ABSTRACT

Title of dissertation: ESSAYS ON FINANCIAL REFORMS AND FIRM PERFORMANCE IN EMERGING MARKETS

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This dissertation describes three studies on the linkages between changes in financial markets and firm-level performance in real economy. The first chapter studies the impact of foreign bank deregulation on domestic firms' credit access and real outcomes in China, using an extensive firm-level data set from the manufacturing census. Following the deregulation policies implemented by the government in 2001, foreign banks were allowed to enter the Chinese banking market gradually, in different years in different cities. As a result, from 2001 to 2006 firms in different cities had differential access to foreign bank credit. Empirical results suggest that after foreign bank entry, private-owned firms which were previously more credit-constrained obtained more bank loans, increased investment and increased sales significantly more than state-owned firms, which were previously less constrained. The findings provide evidence that policy-driven positive foreign credit supply shocks could reduce domestic firms' financing constraints, especially for private-owned enterprises. In ad-

dition, I investigate the hypothesis that foreign bank entry intensified competition in the domestic banking sector, using a newly constructed regional bank competition index. Results confirm that increases in bank competition brought by foreign bank entry improved credit access for private-owned firms relative to state-owned firms.

The second chapter studies determinants and impacts of foreign currency borrowing by firms in emerging Europe. Most of existing studies on currency mismatch focus on large corporations, and this study complements literature by using firm-level survey data mainly covering small non-listed firms. The third chapter presents evidence on zombie firms and stimulating policies in China. We apply the framework from the seminal study of zombie firms in Japan to a broader manufacturing census sample in China between 1998 and 2013. We show that the number and the magnitude of undesirable zombie firms increased sharply after an enormous monetary expansion right after the 2008 financial crisis.

ESSAYS ON FINANCIAL REFORMS AND FIRM PERFORMANCE IN EMERGING MARKETS

by

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Dedication

To my parents, Xiaoqin Xu and Xiaoming Li, and Cassie Weixu Zheng

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List of Abbreviations

CASIF	China Annual Surveys of Industrial Firms
EBRD	European Bank of Reconstruction and Development
EU	European Union
EUR	Euros
FE	Fixed Effects
FX	Foreign Currency/Foreign Exchange
GDP	Gross Domestic Product
IMF	International Monetary Fund
NBS	National Bureau of Statistics
OECD	Organization for Economic Co-operation and Development
PBOC	People's Bank of China
POE	Private-owned Enterprises
RMB	Renminbi, local currency in China
SME	Small and medium enterprises
SOE	State-owned Enterprises
TFP	Total Factor Productivity
USD	US Dollars
WTO	World Trade Organization

Chapter 1: The Impact of Foreign Bank Deregulation on Firm Performance: Evidence from China

1.1 Introduction

Chinese banking is dominated by four very large state-owned banks, the "Big Four", and such state ownership is associated with low efficiency and restricted access to credit for private firms. Recent financial reforms announced by Chinese authorities, including foreign bank entry and development of international bond markets, have allowed domestic corporate borrowers to get access to foreign funds. Previous studies have documented that the entry of these foreign banks has been associated with a more competitive and efficient banking environment in China.[1] In this chapter, I analyze whether opening up the banking sector for foreign bank entry has affected the performance of Chinese manufacturing firms, to the extent that the banking sector became more competitive and efficient after foreign bank entry was allowed. Understanding how financial liberalization affects domestic firms' performance is critical for making informed policy decisions.

[1] See Lin and Zhang (2009) and Xu (2011).

As part of its commitment to join the World Trade Organization (WTO), China removed restrictions on banking in addition to trade. Specifically, the Chinese central government agreed to remove restrictions on foreign banks' local currency business in a number of cities every year during the first 5 years after accession (2001-2006), with no restriction on foreign banks anywhere in the country afterwards. This step-by-step deregulation of foreign banks provides a suitable policy experiment for analyzing the effects of foreign bank entry on the domestic financial system and firms' performance.[2] Theoretically, foreign bank competition may provide a greater supply of aggregate bank credit to all domestic borrowers and improve allocative efficiency. Financially constrained private firms could also benefit when large Chinese corporations increase their borrowing from foreign banks, since local banks might have to look for other small and retail customers. If large firms turn away from domestic financing sources, commercial banks in China would be able to allocate more resources to financially constrained borrowers, creating a "crowd-in effect".

For identification, I explore this policy-driven timing and geographic variation across cities in China, regarding *when* foreign banks started conducting local-currency business with domestic borrowers located in the *same* city. There are three main threats to identification based on the timing and geographic policy variation. First, spillover effects of foreign bank entry across cities could exist. Here I assume that the direct effect of foreign bank entry is localized (although there can be other

[2]"Foreign bank entry/deregulation" in this study refers to foreign banks being allowed to conduct local-currency business with domestic borrowers.

linkages across cities via firm competition, general equilibrium price effects, etc). This assumption is reasonable given the regulation that firms in one city could not borrow from banks in another city before the end of 2006. As a result, these regional policies can be viewed as a shock to local credit supply. During a given period, firms in different cities have differential access to foreign bank credit.

Secondly, there were other reforms undertaken during the sample period, and these reforms could also have differential effects on firms' performance across cities. However, other reforms in China during the period proceeded on a nationwide basis, rather than following a specific regional timetable. Therefore, the effects of other reforms would not confound the foreign bank deregulation effect, and will be absorbed by the time fixed effects. Even if the impact of another policy is not uniform across cities (e.g. international trade exposure), the policy should not be perfectly correlated with the foreign bank entry indicator. Thirdly and more importantly, choices about the timing and location of foreign bank entry may be endogenously determined. The timing decisions on foreign bank entry were made by the central government and I assume they were unrelated to the firm-specific demand for credit. As a robustness check, I also conduct matching exercises to address concerns of selection bias over the choice on "opened cities".

Based on this identification strategy, I estimate the impact of foreign bank entry on firms' credit access and performance in China, focusing on whether the impact at the firm level differs by heterogeneity in credit constraints and productivity. I employ a difference in difference strategy and investigate the effect of the removal of foreign bank regulation on private firms' performance relative to that of state-owned

firms (SOEs), using panel data on manufacturing firms from China Annual Surveys of Industrial Firms (CASIF) from 1998 to 2007. This dataset covers around 90% of manufacturing GDP in China during the sample period, and provides detailed information on firms' performance and ownership structure. Following Song et al. (2011), I use ownership structure as a proxy for firms' financial constraints under the assumption that private-owned firms had less access to credit than state-owned firms prior to bank deregulation.[3] With rich panel data, I can control for firm and city-sector-year fixed effects, as well as time trends that are different for SOEs and private firms, as well as city-year or sector-year specific policy changes, identifying using the difference between within-firm changes of state-owned and private-owned firms.

I find that foreign bank entry does not have a significant impact on credit access for the average firm, as measured by the amount of bank loans, investment and sales. However, the impact of foreign bank entry varies with a firm's ownership. Private-owned firms, which were presumably previously more financially constrained, generally benefit more from foreign bank entry relative to less constrained state-owned firms. After foreign bank entry is allowed, private-owned firms obtain more bank loans, increase investment and increase sales significantly more than state-owned firms. This finding that foreign bank deregulation benefits private firms' credit access more than that of state-owned firms provides new insights on financial liberalization in China. My results do not suggest that foreign banks

[3]The key model building block in Song, Storesletten and Zilibotti (2011) assumes that private firms with high productivity are financially constrained, while state-owned enterprises with low productivity have access to external finance, and this assumption is justified by empirical evidence.

deal mostly with large state-owned firms with government support due to foreign banks' information disadvantage. One potential mechanism for my findings is that foreign bank deregulation is related to a higher level of banking competition and more abundant credit flow to domestic private firms via a "crowd-in effect".

In terms of methodology, this chapter is related to studies on state-level banking reforms in United States. Using timing and state-level variation on cross-state bank branch legislation, Morgan et al. (2004) find that interstate bank branching deregulation leads to higher integration and less output volatility across US states. My chapter focuses on city-level foreign bank deregulation policies adopted in different years in China. One important difference is that each US state made individual decisions on legislation about bank branching, while the deregulation policies in China were implemented by the central government.

This chapter also adds to the literature on the impact of foreign bank entry into developing countries. There exist two different views on the impact of foreign bank entry on firms' access to credit and performance.[4] Some papers find a "cream-skimming" effect, where foreign banks lend only to the most profitable local firms. For example, Mian (2006) and Gormley (2010) suggest that foreign bank entry tends to benefit larger firms only and may even hurt SMEs due to information asymmetry. However, Clarke et al. (2006) find that foreign bank entry helps reduce financing constraints for all firms, including SMEs. Giannetti and Ongena (2009) conclude that foreign bank entry stimulates growth in firm sales, assets and leverage for both listed and unlisted companies in Eastern European countries. My results are similar

[4]See Clarke et al. (2006), Mian (2006), Detragiache et al. (2008), and Gormley (2010).

to the latter two studies, suggesting that foreign bank entry in China relaxes financial constraints.

As a case study in an emerging market, this chapter is closely related to Gormley (2010), which studies the impact of foreign bank entry on firms' performance in India. He uses variation in the location of foreign banks following a change in India's foreign bank lending policy. He finds that firms on average are less likely to get bank credit after foreign bank entry due to information asymmetry, but that profitable firms are more likely to secure bank credit. This chapter differs in two important dimensions. First, China has a state-run sector that had privileged access to credit prior to reform, so I focus on the differential effects between state-owned firms and private-owned firms, not just the overall level effect. Second, unlike India, the Chinese banking market was liberalized to foreign competition gradually, rather than all at once. In addition, I use a large representative sample of both state-owned firms and private-owned firms from manufacturing census data to study the impacts of foreign bank entry on different outcomes via an easing of financial constraints and through increased banking competition, instead of focusing on the information disadvantage of foreign banks.

The remainder of the chapter proceeds as follows. Section 1.2 provides an overview of China's policy change regarding foreign bank deregulation. Section 1.3 describes the firm-level data I use in this study, and the baseline regression and identification strategy are explained in Section 1.4. Sections 1.5 and 1.6 present the main results and robustness checks. Finally, Section 1.7 concludes.

1.2 Policy Experiment with Banking Sector Liberalization

1.2.1 The Chinese Banking Sector before WTO Accession

Prior to the reform in 1978, China had a single financial system. The People's Bank of China (PBOC) acted both as a commercial bank and a central bank. In 1978, the PBOC was split into four state-owned banks and authorities began to establish various specialized commercial banks. Despite these reforms, financial policies in China remained heavily repressive, with heavily regulated interest rates, state-influenced credit allocation, frequently adjusted reserve requirements, and a tightly controlled capital account. A comprehensive dataset provided by Abiad et al. (2010) provides an index of financial liberalization for China and other countries in 2001, the year of China's WTO entry. China's financial liberalization index for that year was 0.36, which is quite low compared to the average for advanced economies, 0.93, or the average for emerging economies, 0.67.

This chapter focuses on the financial opening in China following WTO entry. Before 2001, there were already a certain number of foreign bank branches operating in different cities. These branches, however, were only allowed to conduct foreign-currency business with foreign companies and foreign residents. Some foreign banks actually came to China following companies from their home countries that were making direct investments in the country. These banks had very limited business scope and could not lend to domestic firms directly.

