirm my hypothesis that banks are more likely to expand to places of political interest, and the inclination gets stronger when the share concentration is high (less balance of power from the board of directors), and weaker when a foreign strategic investor is sitting on the board. Distance carries a negative and significant sign, confirming that distance still matters in bank expansion. The result is in line with the previous distance and productivity literature, such as Kalnins and Lafontaine (2013).

Table 3.4 shows the median, mean, 10% and 90% percentile of the "desirability" scores. The numbers show that within-territory entries on average have less profitability potential than outside-territory entries. The difference is largely driven by entries into locations of low-desirability at the tail. The results provide suggestive evidence that within-territory expansion driven by political intervention is less economically desirable, meaning that politically driven expansions are non-optimal.

Table 3.5 reports the key empirical results of Equation (3.2) based on the baseline model and FE model for panel data. Year and bank FEs are always controlled for all specifications. The first column presents results when the dependent variable is asset turnover. The the main variable of interest, the number of outside-territory entry, is positively signed and significant, suggesting that expanding outside bank's own territory improves utilization of asset. The second column presents result when the dependent variable is Core Capital Adequacy Ratio. The main variable of interest, the number of inside-territory entry, is positively signed and significant. The result suggests that expanding inside the bank's own territory deteriorates the bank's financial prudence. The third column displays estimates for Allowance Doubtful/Asset ratio as the dependent variable. The coefficient on the number of inside-territory entry is negative and significant, while the number of outside-territory entry, is positively signed and significant. It can be inferred that banks that expand within-territory tend to have less core capital and maintain less reserve for doubtful for accounts receivable which are expected not to be paid.

Table 3.6 is the continuation of the last table. Column 1 and 2 report estimates when left-hand side variables are efficiency measures as defined in Section 3.3. The coefficient on the number of outside-territory entry is significant for cost-efficiency but not profit efficiency. The results suggest that outside-territory expansion improves input allocation in cost-minimizing, but not in profit-maximizing. The third rows report the effect of within-territory expansion on the share of lending to the government. The coefficient on the number of inside-territory entry is positive and significant for both specifications, indicating that banks are more likely to be involved in public projects after within-territory expansion. This is consistent with my initial guess and the anecdote that government leverages banks to expand within its jurisdiction to fund government-related programs.

Table 3.7 reports estimates of Equation (3.5), which examines the effect of geographical concentration on the bank's ability to handle unfavorable shocks. Columns 1 and 2 present the results when the dependent variable is the percentage of the non-performing loan. The dependent variable is changed to the percentage of special-mention loan in Columns 3 and 4. Headquarter FE is added for Columns 2 and 4 to control for regional policies and characteristics that are not captured in my specifications. The coefficient on the interaction term of Trade Exposure and HHI-G is positive and significant for most specifications, suggesting that trade decline had a more negative impact on geographically concentrated banks. This is not surprising since banks can diversify risk by operating more dispersedly.

3.6 Conclusion

In this paper, I examine how political considerations distort banks' entry choices and the effect on bank performances. Driven by the availability of data, the tests are based on a unique dataset of Chinese banks over the sample period 20062015. While data limitations mean that the results need to be interpreted with caution, they do confirm the existence of political interventions of CCBs. CCBs are more likely to enter jurisdictions under the control of their local government owners. These locations are generally less economically desirable. Subsequent to sub-optimal entries, banks become less financially prudent, riskier and more likely to increase government lending, while outside-territory entries improve bank's cost efficiency and asset utilization. These results present a consistent story about the political economy behind the bad performance of state-owned banks and partly explain the micro-mechanism.

The results also find that banks with a lower level of share concentration or presence of foreign strategic investors are less likely to be dominated by political incentives in their market entry decisions. The findings are consistent with previous literature about the way in which board monitoring improves performance and the role of foreign shareholders in economic transition.

Moreover, using export decline during the Great Recession as an exogenous shock, I find that more geographically concentrated banks are less capable of handling external shocks. The finding reveals one of the hidden costs of political interference in banking. Whether bank branch deregulation should be encouraged is a long-standing policy debate worldwide and in China as well. This paper provides policy implications from a financial risk aversion perspective that facilitating geographical diversification enhances the robustness of banks to external turbulence.