1.2.2 Policy Experiment with Foreign Bank Entry

"Foreign bank entry" in this study refers to foreign banks being allowed to conduct local-currency business with domestic firms. Restrictions on foreign banking activities were substantially relaxed after China acceded to the WTO in December 2001. During 2001-2006, the geographic and client restrictions on local currency business of foreign banks were phased out gradually based on the WTO accession agenda. This step-by-step entry of foreign banks provides a unique policy experiment for analyzing the effects of financial opening on the domestic economy. Foreign banks were allowed to enter 20 Chinese cities (the "opened regions") in phases before the end of 2005, and all geographic restrictions were removed by the end of 2006.[5]

Table 1.1 shows a detailed timeline of geographic and client restrictions for local currency business.[6] For local currency business, the geographic restrictions on foreign bank lending were phased out gradually, starting with 4 cities (Shanghai, Shenzhen, Tianjin, Dalian) at the end of 2001. Foreign banks were allowed to conduct RMB business in Guangzhou, Zhuhai, Qingdao, Nanjing and Wuhan at the end of 2002; in Jinan, Fuzhou, Chengdu, Chongqing at the end of 2003; in Beijing, Kunming and Xiamen at the end of 2004; and in Shantou, Ningbo, Shenyang and Xi'an at the end of 2005. Geographic restrictions on local currency business were completely lifted at the end of 2006. Before the end of 2006, foreign financial institu-

[5] The city locations for opened regions are mapped in Figure 1.5, which highlights the 20 cities where foreign banks could enter in phases.

[6] For foreign-currency business, there were no geographic or client restrictions at the time of WTO accession.

Table 1.1: Geographic and client restrictions for local currency business of foreign banks

Geographic coverage	Cities with foreign bank entry in local currency business
the end of 2001	Shanghai, Shenzhen, Tianjin, Dalian
the end of 2002	Guangzhou, Zhuhai, Qingdao, Nanjing, Wuhan
the end of 2003	Jinan, Fuzhou, Chengdu, Chongqing
the end of 2004	Beijing, Kunming, Xiamen
the end of 2005	Shantou, Ningbo, Shenyang, Xi'an
the end of 2006	All other regions
Client coverage	**local currency business for foreign banks**
the end of 2001	permitted to invest in domestic banks
the end of 2003	permitted to provide services to Chinese enterprises
the end of 2006	permitted to provide services to all Chinese clients

Source: See page 34 of the document WT/ACC/CHN/49/Add.2, which is available at *http://www.wto.org/english/thewto_e/acc_e/completeacc_e.htm*

tions in one region of China could not serve clients in any other region that had not been opened for foreign banks. In addition to the geographic coverage regulation, Table 1.1 also shows the client coverage policy. For local currency business, foreign financial institutions were permitted to provide services to Chinese enterprises at the end of 2003. The client restriction was lifted at the end of 2006, when foreign financial institutions were permitted to provide services to all Chinese clients, including both firms and households.

I combine the geographic and client restrictions on foreign bank lending listed in Table 1.1 to obtain geographic variation across regions in local firms' access to foreign bank local currency lending. First, foreign banks in 13 cities were allowed to conduct local currency business with domestic firms in the same city, starting from the end of 2003.[7] The authorities added another three cities to the list at

[7]The 13 cities are listed in the first 3 rows in Table 1.1.

the end of 2004 and four more cities at the end of 2005. Foreign banks could still invest in domestic banks in opened cities when they could not lend to domestic firms directly. In this way, domestic firms could benefit from foreign bank entry indirectly. Restrictions on the geographic and client coverage of foreign banks' local-currency business were completely lifted by the end of 2006. Beginning in 2007, foreign banks were allowed to conduct local-currency business with local firms and households across the entire country.

Aggregate Foreign Bank Data

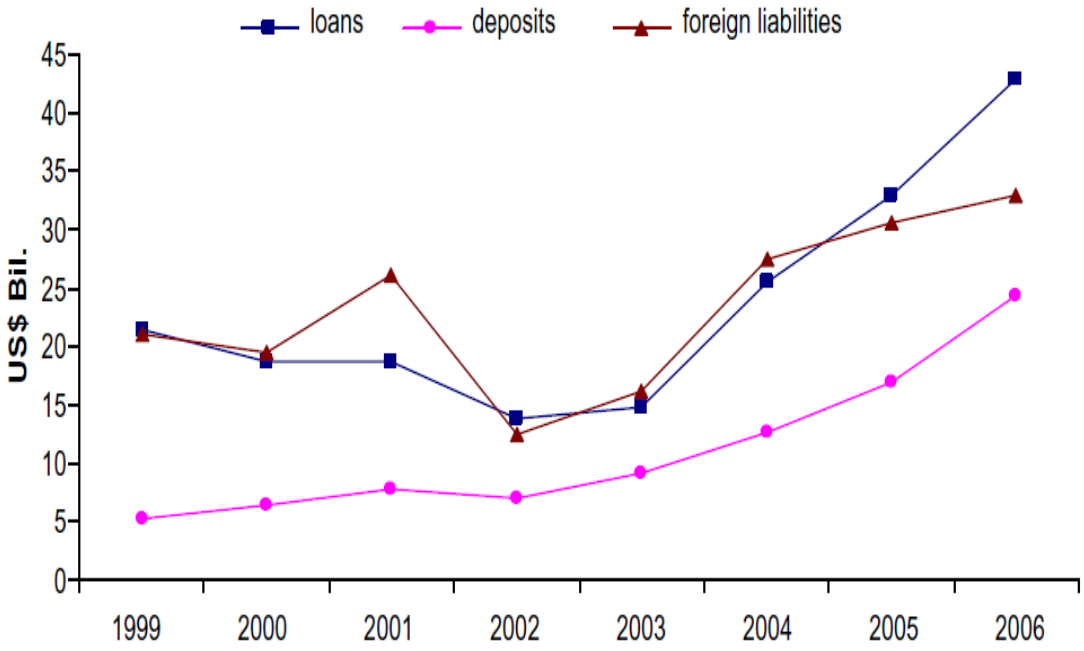
As a result of the government's liberalization on foreign entry and foreign banking activities, China has seen a rapid increase of foreign bank presence in the post-WTO period. Foreign banks indeed entered into Chinese cities to commence local-currency business when restrictions were removed, and existing foreign banks expanded their business. For example, foreign banks issued more than 40% of new local-currency loans in Shanghai in 2006 (Xu and Lin, 2007).

Table 1.2 summarizes the activities of foreign bank entities in China between 2003 and 2010.[8] During the financial opening period, the total number of foreign banking entities almost doubled, and total banking assets tripled from 2003 to 2007. Figure 1.1 shows that there was a surge in foreign bank loans between 2003 and 2004 when foreign banks were permitted to lend to local firms. Another important feature of foreign bank activities shown in Figure 1.1 is that foreign banks extended more loans than they collected in deposits, because they could get funding from

[8]Data for foreign bank activities is not available prior to 2003.

foreign countries to fill the gap between loans and deposits. Following the WTO accession, there was a sharp rise in loans followed by a rise in deposits, indicating a faster expansion of business due to relaxed restrictions.

Figure 1.1: Balance sheets of foreign banks in China



Source: Almanac of China's Finance and Banking (2007), Xu (2011)

1.3 Data

1.3.1 Industrial Firm-Level Data

The Chinese firm-level data are from China Annual Surveys of Industrial Firms (CASIF) from 1998 to 2007. These surveys are conducted by the government's National Bureau of Statistics (NBS). This dataset covers *all state-owned* and *non-*

Table 1.2: Foreign bank entities in China

Year	2003	2004	2005	2006	2007	2008	2009	2010
Number of foreign bank entities	171	188	207	224	274	311	338	360
Growth of number of branches (%)	-	9.9	10.1	8.2	22.3	13.5	8.7	6.5
Foreign bank assets (RMB billion)	415.9	582.3	715.5	927.9	1252.5	1344.8	1349.2	1742.3
Growth of foreign bank assets (%)	-	40.0	22.9	29.7	35.0	7.4	0.3	29.1
Share of total banking assets (%)	1.50	1.84	1.91	2.11	2.38	2.16	1.71	1.85

Source: China Banking Regulatory Commission (2010). The data series start from 2003 as this is the first year when China Banking Regulatory Commission started to provide detailed statistics on foreign banks in China.

state-owned industrial firms with more than 5 million RMB in revenue.[9] Industrial firms are defined here to include manufacturing, mining and public utilities.[10] The unit of observation is a firm, defined as a legal unit. Large Chinese enterprises may have multiple subsidiaries. As long as these subsidiaries are legal units, they will enter the dataset as individual firms. Brandt et al. (2012b, 2014) provide an excellent introduction and description of the CASIF dataset.

Coverage of the Sample

I set the sample period from 1998 to 2007 to cover the financial opening period following WTO accession. The raw dataset consists of over 160,000 firms in 1998 and grows to over 330,000 firms in 2007. This unbalanced panel of firms between 1998-2007 is the most comprehensive data available for Chinese firm-level research.[11] It includes the production and financial variables of small and private firms, which is a big advantage over Compustat/Worldscope, which cover only large listed corporations. Table 1.3 provides the number of firms for the data sample in each year,

[9]This dataset is truncated by size, as measured by firm's revenue. At the exchange rate of 8.27 RMB/USD, in force between January 1997 and July 2005, 5 million RMB amounts to 605,000 USD. Since smaller Chinese firms are more likely to be financially constrained, the estimated financial friction should be interpreted as a lower bound of the credit constraints faced by Chinese firms.

[10]Dougherty et al. (2007) and Jefferson et al. (2008) are two of the earliest studies using this data. These studies analyze topics of particular importance to China, namely, the emergence of the private sector and productivity convergence by ownership type and across space. Subsequently, researchers have studied a variety of topics spanning almost all fields of economics. In macroeconomics, for example, Hsieh and Klenow (2009) and Song et al. (2011) use the data to study resource reallocation and aggregate TFP growth. In international economics, Park et al. (2010) study the impact of the Asian financial crisis on Chinese manufacturing firms, while Brandt et al. (2012a) document large productivity effects associated with China's entry into the WTO. In industrial organization, Gao and Van Biesebroeck (2014) estimate the efficiency gains resulting from restructuring of the electricity sector. Aghion et al. (2015) evaluate the effectiveness of China's industrial policy more generally.

[11]Some key variables are missing in 2008 and 2009, so I use the years from 1998 to 2007.

as well as the shares of value added and the wage bill compared with national aggregate statistics in the manufacturing sector. Generally, the data sample has very good coverage in China's manufacturing sector, in terms of value added and the wage bill. For example, compared to the full census of firms conducted by NBS in 2004, this truncated census sample used in this chapter represents about 90% of value added in manufacturing industries, showing the sample is very close the universe of all manufacturing firms in China.

Table 1.3: Sample coverage: compared with national aggregate statistics

		Share in manufacturing sector	
Year	Number of firms	Value added	Wage bill
1998	165,118	0.57	0.75
1999	162,033	0.60	0.71
2000	162,885	0.64	0.72
2001	171,256	0.64	0.72
2002	181,557	0.70	0.70
2003	196,222	0.77	0.73
2004	279,092	0.90	0.85
2005	271,835	0.82	0.87
2006	301,961	0.88	0.90
2007	336,768	0.93	0.96

Notes: Statistics are calculated by summing over all active firms in the CASIF dataset , and then dividing by the aggregate statistics from China's macro data in China Statistical Yearbooks.

Firm-Level Variables

Table 1.4 lists the most important variables included in the CASIF data. The data include identifying information with detailed industry and geographic codes. Firm ownership can be identified using the official registration type or from the share in paid-up capital of different groups. Stock variables include various measures of

assets, debt, equity inventory, and accounts receivable. Flow variables detail various dimensions of output, including export volumes, inputs, and taxes.

Table 1.4: Variables reported in the annual CASIF firm-level data

Variables	Sample period 1998-2007
Identification	ID, name, registration type, shareholding status, legal person name, industry code, geographic code, zip code, phone, start year
Stocks	*Capital structure:* owner's equity, paid-in capital (split into six categories)
	Assets: total, current, fixed assets, intangible, inventory, accounts receivable
	Debts: total, current, long-term liabilities
Flows	*Output:* sales revenue, output value, value added, exports, total profit
	Input factors: employment, wages, materials and intermediate inputs, long-term investment, depreciation, financial cost, interest expense

Notes: (1) paid-in capital split into six categories: state, collective, foreign, Hong Kong/Macau/Taiwan (HMT), individual, legal person; (2) for fixed assets, values for total, net value, and at original price fixed assets are reported.

Table 1.5 shows the structure of this unbalanced panel data after matching firms over time. The majority of firm linkages over time are made directly using the unique firm identifiers assigned by the NBS. The current system of IDs was implemented in 1998 and the same IDs are also used in the full census. Occasionally, firms receive a new ID as a result of restructuring, merger or acquisition. In these cases, I also use the firm's name, industry, and address to link firms across years, following the do-file code provided by Brandt et al. (2012b).

Table 1.5: Linking observations over time to identify firms

Years in the sample	% of observations	% of firms
1	7.2%	27.9%
2-3	17.6%	27.6%
4-5	25.1%	21.3%
6-10	50.1%	23.3%

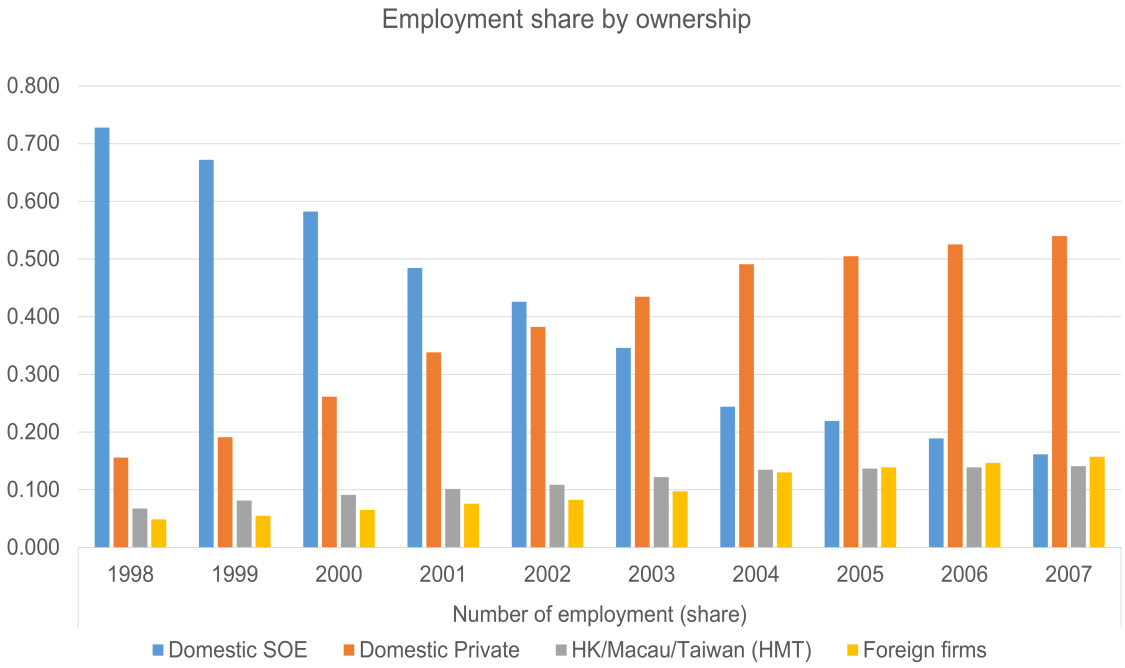
State-Owned vs. Private Firms

Firm ownership status is a potential source of heterogeneity in the impact of the financial opening policy in China.[12] Figure 1.2 reports that there was a substantial drop in the share of firms that were state-owned between 1998 and 2007, primarily due to reforms and privatizations on public enterprises implemented in the late 1990s.[13] Therefore, the changes in ownership composition across sectors can be a source of heterogeneity to exploit in my empirical analysis. I will control for different trends for firms with different ownership in my analysis in the next section.

[12]The CASIF dataset reports registered ownership type for each firm, and I use this registration type to identify firms' ownership category. I can also identify firm's ownership based on owner's equity structure (paid-in capital), as we observe the composition of firms' paid-in capital split into six categories. The two measures of firm's ownership are very similar, and results are robust if I move to the ownership definition based on equity structure.

[13]See Hsieh and Song (2015) for more details on the institutional background of SOE reforms.

Figure 1.2: Share of state-owned firms in China declines over time



Source: Author's calculation based on CASIF data

Existing empirical literature suggests that there are large differences between SOEs and private firms in terms of productivity, capital intensity, bank discrimination and credit constraints.[14] SOEs generally have political connections and benefit from subsidized credit from state-owned banks, while private firms (generally without political connections) can only borrow at high interest rates from informal financial markets or rely on self-financing.

Here I provide some additional suggestive evidence that SOEs are different from private firms, using firm-level data on subsidies received and interest payments. Table 1.6 shows that state-owned firms on average received more government subsidies and paid less interest relative to domestic private firms during the sample

[14]See Brandt and Li (2003) and Hsieh and Song (2015).

period, after controlling for firm-level profitability and total liabilities in the last year as well as city-year and industry-year fixed effects.

Table 1.6: SOEs received more subsidies and paid less interest

Dependent variable	$log(subsidy)$	$log(interest\,payment)$
sample: all cities	(1)	(2)
SOE	0.283***	-0.439***
	(0.037)	(0.031)
Profitability (lagged)	Yes	Yes
Firm size (lagged total liabilities)	Yes	Yes
City-year FE	Yes	Yes
Industry-year FE	Yes	Yes
Observations	1,116,740	462,173
R-squared	0.125	0.373

Notes: The dependent variables are logs of firm-level subsidies received from government and total interest payments. SOE is defined as a dummy which equals one if the registration ownership type is state-owned, and zero otherwise. Other control variables include firms' total liabilities in the previous year and the ratio of profit to revenue (profitability) in the previous year. Clustered standard errors (at city level) in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

1.3.2 City-Level Financial Opening Reforms

China's gradual opening up to foreign banks is a good experiment to study the impact of foreign bank entry, or more generally to study the impact of financial reform.[15] To identify the impact of foreign bank entry at the city-level, I use variation in both the timing and location of new foreign banks' entry, based on the banking sector liberalization policy adopted by the Chinese central government upon accession to the WTO in 2001.

[15] Fan and Kalemli-Özcan (2016) study the effect of country-level financial reform on corporate savings in Asian countries. Here I use within-country variation across cities to identify the effect of foreign bank entry reform.

One might want to measure foreign bank activities in terms of their total assets or total loans in a given region and year. It would also be useful to measure the distribution of banks' loans to different types of firms. However, there are empirical challenges to obtaining such measures of foreign bank activities. Annual reports of banks typically do not report the distribution of assets in different regions and the distribution of loans to different types of firms. On the other hand, from the manufacturing firm data, I cannot observe the sources of funds. In addition, these measures are more likely than a simple dummy policy variable to be correlated with local credit demand shocks.

Given these data limitations and endogeneity concern, I follow Lin (2011) and simply use a dummy policy variable $FBank_{c,t}$ indicating the timing and geographic variation in foreign bank entry into local currency business with firms in a particular city. For example, in the city of Beijing, $FBank_{c,2004} = 0$ and $FBank_{c,2005} = FBank_{c,2006} = 1$, since Beijing opened up for foreign bank entry at the end of 2004.

1.4 Empirical Strategy

1.4.1 The Average Impact of Foreign Bank Deregulation

Before I focus on differential impacts across firms, I first study the average impact of financial reform on firms' credit access and real activity. Firms located in cities where foreign bank credit was unavailable and hence were plausibly unaffected by foreign bank entry comprise the control group. Comparing outcomes of firms with access to foreign bank lending to those of firms without such access identifies the

average impact of foreign bank entry at the firm level. Specifically, I examine the average impacts using the following specification:

$$Y_{i,c,j,t} = \alpha_i + \delta_{p,t} + \phi_{j,t} + \beta FBank_{c,t} + \gamma X_{i,c,j,t} + \varepsilon_{i,c,j,t} \tag{1.1}$$

where i, c, j, t stand for firm, city, industry, and year respectively. The dependent variable $Y_{i,c,j,t}$ is a firm-level outcome variable, such as bank loans, investment or sales. Here I want to look at the direct impact of foreign bank deregulation, so I control only for firm fixed effects α_i, which absorb any unobserved time-invariant firm effects, industry-year fixed effects $\phi_{j,t}$ and province-year fixed effects $\delta_{p,t}$. I do not use city-industry-year fixed effects here, which will be included in the next specification. The foreign bank entry indicator $FBank_{c,t}$ varies at the city-year level, so there is still within-province variation when province-year fixed effects are included[16]. $X_{i,c,j,t}$ controls for time-varying firm-level variables such as lagged firm size and lagged profitability. The average impact of foreign bank entry is captured by β. I assume that the effect of foreign bank entry is localized. This assumption is justified given the regulation that firms in a given city could not borrow from banks in another city before the end of 2006.[17]

City-level Aggregate Results

In additional to equation (1.1), I also run regressions at the city-level instead of the firm level, to examine whether opening up a city for foreign bank entry is related

[16]Each province includes 10-20 cities.

[17]Due to the government imposed market segmentation by cities in China, firms are supposed to apply for loan from banks in the same city.

to changes in aggregate investment and output growth. City-level regressions are specified with the following structure:

$$City\_Aggregate_{c,t} = \alpha_c + \delta_t + \beta FBank_{c,t} + \varepsilon_{c,t} \tag{1.2}$$

α_c and δ_t represent city and year fixed effects. $City\_Aggregate_{c,t}$ equals the sum of firm-level output or the real investment rate over all manufacturing firms located in city c. The real capital stock for each year is obtained by deflating the nominal capital stock with the investment deflator, which is calculated by Brandt, Van Biesebroeck, and Zhang (2012). City-level investment is normalized by the city-level real capital stock.