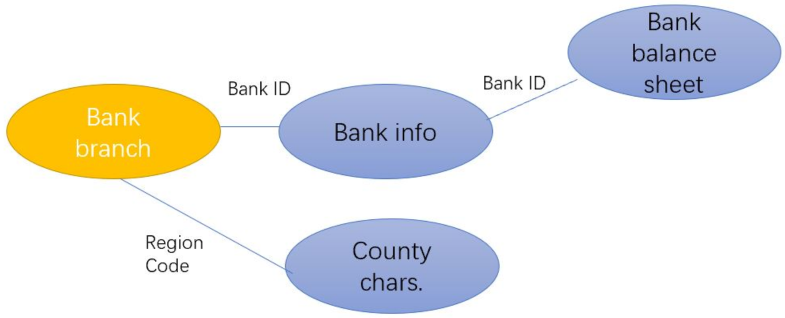

Figure 3.1: Construction of the Dataset

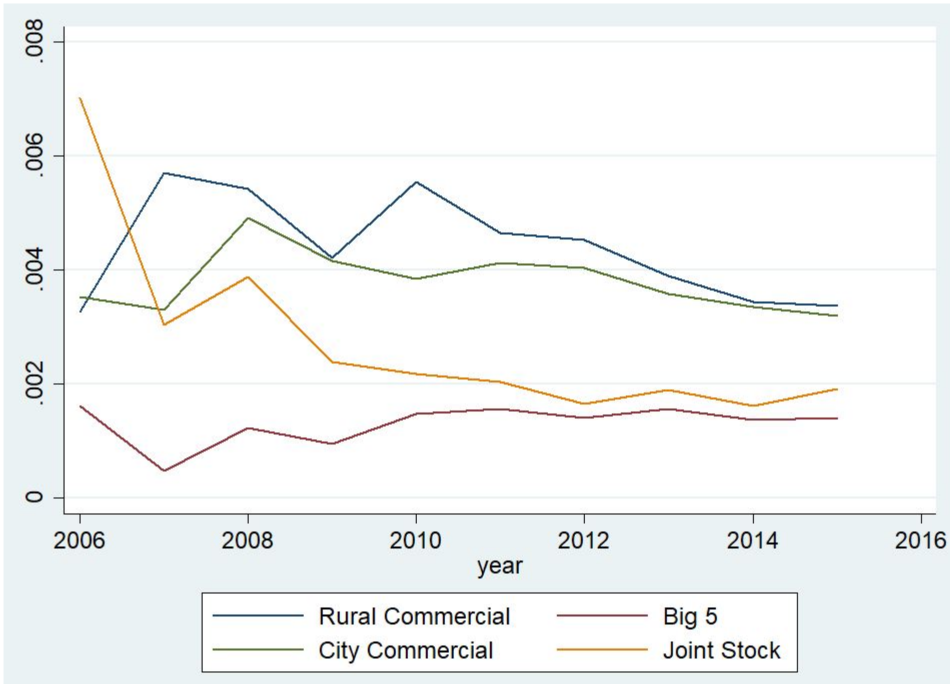

Figure 3.2: Combined Standard Error in ROA, by Year and Bank Type

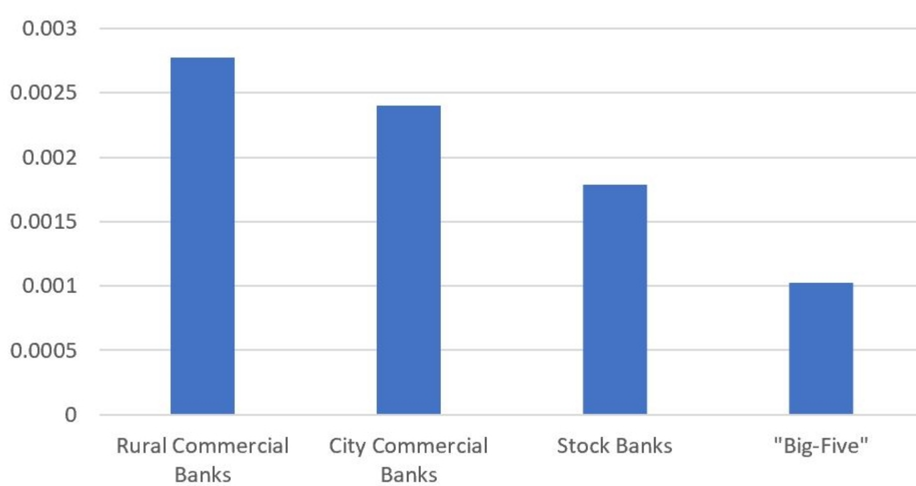

Figure 3.3: Combined Standard Error in ROA, Within Each Bank Type

Table 3.1: Summary Statistics, Comparing CCBs with Other Bank Categories

Variable	City Commercial	Full Sample	Big 5	Joint Stock
Asset	14.1 Billion	62.8 Billion	1110 Billion	170 Billion
Net ROA	1.01%	0.97%	1.11%	0.81%
Asset Turnover	2.69%	2.78%	2.92%	2.57%
Loan/Depo Ratio	61.0%	64.51%	68.14%	72.90%
Non-performing Loan	1.19%	1.75%	2.59%	1.25%
Capital Adequacy	11.32%	12.01%	10.41%	8.74%
(Allowance Account Doubtful/Deposit)	1.06%	1.23%	0.99%	1.17%

This table reports the mean values of key bank characteristics of different bank categories. The characteristics reported are size (asset), returns (ROA), capital utilization (asset turnover), key regulatory ratios (loan/deposit ratio, non-performing loan, capital adequacy and percentage of allowance account doubtful). Section 3.4 contain the definitions of all variables and also a description of how they are computed.

Table 3.2: Summary Statistics, City Commercial Banks Only

Variable	Mean	Median	P25	P75
Asset	14.1 Billion	7.23 Billion	3.31 Billion	15.9 Billion
Net ROA	1.01%	0.99%	0.77%	1.23%
Asset Turnover	2.69%	2.65%	2.19%	3.15%
Loan/Depo Ratio	0.61	0.63	0.53	0.7
Government Ownership	23.64%	21.90%	11.20%	31.26%
Non-performing Loan	1.19%	0.99%	0.68%	1.48%
Pct. Top 10 Shareholder	24.59%	20.80%	12.30%	33.17%
Capital Adequacy	11.32%	11.29%	9.83%	13.09%
(Allowance Account Doubtful/Deposit)	1.06%	0.95%	0.62%	1.51%