1.4.2 Foreign Bank Deregulation and Firm Heterogeneity

To test whether foreign bank entry has differential effects across different types of firms, I employ a difference-in-difference methodology and estimate the following regression equation:

$$Y_{i,c,j,t} = \alpha_i + \delta_{c,j,t} + \beta FBank_{c,t} \times FirmType_i + \gamma X_{i,c,j,t} + \lambda t \times FirmType_i + \varepsilon_{i,c,j,t} \tag{1.3}$$

where i, c, j, t stand for firm, city, industry, and year respectively. The dependent variable is a firm-level outcome $Y_{i,c,j,t}$, such as bank loans, investment, or sales. $FirmType_i$ is an indicator or continuous firm characteristic variable that captures ex ante heterogeneity among firms, such as ownership type, profitability, productivity and collateral ratio. The interaction term between $FirmType_i$ and policy dummy $FBank_{c,t}$ allows me to test whether foreign bank entry has differential effects across different types of firms. $\delta_{c,j,t}$ denotes city-industry-year fixed effects, in

which sectors are defined at the 2-digit-SIC level. These fixed effects control for any industry-level policies and city-level policies that vary across years, such as subsidies and taxes, as well as industry-city specific demand factors, that might affect results. α_i is a firm fixed effect, which absorbs any unobserved time-invariant firm effects. A set of year and firm type interactions, $t \times FirmType_i$, are also included to allow firms with different pre-determined types have different linear trend. $X_{i,c,j,t}$ controls for time-varying firm-level variables such as lagged firm profitability and firm size. $\varepsilon_{i,c,j,t}$ represents the error term. The standard errors are clustered by city to allow for correlation within a city across time, following Bertrand et al. (2004).

1.5 Empirical Results

1.5.1 The Average Impact of Foreign Bank Entry

Table 1.7 shows estimation results measuring the average impact of foreign bank entry on firm-level performance. Column (4) shows that firms in cities that gained access to foreign bank loans increased investment by 12.7% (p-value=0.07), relative to those in cities without foreign bank loans. In the other specifications, the results indicate that on average firms did not increase sales, increase investment or obtain more bank loans after the city was opened to foreign bank entry.

Table 1.7: The average impact of foreign bank entry at firm-level

Dependent variable	$log(sales)$		$log(investment)$		$log(loans)$	
All cities	(1)	(2)	(3)	(4)	(5)	(6)
$Foreign\,bank$	0.019	0.009	0.051	0.127*	0.022	0.033
	(0.034)	(0.061)	(0.061)	(0.065)	(0.027)	(0.029)
$Firm\,size_{t-1}$	Yes	Yes	Yes	Yes	Yes	Yes
$Profitability_{t-1}$	Yes	Yes	Yes	Yes	Yes	Yes
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry-year FE	Yes	Yes	Yes	Yes	Yes	Yes
City FE	Yes		Yes		Yes	
Province-year FE		Yes		Yes		Yes
Observations	1,022,776	1,022,776	862,613	862,613	1,022,776	1,022,776
Adjusted R-squared	0.825	0.827	0.540	0.542	0.716	0.717

Notes: This table reports coefficients from regressions of firm outcomes on the foreign bank entry policy dummy using OLS. Firm fixed effects and industry-year fixed effects are included in all columns. Columns (1), (3) and (5) control for city fixed effects while Columns (2), (4) and (6) include province-year fixed effects. Lagged firm size (total assets) and lagged profitability (profit divided by revenue) are used as firm-level time-varying control variables. Standard errors, clustered at the city level, are reported in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Aggregate Results at City-level

Table 1.8 reports coefficients from a regression at the city-level as in equation (2). The dependent variable is a city-level outcome, measured by aggregate output or the aggregate investment rate. The insignificant coefficients on $FBank_{c,t}$ reported in both columns indicate that cities that gained early access to foreign bank loans did not increase aggregate investment or output relative to cities without access to foreign bank loans. In the next section, I will turn to micro-data at the firm level and report the differential effects of foreign bank deregulation across different types of firms.

Table 1.8: The aggregate impact of foreign bank entry at city-level

Dependent variable	$log(output)$	$log(investment)$
	(1)	(2)
$Foreign\,bank$	0.023	0.026
	(0.101)	(0.157)
City fixed effect	Yes	Yes
Year fixed effect	Yes	Yes
Observations	2,404	2,845
Adjusted R-squared	0.920	0.759

Notes: This table reports coefficients from city-level panel regressions of city-level aggregate output and investment (rate) on the foreign bank entry dummy using OLS. City and year fixed effects are included. Standard errors are reported in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

1.5.2 Differential Effects of Foreign Bank Entry and Firm Heterogeneity

In this section, I report the differential effects of foreign bank entry across firms with different ownership structure, productivity and collateral ratio, using the timing variation of foreign bank entry across cities in the full sample.

1.5.2.1 State-owned vs. Private Firms (Main Results)

Previous literature suggests that discrimination in credit against private-owned firms (POE) was common in domestic commercial banks even after WTO accession; see Song et al. (2011). Here I test whether foreign bank entry has differential effects on firms' credit access and real performance between state-owned firms and private firms, using the following specification:

$$Y_{i,c,j,t} = \alpha_i + \delta_{c,j,t} + \beta FBank_{c,t} \times Private_i + \gamma X_{i,c,j,t} + \lambda t \times Private_i + \varepsilon_{i,c,j,t} \quad (1.4)$$

Here I focus on domestic-owned firms only. $Private_i$ is a time-invariant indicator variable equal to 1 if the firm is classified as a private-owned firm in its initial year in the sample, and 0 if the firm is state-owned. Lagged firm size (total assets) and profitability are used as firm-level time-varying control variables. I use measures of credit access, log sales and log investment as dependent variables. I control for city-industry-year fixed effects. I also include a linear trend for private-owned firms, $t \times Private_i$, to allow firms with different ownership to have different trends.

Credit Access

For credit access, I measure firm-level bank loans as the difference between *short-term liabilities* and *accounts payable*. The main rationale for this approximation is that (1) Chinese firms are less likely to borrow long-term using bank loans during 1998-2007, and (2) financial intermediation in China is overwhelmingly dominated by bank loans.

Table 1.9 shows the maturity composition of firms' liabilities. Most firms cannot access long-term financing and have to rely on short-term debt, especially private-owned firms. Long-term financing seems a luxury good for firms during the sample period. 65% of private firms report zero long-term debt on their balance sheets. Table 1.9 also breaks down short term liabilities into accounts payable and other short-term liabilities (primarily bank loans). Foreign firms receive more short-term financing from accounts payable.

Table 1.9: Total liability decomposition

	Ownership type		
Share in total liability (%)	State-owned	Private-owned	Foreign-owned
(1) Short-term liabilities	82.3%	89.2%	92.9%
(1.1) Accounts payable	21.7%	26.3%	39.2%
(1.2) Other short-term liabilities	60.6%	62.9%	53.7%
(2) Long-term debt	16.7%	8.9%	5.9%
Observations	469,802	1,068,516	379,412
% of firms report zero LT-debt	42.1%	64.7%	72.3%

Notes: Ownership defined based on registration ownership type. Total liabilities are decomposed into short-term and long-term debt. I use the difference between *short-term liabilities* and *accounts payable* as proxy for firm-level bank loans.

Table 1.10 reports the results using firm-level bank loans and long-term debt (LT_debt) as dependent variables in columns (1) and (3). Columns (2) and (4) report results when the dependent variables are changes in the stock of loans or long-term debt. I find that private-owned firms get more access to bank loans (both in levels and in changes) after foreign bank entry, compared with SOEs. Column (3) suggests that differential effects of foreign bank entry on access to long-term debt financing (e.g. bonds) are not significant, due to a large standard error. One possible reason is that the bond market in China was still under-developed during 2001-2007, when financial institutions in China were almost all banks and few firms could have access to long-term debt through the bond market.

Table 1.10: Differential effects on credit access: SOE vs. POE

Dependent variable	$log(loans)$	$\Delta log(loans)$	$log(LT\,debt)$	$\Delta log(LT\,debt)$
All cities	(1)	(2)	(3)	(4)
$Foreign\,bank \times Private$	0.049**	0.051**	0.115	0.134
	(0.021)	(0.021)	(0.074)	(0.082)
$Firm\,size_{t-1}$	0.276***	-0.641***	0.314***	-0.375***
	(0.014)	(0.018)	(0.045)	(0.033)
$Profitability_{t-1}$	0.076**	0.450***	-0.024	0.240*
	(0.030)	(0.045)	(0.115)	(0.140)
Firm FE	Yes	Yes	Yes	Yes
City-industry-year FE	Yes	Yes	Yes	Yes
POE-time trend	Yes	Yes	Yes	Yes
Clustered at	city	city	city	city
Observations	1,022,776	1,022,776	1,022,776	1,022,776
R-squared	0.717	0.272	0.719	0.283

Notes: This table reports the effects of foreign bank deregulation on private firms' credit access relative to that of SOEs. The dependent variables are (1) firm's bank loans, proxied by the difference between short term liabilities and accounts payable, and (2) long-term debt. All regressions control for city-industry-year fixed effects, where industry classifications are at the 2-digit SIC level. Lagged firm size (total assets) and lagged profitability (profit divided by revenue) are used as firm-level time-varying control variables. Foreign firms are not included in the sample. Clustered standard errors (at city level) in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Sales, Investment and Productivity

Table 1.11 reports differential impacts of foreign bank entry on measures of firms' real activity. Column (1) indicates that sales revenue for private firms increases more after foreign bank entry than revenue for SOEs. Sales grow by 3.8% more among private firms than among SOEs after foreign bank entry. Columns (2) shows that private firms increase investment by 4.3% more relative to SOEs after foreign bank loans become available. Column (3) examines firm TFP as an outcome variable. I test whether foreign bank entry, as a reduction in distortions in the access to international capital markets, leads to an increase in productivity. One possible

channel is that previously credit-constrained firms respond to better financing terms by increasing their investment in technology[18]. Results in column (3) find that the differential effects of foreign bank entry on firm's estimated productivity are not significant.

Table 1.11: Effect of foreign bank entry on firms' performance: SOE vs. POE

Dependent variable	$log(sales)$	$log(investment)$	$log(TFP)$
All cities	(1)	(2)	(3)
$Foreign\,bank \times Private$	0.038***	0.043***	-0.006
	(0.004)	(0.015)	(0.013)
$Firm\ size_{t-1}$	0.322***	-0.038***	0.048***
	(0.001)	(0.005)	(0.004)
$Profitability_{t-1}$	0.753***	0.874***	0.247***
	(0.006)	(0.022)	(0.016)
Firm FE	Yes	Yes	Yes
City-industry-year FE	Yes	Yes	Yes
POE-time trend	Yes	Yes	Yes
Clustered at	city	city	city
Observations	1,022,776	862,613	1,022,776
R-squared	0.924	0.669	0.729

Notes: This table reports the effects of foreign bank deregulation on private firms' performance relative to that of SOEs. The dependent variables are firm's annual sales, investment and TFP measured following Wooldridge (2009). All regressions control for firm and city-industry-year fixed effects, where industry classifications are at the 2-digit SIC level. Lagged firms size (total assets) and lagged profitability (profit divided by revenue) are used as firm-level time-varying control variables. Foreign firms are not included in the sample. Clustered standard errors (at city level) in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

One interpretation of these results is that repressive financial policies discriminate against private firms but favor SOEs, while foreign bank entry and competition in banking may be viewed as a way to reverse the effects of financial repression. Therefore, previously constrained private firms are able to increase investment and

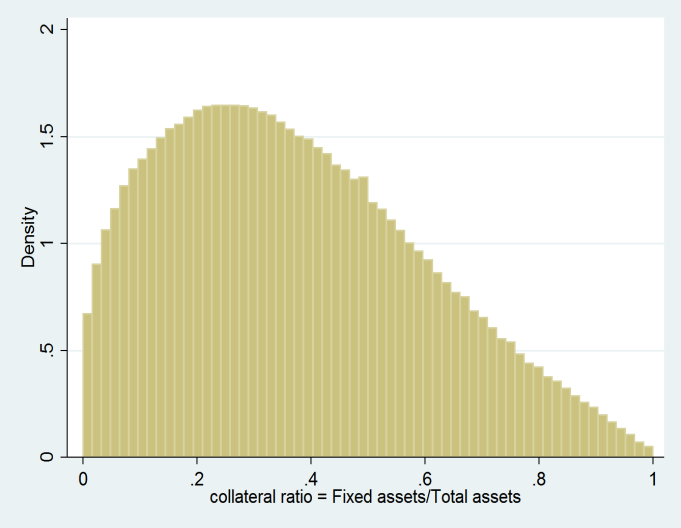
[18]Varela (2016) provides evidence on this channel using firm-level data around the deregulation of international financial flows in Hungary.

sales when they get more access to bank credit. These results are consistent with the financial constraint hypothesis. I consider that the coefficient estimate of the foreign bank entry dummy β in equation (1.4) is a measure of the overall impact of this financial market opening policy on private firms relative to state-owned firms. On the one hand, the increase in loans could come directly from foreign banks, suggesting that foreign banks directly contribute to credit supply. On the other hand, even if only some firms can borrow from foreign banks, domestic banks could switch customers and lend more to other firms in the same city. These firms could benefit from foreign bank entry indirectly.

1.5.2.2 High-collateral vs. Low-collateral Firms

The availability of tangible assets that firms can pledge as collateral is important in raising external funds in countries with less-developed financial markets. In this subsection, I define firm-level collateral as the ratio between fixed assets and total assets. Figure 1.3 shows the distribution of the firm-level collateral ratio. 25% of firms have a ratio of fixed assets to total assets lower than 20%, and the median collateral ratio is 0.35.

Figure 1.3: Distribution of firm-level collateral ratio



Source: Author's calculation based on Chinese Industrial Firm-level Data. Collateral ratio is defined as firm-level fixed assets divided by total assets.

I test the effects of foreign bank deregulation on high-collateral firms' credit access and performance relative to that of low-collateral firms, using the following equation:

$$Y_{i,c,j,t} = \alpha_i + \delta_{c,j,t} + \beta FBank_{c,t} \times Collateral_i + \lambda t \times Collateral_i + \gamma X_{i,c,j,t} + \varepsilon_{i,c,j,t} \quad (1.5)$$

Here $Collateral_i$ is a continuous variable defined as the ratio between a firm's fixed assets and total assets in its initial year in the sample. The results suggest that firms with less collateral before financial opening receive more benefits from foreign bank entry reform in terms of significantly higher loan access. The differences in sales, investment and TFP among firms with different collateral ratios are not significant.

Table 1.12: Firm performance and collateral availability

Dependent variable	$log(loans)$	$log(sales)$	$log(investment)$	$log(TFP)$
All cities	(1)	(2)	(3)	(4)
$Foreign\,bank \times Collateral$	-0.554***	-0.076	0.137	0.009
	(0.087)	(0.053)	(0.230)	(0.044)
$Firm\,Size_{t-1}$	0.374***	0.294***	-0.027	0.051***
	(0.043)	(0.024)	(0.029)	(0.012)
$Profitability_{t-1}$	0.008	0.287***	0.399***	0.182***
	(0.122)	(0.060)	(0.108)	(0.056)
Firm FE	Yes	Yes	Yes	Yes
City-industry-year FE	Yes	Yes	Yes	Yes
Collateral-time trend	Yes	Yes	Yes	Yes
Clustered at	city	city	city	city
Observations	1,022,776	1,022,776	862,613	1,022,776
R-squared	0.797	0.895	0.722	0.747

Notes: This table reports the effects of foreign bank deregulation on performance of firms with different levels of the collateral ratio. Firm-level "collateral" is defined as the ratio between fixed assets and total assets. The dependent variables are firm's loans, annual sales, investment and TFP measured following Wooldridge (2009). Lagged firm size (total assets) and lagged profitability (profit divided by revenue) are used as firm-level time-varying control variables. All regressions control for firm and city-industry-year fixed effects, where industry classifications are at the 2-digit SIC level. Foreign firms are not included in the sample. Clustered standard errors (at city level) in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

1.5.2.3 High ROA vs. Low ROA firms

A natural question following a financial opening is whether foreign banks only target the most profitable firms. If costs of screening domestic borrowers are high for foreign banks, the high information costs may induce foreign banks to lend only to the most profitable local firms (See Detragiache et al., 2008). Another relevant study on firms' profitability and foreign bank entry is Lin (2011). She analyses data from listed companies on the Shanghai and Shenzhen stock exchanges and finds that more profitable firms benefit more from foreign bank entry in China. The main difference

relative to this chapter is that private firms listed on stock exchanges are generally large and profitable, and they are arguably not subject to financial constraints.

Here I test whether the additional credit supply brought by foreign bank entry has differential effects between profitable firms and unprofitable firms, using the following specification.

$$Y_{i,c,j,t} = \alpha_i + \delta_{c,j,t} + \beta FBank_{c,t} \times HighROA_i + \lambda t \times HighROA_i + \gamma X_{i,c,j,t} + \varepsilon_{i,c,j,t} \quad (1.6)$$

$HighROA_i$ is a pre-determined indicator variable that takes the value of 1 if the average return on assets (ROA) of firm i is above the median (over all firms in the same city) before the deregulation policy was adopted. Table 1.13 shows that profitable firms increase investment and sales relative to unprofitable firms after foreign bank entry, but take out fewer loans relative to unprofitable firms. This is a bit different from Table 1.10. Although on average private firms received more loans relative to state-owned firms after foreign bank entry, the results suggest that (1) high-ROA firms can get loans at lower interest rates although the volume of loans does not increase relative to low-ROA firms and (2) the increased investment in these high-ROA firms may be supported by internal funds (retained earnings).

Table 1.13: Firm performance and profitability (ROA)

Dependent variable	$log(loans)$	$log(sales)$	$log(investment)$	$log(TFP)$
All cities	(1)	(2)	(3)	(4)
$Foreign\,bank \times HighROA$	-0.059***	0.239***	0.092***	0.184***
	(0.012)	(0.011)	(0.020)	(0.014)
$Firm\,Size_{t-1}$	0.355***	0.258***	-0.096***	0.043***
	(0.014)	(0.008)	(0.017)	(0.004)
$Profitability_{t-1}$	0.098***	0.407***	0.450***	0.220***
	(0.029)	(0.020)	(0.042)	(0.016)
Firm FE	Yes	Yes	Yes	Yes
City-industry-year FE	Yes	Yes	Yes	Yes
ROA-time trend	Yes	Yes	Yes	Yes
Clustered at	city	city	city	city
Observations	1,022,776	1,022,776	862,613	1,022,776
R-squared	0.717	0.889	0.526	0.730

Notes: This table reports the effects of foreign bank deregulation on the performance of firms with different levels of return on assets (ROA). "HighROA" is a pre-determined indicator variable that takes the value of 1 if the average return on assets (ROA) of the firm is above the median (over all firms in the same city) before the deregulation policy was adopted. The dependent variables are firm's loans, annual sales, investment and TFP. Lagged firm size (total assets) and lagged profitability (profit divided by revenue) are used as firm-level time-varying control variables. All regressions control for firm and city-industry-year fixed effects, where industry classifications are at the 2-digit SIC level. Foreign firms are not included in the sample. Clustered standard errors (at city level) in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

1.5.2.4 High TFP vs. Low TFP firms

Return on assets may not be a good measure to identify "good firms". Here I also use estimated total factor productivity (TFP) to distinguish firms. In order to avoid possible production function estimation biases commonly encountered in the Solow residual and Levinsohn and Petrin (2003) estimation approaches, I adopt the methodology developed in Wooldridge (2009) to estimate firm-level TFP.[19]

[19]See Appendix A.5 for details on production function estimation.

Similar to the previous section, I test whether foreign bank entry has differential effects across firms with different levels of TFP, using the following specification:

$$Y_{i,c,j,t} = \alpha_i + \delta_{c,j,t} + \beta FBank_{c,t} \times TFP_i + \lambda t \times TFP_i + \gamma X_{i,c,j,t} + \varepsilon_{i,c,j,t} \quad (1.7)$$

where TFP_i is a pre-determined variable that equals the estimated TFP of firm i one year before the deregulation policy was adopted. The coefficient of interest β tells us the differential effects of foreign bank entry according to various levels of productivity. The regression results are reported in Table 1.14. Results show that more productive firms have in increase in investment and sales relative to less productive firms after foreign bank entry. However, there is no significant difference between productive firms and unproductive firms for the increase of bank loans following foreign bank entry. One possibility is that increased investment in high-TFP firms are mainly supported by retained earnings.

Table 1.14: Firm performance and productivity

Dependent variable	$log(loans)$	$log(sales)$	$log(investment)$
All cities	(1)	(2)	(3)
$Foreign\,bank \times TFP_{t-1}$	0.004	0.157***	0.045**
	(0.0055)	(0.015)	(0.021)
$Firm\ size_{t-1}$	0.342***	0.257***	-0.066**
	(0.039)	(0.022)	(0.026)
$Profitability_{t-1}$	0.025	0.253***	0.429***
	(0.109)	(0.049)	(0.093)
Firm FE	Yes	Yes	Yes
City-industry-year FE	Yes	Yes	Yes
TFP-time trend	Yes	Yes	Yes
Clustered at	city	city	city
Observations	1,022,776	1,022,776	862,613
R-squared	0.738	0.891	0.546

Notes: This table reports the effects of foreign bank deregulation on the performance of firms with different levels of TFP. TFP is a pre-determined variable that equals the firm-level estimated TFP one year before the deregulation policy was adopted, where TFP is measured following the methodology by Wooldridge (2009). The dependent variables are firm's loans, annual sales and investment. Lagged firm size (total assets) and lagged profitability (profit divided by revenue) are used as firm-level time-varying control variables. All regressions control for firm and city-industry-year fixed effects, where industry classifications are at the 2-digit SIC level. Foreign firms are not included in the sample. Clustered standard errors (at city level) in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Multiple interactions

In the final specification, I include all the interaction terms between foreign bank deregulation and firm-level private ownership, collateral ratio, high ROA simultaneously to check the relative importance of each dimension of heterogeneity among firms[20]. The regression results are reported in Table 1.15. These results are consistent with most of the previous results when I include each dimension of heterogeneity separately. For credit access, private-owned firms and firms with

[20]Firm-level TFP is highly correlated with ROA, so I omit the interaction term with TFP in this specification.

low collateral ratio obtained (relatively) more loans after foreign bank deregulation. These relatively more loans correspond to relatively higher level of sales. Firms with high ROA seem to take out fewer loans relative to unprofitable firms. However, only firms with higher collateral ratio increased investment relative to other firms, the relative effect of private ownership on investment is not significant once I control for high ROA dummy and collateral ratio.