This table reports the mean values, medians, P25 and P75 of key bank characteristics of city commercial banks. The characteristics reported are size (asset), returns (ROA), capital utilization (asset turnover), key regulatory ratios (loan/deposit ratio, non-performing loan, capital adequacy and percentage of allowance account doubtful), and government ownership. Section 3.4.1 contain the definitions of all variables and also a description of how they are computed.

Table 3.3: Determinants of Bank Entry

VARIABLES	(1) I(Entry)	(2) I(Entry)
#Existing Branches	0.0947***	0.0905***
	(0.00475)	(0.00494)
Tot. Depo. Balance	2.12e-08***	2.30e-08***
	(6.49e-10)	(6.72e-10)
Govt. Ownership	-0.0262***	-0.0141*
	(0.00444)	(0.00759)
I(Own Place)	1.792***	2.548***
	(0.122)	(0.153)
I(Own Place)*Govt. Ownership	0.0110***	-0.00112
	(0.00347)	(0.00459)
Share Concentration	-0.00180	-0.0192**
	(0.00265)	(0.00840)
I(Own Place)*Share Concentration	0.00690*	0.00922*
	(0.00385)	(0.00540)
I(Diff. Province)	-0.403***	-0.0334
	(0.113)	(0.142)
Distance	-0.00394***	-0.00399***
	(8.48e-05)	(8.56e-05)
Foreign Strate. Inv.	0.763***	-0.0874
	(0.0875)	(0.385)
I(Own Place)*Foreign Strate. Inv.	-1.481***	-1.854***
	(0.152)	(0.158)
Observations	1,112,406	1,112,406
Year FE	X	X
Bank ID FE		X

Standard errors in parentheses

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

This table reports determinants of bank entry for city commercial banks between 2006-2015. The dependent variable is a binary indicator that equals 1 the bank enters a certain county and 0 otherwise. The main variable of interest is $I(OwnPlace)$, which equals 1 if the county is inside the jurisdiction of the local government that controls the bank. Column 1 tests the specification with only year fixed effect. Column 2 adds bank-specific fixed effect to this specification. Section 3.4.1 contain the definitions of all variables and also a description of how they are computed.

Table 3.4: Desirability Score of CCBs' Outside-territory and Within-territory Entry Locations

Statistic	Outside-territory	Within-territory
Mean	0.083	0.059
P25	0.014	0.011
Median	0.109	0.028
P75	0.118	0.084

This table reports the mean, median, 25th and 75th percentiles of desirability score of CCBs' outside-territory and within-territory entries. The desirability score is obtained by: (1) first regressing Eq. 3.4 for Big 5 and joint-stock banks (2) predict the probability of entry for each entry locations with CCB data.

Table 3.5: Bank Expansion and Bank Performance, Key Indicators

VARIABLES	Asset Turnover	Core Capital Adequacy	(ADA/Deposit)
Lag. # Entry Outside Own Place	0.000281***	-0.108	9.26e-05***
	(6.19e-05)	(0.0720)	(3.53e-05)
Lag. # Entry Inside Own Place	4.50e-05	-0.115**	-0.000106*
	(4.41e-05)	(0.0505)	(5.93e-05)
Public firm	0.00183**	0.0162**	-0.00204
	(0.000815)	(0.00803)	(0.00183)
log(Asset)	-0.00340***	-3.234*	-0.00330
	(0.000388)	(1.800)	(0.00286)
Constant	0.100***	82.52*	0.107
	(0.00930)	(41.85)	(0.0663)
Observations	481	281	452
R-squared	0.249	0.690	0.732
Year FE	X	X	X
Bank FE	X	X	X

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

This table reports the results of the effect of bank expansion for city commercial banks between 2006-2015. The first row presents the result when the dependent variable is asset turnover. The second row presents the result when the dependent variable is Core Capital Adequacy ratio. The third row displays estimates for Allowance Doubtful/Asset ratio as the dependent variable. Year and bank FEs are always controlled for all specifications.

Table 3.6: Bank Expansion and Bank Performance, Efficiency and Government Lending

VARIABLES	Cost Efficiency	Profit Efficiency	Pct. lending to Govt.
Lag. # Entry Outside Own Place	0.00507**	-0.000297	-0.219**
	(0.00237)	(0.000907)	(0.0937)
Lag. # Entry Inside Own Place	0.00128	0.000161	0.0209
	(0.00198)	(0.000593)	(0.0672)
Public firm	0.226***	0.0839**	3.424**
	(0.0608)	(0.0400)	(1.383)
log(Asset)	-0.216*	0.0484	-3.17*
	(0.113)	(0.0488)	(1.861)
Constant	6.717**	-0.245	4.000***
	(2.636)	(1.126)	(0.275)
Observations	451	452	108
R-squared	0.725	0.593	0.192
Year FE	X	X	X
Bank FE	X	X	X

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

This table reports the results of the effect of bank expansion for city commercial banks between 2006-2015. The first row presents the result when the dependent variable is cost efficiency. The second row presents the result when the dependent variable is profit efficiency. The third row displays estimates for Percentage of Lending to Government as dependent variable. The definition and calculation of cost/profit efficiency can be found in Section 3.3.1. Year and bank FEs are always controlled for all specifications.