Table 1.15: Firm performance with multiple interactions

Dependent variable	$log(loans)$	$log(sales)$	$log(investment)$	$log(TFP)$
All cities	(1)	(2)	(3)	(4)
$Foreign\,bank \times Private$	0.083**	0.006	0.012	0.019
	(0.040)	(0.021)	(0.058)	(0.020)
$Foreign\,bank \times HighROA$	-0.057***	0.258***	0.056	0.271***
	(0.018)	(0.016)	(0.034)	(0.021)
$Foreign\,bank \times Collateral$	-0.577***	-0.157***	2.610***	-0.545***
	(0.096)	(0.042)	(0.325)	(0.069)
$Firm\,size_{t-1}$	0.346***	0.301***	-0.043**	0.042***
	(0.039)	(0.023)	(0.021)	(0.009)
$Profitability_{t-1}$	0.017	0.299***	0.398***	0.130***
	(0.116)	(0.054)	(0.090)	(0.038)
Firm FE	Yes	Yes	Yes	Yes
City-industry-year FE	Yes	Yes	Yes	Yes
Clustered at	city	city	city	city
Observations	1,022,776	1,022,776	862,613	1,022,776
R-squared	0.806	0.898	0.738	0.758

Notes: This table reports the effects of foreign bank deregulation on the performance of firms with different ownership, ROA and collateral ratio by including multiple interaction terms simultaneously. The dependent variables are firm's loans, annual sales, investment and TFP, which is measured following the methodology by Wooldridge (2009). Lagged firm size (total assets) and lagged profitability (profit divided by revenue) are used as firm-level time-varying control variables. All regressions control for firm and city-industry-year fixed effects, where industry classifications are at the 2-digit SIC level. Foreign firms are not included in the sample. Clustered standard errors (at city level) in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

1.5.3 Possible Channel: Increasing Banking Competition

The simple foreign bank entry dummy variable I use for empirical analysis indicates whether each city is subject to actual as well as *potential* foreign bank entry. Therefore, this dummy is associated with the extent of competition in the domestic banking market. Recent studies find that foreign banks are more efficient than domestic banks, and that foreign bank entry in China makes the banking market more competitive.[21] As a result, the coefficient estimate of the foreign bank entry dummy could capture two channels through which financial opening policy could affect firms: (1) directly through the increased banking activities (credit supply) of the new foreign bank branches and (2) indirectly through increased competition in banking. This competitive pressure could impact firms' credit access and real performance.

To investigate the correlation between foreign bank entry, banking competition and firm-level outcomes, I apply a two-step method. First, I use provincial data in China to regress a bank competition index (*Comp*) on foreign bank entry dummy variables (*Fbank*). Second, I study the effect of the fitted value of this regression on firms' outcome variables. The two step model consists of the following two equations:

$$Comp_{pt} = \alpha_p + \delta_t + \beta Fbank_{pt} + \varepsilon_{pt} \quad (First\,Stage)$$

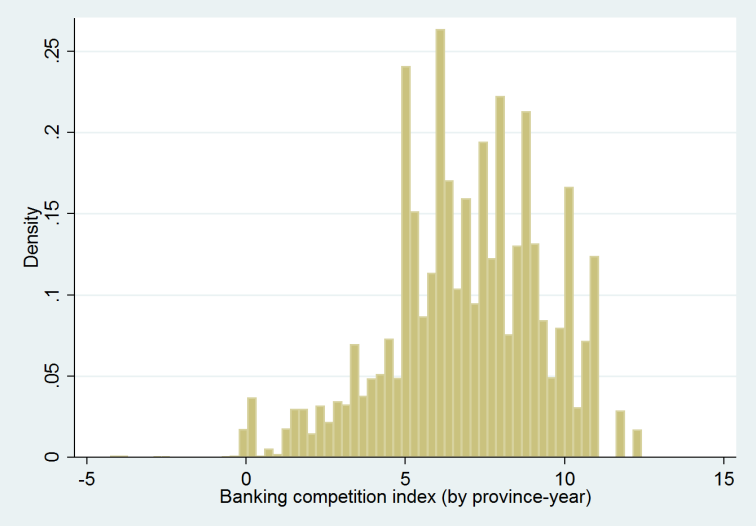
$$log(loans)_{icjt} = \alpha_i + \delta_c + \phi_{jt} + \gamma_1 Comp_{pt} + \gamma_2 Comp_{pt} \times Private_i + \varepsilon_{icjt} \quad (Second\,Stage)$$

[21] See Berger, Hasan and Zhou (2009) and Xu (2011).

First stage: foreign bank entry and banking sector competition

In first stage equation, I measure the bank competition index as the NERI (National Economic Research Institute) index of marketization for provinces in China. The index measures the share of deposits and loans in non-state banks relative to state-owned banks. I use this index to proxy the competitiveness of the local banking sector. For foreign bank entry at the province level, if there is at least one city in province p allowing foreign banks to enter in year t, then I define $Fbank_{pt} = 1$.[22] Figure 1.4 shows the variation of the bank competition index across provinces and years. A higher number represents a higher presence of non-state banks (joint-stock banks, city commercial banks and foreign banks) and a higher level of banking competition in that province.

Figure 1.4: Distribution of province-level bank competition index



Source: NERI index of marketization in China. See Fan, Wang and Zhu (2010)

[22]Here province in China is similar to state in US, and city is similar to county in US. There are 31 provinces in China and 354 cities in China.

Table 1.16 reports the first-stage results based on a province-level panel regression. The table shows that foreign bank entry indeed intensified banking competition in the local financial market.

Table 1.16: First stage: foreign bank entry increases competition in banking sector

Dependent variable	Bank competition index	
Province-year panel	(1)	(2)
$Foreign\,bank$	0.509*	0.508**
	(0.271)	(0.249)
$log(GDP)$		4.792**
		(2.168)
$log(Population)$		-0.269
		(2.921)
Year dummy	Yes	Yes
Province dummy	Yes	Yes
Observations	310	310
Number of provinces	31	31
R-squared	0.570	0.599

Second stage: banking sector competition and firm's performance

In second stage equation, I use 2SLS to regress firm-level loans or investment on the bank competition index, using foreign bank entry dummy as an instrument. I include firm, city, and industry-year fixed effects. Including interactions of bank competition with dummy variables for private and foreign-owned firms allows me to investigate whether the impact of competition differs by firm type.

Empirical results of the second stage regression are reported in Table 1.17. The table shows that increases in bank competition brought about by foreign bank entry have differential effects across firms. There is a positive impact on private firms' credit access and investment, relative to state-owned firms. There is no significant

effect for foreign-owned firms relative to state-owned firms. The result for foreign firms is consistent with the fact that foreign firms already had a high level of credit access before the foreign bank deregulation. Foreign firms should not be affected directly by increased competition after foreign bank entry.

Table 1.17: Second stage: predicted banking competition on firm's outcome

Dependent variable	$log(loans)$	$log(investment)$
	(1)	(2)
$Competition\,Index$	-0.148	-0.028
	(0.097)	(0.147)
$Competition\,Index\times$	0.249***	0.201**
$Private\,dummy$	(0.085)	(0.088)
$Competition\,Index\times$	0.171	0.032
$Foreign\,dummy$	(0.100)	(0.139)
$Firm\,size_{t-1}$	0.403***	-0.024
	(0.040)	(0.025)
$Profitability_{t-1}$	-0.009	0.431***
	(0.108)	(0.100)
Firm FE	Yes	Yes
City FE	Yes	Yes
Industry-year FE	Yes	Yes
Ownership-time trend	Yes	Yes
Clustered at	city	city
Observations	1,022,776	862,613
R-squared	0.729	0.553

Notes: Robust standard errors, clustered at the city-level, are reported in parentheses, *** p<0.01, ** p<0.05, * p<0.1. Here I control for city and industry-year fixed effects (not city-industry-year triple fixed effects), to identify the level effect from changes in the bank competition index in addition to the differential effects from interaction terms.

1.6 Robustness Checks

1.6.1 Financial Liberalization or Trade Liberalization in post-WTO period?

In this section, I investigate whether the estimated differential effects of foreign bank entry on state-owned firms and private firms in Section 1.5.2 should be attributed to (possibly time-varying) regional trade shocks. Although the domestic financial sector experienced increased foreign competition after China's WTO accession (financial liberalization), China's exports also increased rapidly following the tariff decline at the same time (trade liberalization). Even if the timeline of tariff declines was the same across cities in China, the impact of trade exposure could be different across cities.

To address the possible threat to identification from trade liberalization, I construct a time-varying trade openness index at the city-level using the average export exposure per worker following Autor et al. (2013):

$$Trade\,Openness\,Index_{c,t} = \sum_i Exports_{i,c,t} / \sum_i Number\,of\,workers_{i,c,t}$$

where i, c, j, t stand for firm, city, industry, and time respectively. Then I run the following regression to estimate the differential impacts of both foreign bank entry and trade openness:

$$Y_{i,c,j,t} = \alpha_i + \phi_{c,j,t} + \beta_1 FBank_{c,t} \times Private_i + \beta_2 Trade_{c,t} \times Private_i + \varepsilon_{i,c,j,t} \quad (1.8)$$

Both the financial liberalization and trade liberalization shocks vary at the city-year level. The results, reported in Table 1.18, show that after controlling for city-level trade exposure, foreign bank deregulation still has larger impacts on private firms relative to state-owned firms, in terms of credit access and investment. The effects on private firms' relative sales and TFP (Columns 2 and 4) are very small and not significant.

One possible explanation for the negative coefficient of the trade openness interaction term in the regression for bank loans (in Column (1)) is that private firms could turn to trade credit as a substitute for bank loans once these firms are more exposed to international trade. This robustness check suggests that the main results in Section 5.2 are not driven by private firms being more exposed to export opportunities after China joined the WTO, and that financial development did play a role in explaining the relatively higher growth of credit access and investment among private-owned firms.

Table 1.18: Foreign bank entry vs. Trade openness

Dependent variable	$log(loans)$	$log(sales)$	$log(investment)$	$log(TFP)$
Sample: opened cities	(1)	(2)	(3)	(4)
$Foreign\,bank \times Private$	0.075**	0.010	0.108**	0.011
	(0.034)	(0.019)	(0.042)	(0.028)
$Trade\,Openness \times Private$	-0.011*	0.003	0.005	0.004
	(0.005)	(0.003)	(0.014)	(0.005)
$Firm\ size_{t-1}$	0.340***	0.302***	-0.034	0.048***
	(0.039)	(0.023)	(0.024)	(0.008)
$Profitability_{t-1}$	0.014	0.305***	0.382***	0.157***
	(0.119)	(0.060)	(0.097)	(0.049)
Firm FE	Yes	Yes	Yes	Yes
City-industry-year FE	Yes	Yes	Yes	Yes
Clustered at	city	city	city	city
Observations	295,229	312,772	205,867	295,229
Adj. R-squared	0.736	0.895	0.546	0.665

Notes: This table reports coefficients from regressions including a city-level trade openness index to address the threat to identification from trade liberalization. City-level time varying trade openness is defined as the average export value per worker in the manufacturing sector within the city. The dependent variables are the firm's loans, annual sales, investment and TFP measured following the methodology in Wooldridge (2009). Lagged firm size (total assets) and lagged profitability (profit divided by revenue) are used as firm-level time-varying control variables. All regressions control for firm and city-industry-year fixed effects, where industry classifications are at the 2-digit SIC level. Foreign firms are not included in the sample. Robust standard errors, clustered at the city-level, are reported in parentheses, *** p<0.01, ** p<0.05, * p<0.1.