Table 3.7: Geographical Concentration and Response to Exogenous Shock

VARIABLES	(1) Pct. Non-Performing	(2) Pct. Non-Performing	(3) Pct. Special-mentioned	(4) Pct. Special-mentioned
Trade Exposure	0.985	-0.0430	0.0352	-0.00167
	(0.629)	(0.652)	(0.0305)	(0.0311)
HHI-G	-0.521	-0.633	-0.0324	-0.0277
	(0.829)	(0.828)	(0.0340)	(0.0437)
Trade Exposure*HHI-G	1.548	4.097*	0.285**	0.248**
	(2.476)	(2.083)	(0.111)	(0.111)
Log(Asset)	-0.362***	-0.537**	-0.0152**	-0.000510
	(0.129)	(0.247)	(0.00721)	(0.0131)
Constant	11.87***	15.97**	0.412**	0.0745
	(3.223)	(6.198)	(0.179)	(0.329)
Observations	121	98	89	89
R-squared	0.174	0.686	0.173	0.531
Headquarter Province FE		X		X
Year FE	X	X	X	X

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

This table reports the effect of geographical concentration on bank's ability to handle unfavorable shocks using CCB subsample from 2007-2008 after the trade collapsing. Column 1 and 2 present the results when the dependent variable is the percentage of non-performing loan. The dependent variable is changed to the percentage of special-mention loan in Column 3 and 4. Headquarter FE is added for Column 2 and 4 to control for for regional policies and characteristics that are not captured in my specification.

APPENDIX A

Appendices for Chapter 1

A.1 Proofs and Graphs in Section 1.3

Proof (1): The purpose of the proof is to show that when firms are not well-funded, i.e. $E_s^1 < E_s^*$ and $E_l^1 < E_l^*$, relaxing reserve requirement ($\tilde{S}$ increasing from $\tilde{S}_1$ to $\tilde{S}_2$) will lead to an increase in equilibrium amount of commercial loans, i.e. $E_s^2 > E_s^1$ and $E_l^2 > E_l^1$. Now the equilibrium condition is marked by:

$$MRL_s - \frac{\partial \theta_s}{\partial E_s} * E_s - \theta_s - r_B = MRL_l - \frac{\partial \theta_l}{\partial E_l} * E_l - \theta_l - r_B \tag{A.1a}$$

$$E_s + E_l = \tilde{S} \tag{A.1b}$$

Prove by contradiction. Let $f_i = MRL_i - \frac{\partial \theta_i}{\partial E_i} * E_i - \theta_i - r_B$, $i \in \{s, l\}$. Take derivative w.r.t E_s and E_l:

$$\frac{\partial f}{\partial E_i} = (p+\eta_e)^{\frac{1}{1-\beta_i}} \alpha_i \beta_i^{\frac{\beta_i}{1-\beta_i}} w^{\frac{-\beta_i}{1-\beta_i}} (\frac{\alpha_i}{1-\beta_i})(\frac{\alpha_i+\beta_i-1}{1-\beta_i}) E_i^{\frac{\alpha_i+2\beta_i-2}{1-\beta_i}} - 2\frac{\partial \theta_i}{\partial E_i} - \frac{\partial^2 \theta_i}{\partial E_i^2} * E_i < 0$$

Suppose $E_s^2 < E_s^1$, since $\tilde{S}_1 < \tilde{S}_2$, so $E_l^2 = \tilde{S}_2 - E_s^2 > E_l^1 = \tilde{S}_1 - E_s^1$. Since f is an increasing function in E and by (10a), $f_l(E_l^2) = f_s(E_s^2) > f_l(E_l^2) = f_s(E_s^1)$, contracting with $E_s^2 < E_s^1$, therefore $E_s^2 > E_s^1$ must be held true. Similarly, it can be proved that $E_l^2 > E_l^1$.

Proof (2): The purpose of the proof is to show that firms with more owned capital are less likely to benefit from relaxation of reserve requirement when the bank does not have enough liquidity . It is needed to prove that the equilibrium desired amount of bank loan E_l^* is more likely to go over the cut-off point E^c when $\overline{W}$ gets larger, i.e. to show that E_l^* is increasing in $\overline{W}$.

Prove by contradiction. Suppose $\overline{W}$ increases from $\overline{W}_1$ to $\overline{W}_2$, the equilibrium levels of lending are E_1^c and E_1^l at $\overline{W}_1$ and E_2^c and E_2^l at $\overline{W}_2$. Assume $E_2^l \leq E_1^l$. Take derivative of f_l w.r.t $\overline{W}$:

$$\frac{\partial f_l}{\partial \overline{W}} = -2E_l \frac{\partial^2 \theta_l}{\partial E_i \partial \overline{W}} - \frac{\partial \theta_l}{\partial \overline{W}} < 0$$

f_l is a decreasing function in $\overline{W}$, $f_l(\overline{W}_2) < f_l(\overline{W}_2)$. By (10a), it implies that now f_s at $\overline{W} = \overline{W}_2$ is smaller than f_s at $\overline{W} = \overline{W}_1$. Since f_s is increasing in E_s, it means $E_2^s < E_1^s$ and further $E_2^l = \tilde{S} - E_1^s > E_1^l = \tilde{S} - E_1^s$, contradicting with the assumption $E_2^l \leq E_1^l$. Therefore, E_l^* is increasing in $\overline{W}$.

Proof (3): The purpose of the proof is to show that the equilibrium level of investment when the large firm chooses bond financing is larger than the cut-off E^c. Let $f = MRL_l - \frac{\partial \theta_s}{\partial E_s} * E_s - \theta_s - r_B$, then $E_l = E_{l1}^*$ when $f = 0$ and $S = S_1$ is the equilibrium before bank's liquidity easing. Take derivative of f with respect to S:
$\frac{\partial f}{\partial S} = \frac{\partial^2 \theta_s}{\partial E_s \partial S} E - \frac{\partial \theta_s}{\partial S} < 0$, since $\frac{\partial^2 \theta_s}{\partial E_s \partial S} < 0$ and $\frac{\partial \theta}{\partial S} < 0$.
So for $S_2 > S_1$, $f(S_2, E_1^*) < f(S_1, E_1^*) = 0$, therefore, the solution E_{s2}^* for $f = 0$ when $S = S_2$ is larger than E_{s1}^*. The second order derivatives suggest:

$$\frac{\partial^2 (i_s E_s)}{\partial E_s^2} = (p+\eta_e)^{\frac{1}{1-\beta_s}} \alpha_s \beta_s^{\frac{\beta_s}{1-\beta_s}} w^{\frac{-\beta_s}{1-\beta_s}} (\frac{\alpha_s}{1-\beta_s})(\frac{\alpha_s + \beta_s - 1}{1-\beta_s}) E_s^{\frac{\alpha_s + 2\beta_s - 2}{1-\beta_s}} - 2\frac{\partial \theta_s}{\partial E_s} - \frac{\partial^2 \theta_s}{\partial E_s^2} * E_s < 0$$

$$\frac{\partial^2 (i_l E_l)}{\partial E_l^2} = (p+\eta)^{\frac{1}{1-\beta_l}} \alpha_l \beta_l^{\frac{\beta_l}{1-\beta_l}} w^{\frac{-\beta_l}{1-\beta_l}} (\frac{\alpha_l}{1-\beta_l})(\frac{\alpha_l + \beta_l - 1}{1-\beta_l}) E_l^{\frac{\alpha_l + 2\beta_l - 2}{1-\beta_l}} - 2\frac{\partial \theta_l}{\partial E_l} - \frac{\partial^2 \theta_l}{\partial E_l^2} * E_l < 0$$

$\frac{\partial (i_l E_l)}{\partial E_l}$ is a decreasing function. By Assumption (5), the marginal revenue of lending is larger than the Fed fund rate, i.e. $\frac{\partial (iE)}{\partial E} >> r_B$ at $E = 0$. So the marginal revenue intersects with $i = r_B$ at some point $E^* > 0$, i.e. $\frac{\partial (iE)}{\partial E} = r_B$ at $E = E_B^*$

A.2 Appendix: Definition of Variables

The table below explains how variables are defined and data sources.