1.6.2 Alternative Sample of Cities

An implicit identifying assumption is that the timing of the opening for foreign bank entry in different cities is exogenous, conditional on other observable characteristics of the cities. However, it is likely that the details of China's foreign bank entry policy were endogenously determined, and that "other cities" without foreign bank access may not form a good control group for the "opened cities" in the regression analysis. When all cities are included in the baseline regressions, the results may

only pick up unobserved differences between the "opened cities" and "other cities" rather than the impact of allowing foreign banks to enter.[23]

To examine whether the timing of opening up for foreign bank entry is related to the observable characteristics of different cities, I estimate a simple probit model across cities where the dependent variable takes value 1 for "opened cities" (defined as cities where foreign banks were allowed before the end of 2006, see Figure 1.5) and 0 otherwise.

Figure 1.5: Opened cities with foreign bank entry during 2001-2006 in mainland China

[23]However, in the differential impact regressions with interaction terms between foreign bank entry and the firm's type, I can control for city-year fixed effects to control for different time effects across cities.

The explanatory variables include city-level population, GDP per capita, and utilized foreign capital (a proxy for foreign direct investment in the city). These city-level variables are obtained from China's City Statistics Yearbook, and they are measured over 1998-2000, before China's WTO accession. The probit regression results, in terms of marginal effects, are reported in Table 1.19. These results show that, before China's WTO accession, the "opened regions" were larger in terms of population, GDP per capita and foreign direct investment. The results suggest that we may not take the choice of the "opened cities" as completely exogenous. To address this concern, I conduct two robustness checks.

Table 1.19: Whether the city is opened for foreign banks before 2006: Probit estimation

Dependent variable	"Opened city"=1			
	(1)	(2)	(3)	(4)
Log population	0.097**			0.096***
	(0.043)			(0.025)
Log GDP per capita		0.178***		0.146***
		(0.029)		(0.039)
Log FDI ($ million)			0.077***	0.027**
			(0.009)	(0.013)
Observations	213	213	213	213

Notes: This table reports the correlation between city-level characteristics (including population, GDP per capita, and total foreign direct investment) and whether the city was chosen to allow foreign bank entry before the end of 2006 based on the probit regression. Dependent variable takes a value of 1 for cities opened up before 2006. Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1.

Results Based on "Opened Cities" Only

First, I simply restrict my sample to the *"opened cities"*, defined as cities where foreign banks were allowed before the end of 2006, as a robustness check. There are

20 cities considered as "opened cities" (as listed in Table 1.1), out of 213 cities in the sample. The number of observations drops to around one quarter of the full sample when I restrict my sample to the opened cities only. Table 1.20 reports the differential effects of foreign bank entry between private firms and SOEs using the sub-sample with opened cities. These regression results are similar to those reported in Table 1.11, and the coefficients for sales and investment are larger when I focus only on opened cities, compared with the coefficients from full sample estimation.

Table 1.20: Firm's performance (SOE vs. POE) based on "Opened Cities"

Dependent variable	$log(loans)$	$log(sales)$	$log(investment)$	$log(TFP)$
Opened cities only	(1)	(2)	(3)	(4)
$Foreign\,bank \times Private$	0.046***	0.057***	0.122***	-0.002
	(0.019)	(0.006)	(0.021)	(0.020)
$Firm\ size_{t-1}$	0.303***	0.352***	0.026***	0.048***
	(0.036)	(0.003)	(0.010)	(0.010)
$Profitability_{t-1}$	0.022	0.736***	0.908***	0.158***
	(0.044)	(0.013)	(0.041)	(0.047)
Firm FE	Yes	Yes	Yes	Yes
City-industry-year FE	Yes	Yes	Yes	Yes
POE-time trend	Yes	Yes	Yes	Yes
Clustered at	city	city	city	city
Observations	210,270	210,270	142,701	210,270
R-squared	0.726	0.923	0.669	0.676

Notes: This table reports the effects of foreign bank deregulation on private firms' performance relative to that of SOEs based on the sample of "opened cities" only. The dependent variables are firm's loan access (proxied by short term liabilities minus accounts payable), annual sales, investment and TFP measured following Wooldridge (2009). All regressions control for city-industry-year fixed effects, where industry classifications are at the 2-digit SIC level. Only 20 "opened" cities where foreign banks were allowed before 2006 are included in the sample. Clustered standard errors (at city level) in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Propensity Score Matching at City-level

Second, after the probit estimation, I also use propensity score matching at the city level to identify a matched control group of "other cities", which have comparable pre-WTO accession characteristics as "opened cities". [24] Then I re-estimate the main regressions using this "matched control group" and "opened cities" as the regression sample.

In particular, this matched control group includes 14 cities: Dongguan, Handan, Hangzhou, Jieyang, Quanzhou, Shijiazhuang, Taiyuan, Taizhou, Tangshan, Weihai, Wuxi, Yantai, Zhenjiang, and Zibo. These cities have comparable observable characteristics as those of 20 opened cities except for Beijing, Guangzhou, Shanghai, Shenzhen, and Tianjin. I run the same probit model as in Table 1.19 to see whether observable characteristics are associated with the status of being an "opened city" within this group of 29 cities (15 opened cities excluding the five largest, plus 14 matched controlled cities). I find that the coefficients of the observable characteristics are statistically insignificant. Note that we cannot find cities with comparable characteristics as those of Beijing, Guangzhou, Shanghai, Shenzhen, and Tianjin. These five "opened cities" are excluded in this robustness exercise, so the results should not be attributed to the five largest cities where pre-existing foreign bank presence prior to 2001 could mix up with the deregulation policy.

The regression results using the sample of open and matched control cities are reported in Table 1.21. Results are generally similar to those reported in Table

[24] I follow the same matching methodology in Lai et al. (2016)to identify matched cities.

1.11. These estimates suggest that my baseline results are unlikely to be driven by differences across "opened cities" and "other cities".

Table 1.21: Firm's performance (SOE vs. POE) based on sample of matched cities

Dependent variable	$log(loans)$	$log(sales)$	$log(investment)$	$log(TFP)$
Matched cities	(1)	(2)	(3)	(4)
$Foreign\,bank \times Private$	0.074**	0.080**	0.091**	-0.003
	(0.035)	(0.037)	(0.037)	(0.028)
$Firm\,size_{t-1}$	0.276***	0.658***	-0.124***	0.055***
	(0.032)	(0.013)	(0.032)	(0.009)
$Profitability_{t-1}$	0.058	1.035***	0.221**	0.148***
	(0.059)	(0.147)	(0.097)	(0.037)
Firm FE	Yes	Yes	Yes	Yes
City-industry-year FE	Yes	Yes	Yes	Yes
POE-time trend	Yes	Yes	Yes	Yes
Clustered at	city	city	city	city
Observations	225,971	225,971	149,085	225,971
R-squared	0.726	0.923	0.507	0.711

Notes: This table reports the effects of foreign bank deregulation on private firms' performance relative to that of SOEs based on the sample of 15 opened cities excluding the five largest, plus 14 matched controlled cities. The dependent variables are firm's loan access (proxied by short term liability minus accounts payable), annual sales, investment and TFP measured following Wooldridge (2009). All regressions control for city-industry-year fixed effects, where industry classifications are at 2-digit level according to SIC. Clustered standard errors (at city level) in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

1.6.3 Robustness Check: Pre-existing Trend Tests

The results so far suggest that foreign bank entry has differential effects across different types of firms. However, it is possible that state-owned firms and private-owned firms had different trends before foreign bank entry, in which case changes in firms' performance cannot necessarily be attributed to foreign bank entry. In this additional robustness check, I do not include differential trends between private-owned and state-owned firms to test pre-existing trend. The growth of private-owned

firms may also affect the timing of foreign bank deregulation. Perhaps Chinese government relaxed foreign bank restrictions anticipating faster growth in private firms and the need to finance attractive projects, leading to a reverse causality problem. Here I conduct placebo tests to see whether future foreign bank entry affects firms' current outcomes. The OLS specification is as follows:

$$Y_{i,c,j,t} = \alpha_i + \delta_{c,t} + \phi_{j,t} + \sum_{\tau} \beta_\tau Before^{\tau}_{c,t}/After^{\tau}_{c,t} \times Private_i + \gamma X_{i,c,j,t} + \varepsilon_{i,c,j,t}$$

where I allow for τ lags $After^{\tau}_{c,t}$ (post-treatment effects) and leads $Before^{\tau}_{c,t}$ (anticipatory effects) for the actual foreign bank entry policy variable $FBank_{c,t}$. In Table 1.22, coefficients of the one-period-led $Before$ interaction term are insignificant. Results show that relative to state-owned firms, private-owned firms are more likely to have higher investment and sales either in the year of or after foreign bank entry. The findings suggest that the results in the main regressions in the previous section do not suffer from the problem of reverse causality. This also addresses concerns that China's central government may have chosen cities with more rapidly growing privately-owned firms for earlier foreign bank deregulation policy.

Table 1.22: Pre-existing trend tests

Dependent variable	$log(investment)$	$log(sales)$
Opened cities, 1998-2007	(1)	(2)
$[OneYear\,Before] \times Private$	0.058	0.028
	(0.038)	(0.021)
$[OneYear\,After] \times Private$	0.099***	0.050***
	(0.029)	(0.010)
$[TwoYears\,After] \times Private$	0.094**	0.053***
	(0.045)	(0.018)
Firm FE	Yes	Yes
City-year FE	Yes	Yes
Industry-year FE	Yes	Yes
Observations	276,308	515,723
R-squared	0.542	0.924

Notes: Table 1.22 shows firm-level regressions using before and after dummies. Robust standard errors in parentheses, clustered at the city level. *** p<0.01, ** p<0.05, * p<0.1.

1.7 Concluding Remarks

This chapter studies the impact of foreign bank deregulation following China's WTO accession on firms' performance. The geographic and time series variation in the policy of foreign bank lending in China offers a suitable setting for identifying the relationship between foreign bank entry and domestic firms' real activities. On average, foreign bank entry in its early stage did not have a significant impact on city-level investment and output. However, the impact differed across ownership groups. The additional credit supply brought by foreign bank entry had a larger impact on investment and sales among private firms compared with state-owned firms.

The findings suggest that the banking sector liberalization policy helped alleviate financial constraints of firms, especially those without political connections. The

liberalization policy may have helped reduce the inefficiency in resource allocation due to state-owned banks' discrimination against private firms in bank lending. In an economy with seriously repressive financial policies, which is a reasonable depiction of the current situation in the China, the state sector is often strongly favored, while the private sector is discriminated against. Introduction of foreign banks reduces the effect of repressive policies and therefore should reverse previous policy effects.

Chapter 2: Why do Firms in Emerging Europe Borrow in Foreign Currency? The Role of Interest Rate Differentials

2.1 Introduction

Unhedged foreign currency (FX) borrowing is widely alleged to be one of the major causes of the severe financial crisis that hit many emerging markets in 1980's and 1990's[1]. Recently, foreign currency borrowing has also expanded rapidly in emerging Europe, especially during the pre-crisis boom[2]. Figure 2.1 shows that the share of foreign currency lending in total lending reached well above 50% in most emerging European economies, which was substantially higher than the shares in other regions. Retail loans, including residential mortgages, other consumer credit and small business loans, take a large share of FX borrowing in these countries. These clients are typically more vulnerable and have only local currency income and assets; as a result, the associated currency mismatch could be a problem for financial stability and economic growth.