Table A.1: Definition of Variables in Chapter 1

Varible name	Description	Source
totloan	Amount of loan extended by the bank	Bank call report. =RCON1400+RCON2165, if YEAR<=1983, =RCON1400 IF YEAR>=1984
totasset	Amount of total asset owned by the bank.	Bank call report. =RCFD2170
totdepo	Yearly average of total deposit of the bank.	Bank call report. =RCON3360
empgrowth	Employment growth rate.	County Business Pattern. = $(Emp_{\cdot i,t} - Emp_{\cdot i,t-1})$ $/(0.5Emp_{\cdot i,t} + 0.5Emp_{\cdot i,t-1})$
reschg	Required reserve change compared to last year. Calculated from bank balance sheet of 12/31 of the previous year.	Imputed from individual bank data.
popdensity	Population density of the county.	Census Bureau US Counties
dist	Distance between two jurisdictions (county or zipcode)	NBER, County Distance Database
totinc	Total personal income of the county (proxy of GDP)	Census Bureau US Counties
ruralcont	Urban-Rural Continuum from 1-9, defined in 1983. The larger the number is, the more rural the county is. >=4 Rural areas.	USDA County Typology Codes
agtp79r	Value=1 Agriculture Dependent County	USDA County Typology Codes
mfgtp79r	Value=1 Manufacturing Dependent County	USDA County Typology Codes
mintp79r	Value=1 Mining Dependent County	USDA County Typology Codes
gvttp79r	Value=1 Government Funding Dependent County	USDA County Typology Codes
rettp79	Value=1 Retirement County	USDA County Typology Codes
povtp79	Value=1 High Poverty County	USDA County Typology Codes

A.3 Appendix: Projected Aggregate Reserve Requirement Based on Individual Level Data vs Publicized Aggregate Required Reserve

Information on reserve requirements for individual banks are not publicly available. So the calculation of the required reserve for each bank is based on bank call report data, reserve laws and regulations. Table A2 and Figure A.1 below benchmarks aggregate required reserve level publicized by the Federal Reserve and my calculation.

Table A.3: Comparing Actual and Imputed Required Reserve

Year	Publicized Aggregate Required Reserve			Imputed Aggregate
	Year Mean	Year Max	Year Min	
1982	40.1494	42.784	38.866	40.56859
1983	38.3228	41.315	37.418	37.6517
1984	37.2363	39.858	35.423	39.77005
1985	42.2505	47.058	39.358	47.41582
1986	50.3549	58.196	45.601	51.63509
1987	58.2969	61.109	55.842	54.80413
1988	60.8003	62.616	58.868	61.71139
1989	59.6767	62.242	57.824	60.97431
1990	60.1418	61.878	57.457	62.94424
1991	49.6899	54.555	46.709	56.88
1992	51.6408	55.423	47.838	57.89611

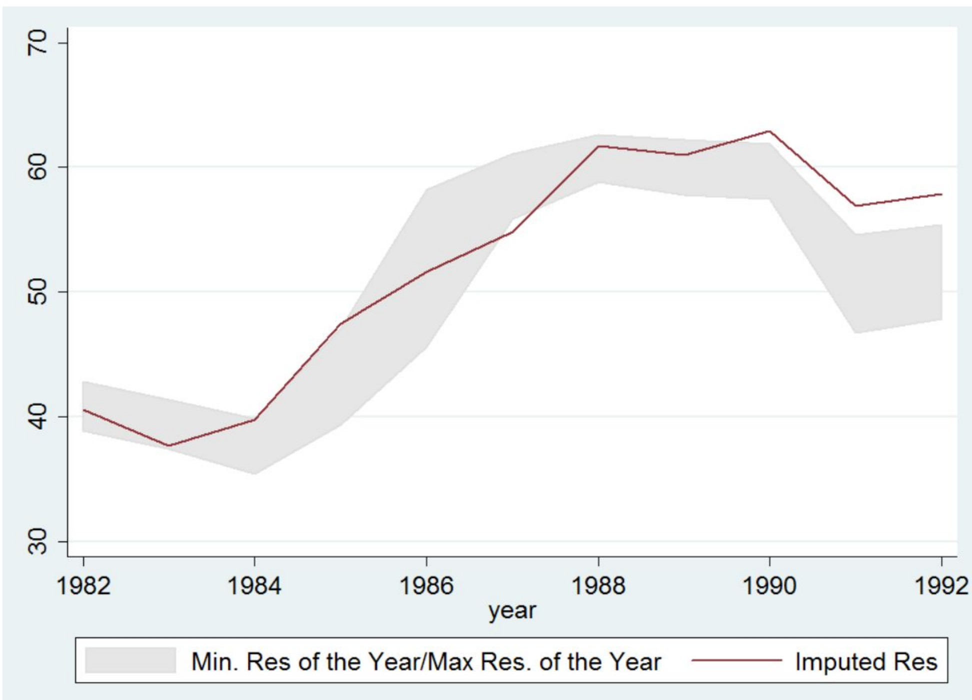

Figure A.1: Imputed Required Reserve and Actual Reserve

A.4 Derivation of the Reserve Change-Employment Change Regression Equation

K_t and L_t are the capital stock and labor input of time t. D_{t-1} is the amount of loanable money at time t-1. c is the marginal rate of investment. ΔRes_t is the change of required reserve at the beginning of time t (so it only depends on the amount of deposit at time t-1). For example, $Res_{Year1990}$=Reserve requirement for deposit on 89/12/31 calculated by 1990 new rates-Reserve requirement for deposit on 89/12/31 calculated by 1989 old rates.
At time t, we have:
$K_t = K_{t-1} + c(D_{t-1} + \Delta Res_t)$, i.e. $K_{t-1} * K_t\% = K_{t-1} + c(D_{t-1} + \Delta Res_t)$
Where $K_t\%$ is the growth rate of K from (t-1) to t, i.e., $K_t = (1 + K_t\%)K_{t-1}$ Add one and take log of both sides:

$$log(K_t\% + 1) = log(cD_{t-1} + c\Delta Res_t + 1) - logK_{t-1} \tag{A.2}$$

Also, starting from the identify below ($L_t\%$ is the growth rate of L from (t-1) to t) :

$$\frac{K_{t-1} * (1 + K_t\%)}{L_{t-1} * (1 + L_t\%)} = \frac{K_t}{L_t} \tag{A.3}$$

Take log of both sides:

$$log(1 + L_t\%) = log(1 + K_t\%) + log(K_{t-1}) - log(L_{t-1}) - log(\frac{K_t}{L_t}) \tag{A.4}$$

Substitute (13) into (11):
$log(1 + L_t\%) = log(cD_{t-1} + c\Delta Res_t + 1) - log(K_{t-1}) + (log(\frac{K_{t-1}}{L_{t-1}}) - log(\frac{K_t}{L_t}))$
$\Longrightarrow\ log(1 + L_t\%) = log[(1 + c\frac{\Delta Res_t}{D_{t-1}} + \frac{1}{cD_{t-1}})cD_{t-1}] - log(K_{t-1}) + (log(\frac{K_{t-1}}{L_{t-1}}) - log(\frac{K_t}{L_t}))$
$\Longrightarrow\ log(1 + L_t\%) = log(1 + \frac{\Delta Res_t}{D_{t-1}} + \frac{1}{cD_{t-1}}) + log(c) + log(D_{t-1}) - log(K_{t-1}) + (log(\frac{K_{t-1}}{L_{t-1}}) - log(\frac{K_t}{L_t}))$
Since $\frac{1}{cD_{t-1}}$ is a very small number, $log(1 + \frac{\Delta Res_t}{D_{t-1}} + \frac{1}{cD_{t-1}})$ can be approximated with $log(1 + \frac{\Delta Res_t}{D_{t-1}})$
Therefore we have
$log(1 + L_t\%) = log(1 + \frac{\Delta Res_t}{D_{t-1}}) + log(\frac{D_{t-1}}{K_{t-1}}) + (log(\frac{K_{t-1}}{L_{t-1}}) - log(\frac{K_t}{L_t}))$
If we assume that capital-labor ratio in one region is stable over time and does not vary

too much across regions, we can omit $(log(\frac{K_{t-1}}{L_{t-1}}) - log(\frac{K_t}{L_t}))$ in the regression. So the regression equation can be set up as:

log(1+employment growth rate at time t)=β_0+$\beta_1$log(1+Reserve change at time t as percentage of loanable money of (t-1))+log(total deposit of t-1/Capital stock of t-1)+$\epsilon_{i,t}$.

Since it is difficult to find data for capital stock, I use the total amount of loan instead.

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