[1]Currency mismatch was an important aspect of the Mexico crisis in 1994 and the East Asian crisis in 1997-98. See Mishkin (1999) and Aguiar (2005).

[2]In this chapter, "Emerging Europe" refers to non-Eurozone emerging countries in Central and Eastern Europe as well as Central Asia. See Appendix B for a discussion on trend of local vs. foreign currency borrowing in other emerging markets. "Foreign currency" refers to US dollar, Euro and Swiss francs in this chapter.

Policy makers in Eastern Europe fear that foreign currency borrowing could lead to widespread credit default and the destabilization of the financial sector. Particularly, they worry about borrowing by retail clients, since these small firm entrepreneurs and households seek lower interest rates and take unhedged exchange rate risks. As a response, authorities in Eastern Europe have started to take measures to reduce foreign currency borrowing in the private sector.[3] Before implementing regulations to discourage foreign currency borrowing, it is crucial to provide micro-evidence documenting which firms are exposed to risk from foreign currency loans and what this exposure may imply in terms of a firm's performance. This chapter provides relevant firm-level evidence in emerging Europe.

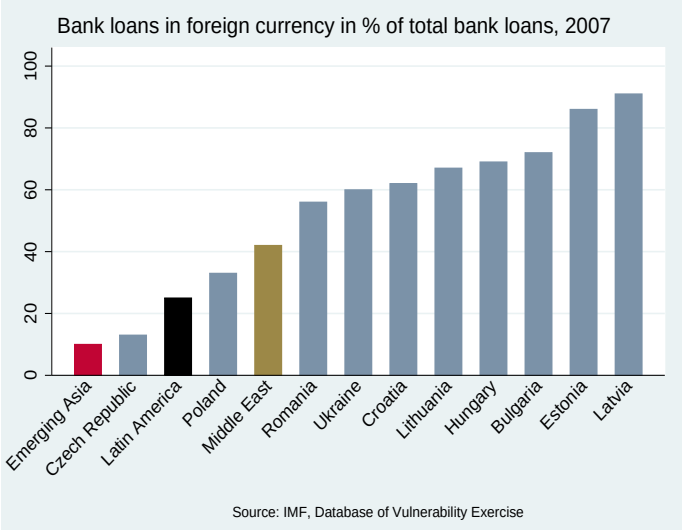
In this chapter, I study the determinants and consequences of foreign currency borrowing by small firms in these emerging economies. My main data source is the Business Environment and Enterprise Performance Survey (BEEPS) from the European Bank of Reconstruction and Development (EBRD) and the World Bank[4]. BEEPS is a cross-country firm-level survey which covers representative samples of firms in 28 transition countries in Emerging Europe, mainly focusing on small non-listed firms. Most important for my analysis in this chapter, the survey identifies whether loans granted to firms are denominated in domestic or foreign currency. Another advantage of this survey is the representativeness of the sample. The comprehensive coverage of the survey allows me to look at the determinants and impacts

[3]For example, banks are now forced to fully disclose the exchange rate risks involved in FX borrowing and have had to tighten eligibility criteria for FX loans in Hungary, Poland and Latvia. Ukraine even completely banned foreign currency lending to households in 2009 (Brown and De Hass, 2010).

[4]See section 3 for a detailed description of dataset.

of FX borrowing on a more representative set of firms. In this sense this chapter complements the existing literature.[5] In this study, I include small and medium firms, which constitute the majority of firms in the economy and can potentially be more vulnerable to unhedged exchange rate risk.

Figure 2.1: Share of foreign currency lending in emerging Europe



Briefly speaking, currency mismatch plays a dual role in emerging markets. There is a trade-off between cheaper credit and currency mismatch risk for FX borrowers. On the one hand, the productive sector in these developing economies needs external finance to fund investments that contribute to output growth. One stylized fact is that much of the external finance from foreign bank lending is denominated in foreign currency. Foreign currency borrowing has been an engine of growth that has helped firms to reduce interest costs and relax borrowing constraints. On the other hand, extensive and possibly excessive use of dollar debt in the pre-crisis years has

[5]For example, Aguiar (2005) and Bleakley and Cowan (2008) use data of publicly listed firms, which are generally large and well-established.

been a common threat in emerging market crises over the past two decades. The resulting currency mismatch on the balance sheet has been singled out as an important factor causing and amplifying crises (for example, see Aghion et al., 2000; Caballero and Krishnamurthy, 2003). A borrower's assets and revenues are mostly in domestic currency, but currency depreciation magnifies liabilities and debt repayment obligations that are mostly in dollars, leading to a drop in net worth and investment. For example, Aguiar (2005) finds that firm-level investment was adversely affected by the 1994 peso devaluation in Mexico, especially among firms with high levels of foreign currency debt. Bordo et al. (2010) show that historically when a country has a greater proportion of foreign currency debt, this country also has a higher frequency of financial crises and larger permanent output losses. Therefore, systemic risk in emerging markets will be high when small firms, in addition to large internationally active firms, take on dollar debt, resulting in correlated defaults in a downturn.

I investigate whether firms that take on currency mismatch, especially those more likely to be financially constrained, enjoy better borrowing conditions and grow faster in the period when vulnerabilities build up.[6] There are two major channels through which foreign currency borrowing can affect firms' performance before the crisis. One is lowering of the user cost of capital and the other is the easing of liquidity constraints.[7] I can test the relevance of the latter channel by allowing heterogeneous effects for various sub-groups of firm, with presumably different levels of liquidity constraints. Small, domestic and non-trading firms are usually presumed

[6]Currently most of the periods covered by survey data are in non-crisis time, therefore my results at this stage are more related to the tranquil time.

[7]Failure of UIP results in lower user cost for foreign currency loans.

to be more liquidity constrained. Therefore, to test the importance of the liquidity constraint easing channel, I use estimations relating firm outcomes to interactions between indicator variables for FX borrowing with measures of size, foreign ownership or exporting status. The regression analysis suggests that currency mismatch reduces the interest rate on loans by 2 percentage points on average, after controlling for firm-level and loan-level characteristics that would affect the cost of borrowing. The results shed light on the relation of foreign currency borrowing to interest rate differentials. In the pre-crisis time between 2004 and 2007, results also show that firms with currency mismatches exhibit faster sales growth and higher investment rates.

Furthermore, I study whether exposure to foreign currency loans affects a firm's growth rate during crisis episodes relative to firms without foreign currency liabilities. Using the most recent wave of the BEEPS survey and comparing the within-firm sales growth rates from 2008 to 2011 across different types of firms, I find that firms with currency mismatches exhibit significantly lower sales growth relative to firms with no foreign currency liability, controlling for total loans. The results suggest there is evidence for a negative balance sheet effect during crises in firms with foreign currency liabilities.

The rest of this chapter is organized as follows. Section 2.2 reviews related literature. Section 2.3 describes the survey data I use, while Sections 2.4 and 2.5 discuss the empirical specifications and report results on the firm-level empirical analysis. Section 2.6 concludes.

2.2 Related Literature

Why do firms borrow in foreign currency?

Eichengreen and Hausmann (1999)document that a large part of borrowing in emerging markets is intermediated in dollars. Why do firms borrow in foreign currency? There are many studies on currency choice when firms borrow from financial institutions or investors, focusing on both the borrower and lender incentives.

On the lender side, much of foreign currency lending is from foreign lenders who lend in dollars and would demand a premium if they were to lend in local currency (Hausmann and Panizza, 2010). Since governments in emerging markets may be tempted to devalue local currency and reduce their real debt burdens, foreign lenders choose to lend in dollars anticipating the devaluation behavior. Shin (2013) also documents that changing patterns of financial intermediation, from the banking sector to capital markets, and from banks to long-term investors in international debt issuance.

On the borrower side, one main advantage of borrowing in foreign currency is the lower interest rate on dollar loans. Uncovered interest rate parity can fail in reality. Therefore, lower interest rates on dollar loans give firms an incentive to borrow in dollars.[8] Allayannis et al. (2003) and Cowan (2006) use firm-level panel data to investigate the link between loan currency and firm characteristics, controlling for macro and institutional variables, in East Asia and Latin America,

[8]I use the terms "dollar" and "foreign currency" interchangeably throughout this chapter unless explicitly separating dollar and euro borrowing.

respectively. They find that interest rate differentials are positively related to foreign currency borrowing. However, the cheaper dollar debt comes at the cost of currency mismatch risk on the borrower's balance sheet.

The second strand of literature argues that firms have hedging motives for incurring dollar debt. Exporting firms who have dollar revenue from exports or FDI operations are more likely to borrow in foreign currency. Bleakley and Cowan (2008) find that firms match the currency of liabilities to the exchange rate sensitivity of revenues. Allayannis et al. (2003) and Aguiar (2005) also provide empirical evidence that exporters are more likely to have dollar debt. Moreover, recent work by Kamil (2012) investigates the effect of various exchange rate regimes on firms' incentives to hedge currency risk.

FX borrowing and balance sheet effects

Large inflows of foreign debt can be problematic to emerging markets[9]. There are many studies that emphasize the balance sheet channel (or collateral channel). In an open economy setting, Céspedes et al. (2004) argue that debt denominated in foreign currency is a central protagonist behind EM financial crises. The key mechanism is that a depreciation inflates the peso value of dollar debt and the resulting weakening of balance sheet positions prevents firms from investing and expanding. In the empirical literature, many of the studies on the effect of FX borrowing and

[9] Forbes and Warnock (2013) find most extreme capital flow episodes, e.g. surges and stops, are driven by debt flows. Mendoza and Terrones (2008) document that credit boom from foreign borrowing lead to crises.

the associated balance sheets effects following depreciation have focused on large and publicly traded firms. The data choice is mainly determined by the availability of data on the currency composition of debt. However, it may be that smaller, non-public firms are even more sensitive to balance sheet effects.

The existing empirical evidence on the effect of FX borrowing is mixed. Aguiar (2005) shows that firms with heavy exposure to short-term foreign currency debt before the Mexican crisis decreased investment during the crisis compared to firms with lower dollar debt. Similarly, Bleakley and Cowan (2008) study corporate dollar debt and depreciation for listed firms in Latin America during the period 1991-1999. They conclude that balance sheet effects associated with currency mismatch are relatively minor. They find that firms holding more dollar debt do not invest less than their peso-indebted counterparts following a depreciation. One recent study, Kalemli-Ozcan et al. (2016), quantifies the effects of the lending channel and balance sheet channel on corporate investment, by comparing performances of foreign-owned and domestic exporters during currency crises and "twin" crises, defined as banking crisis and currency crisis both occurred. They find there is a difference in investment between foreign and domestic exporters only under twin crises when liquidity is scarce. There is evidence for a balance sheet channel effect, but the lending channel is a more important factor hindering investment.

Foreign currency borrowing by small non-listed firms

Much of the literature on the impact of currency mismatch on firms' performance uses listed firm data and finds that balance sheet effects are small. Complementing the above studies, I focus on foreign currency borrowing by small firms, rather than the currency denomination of outstanding corporate debt of large corporations. Brown et al. (2011) is the first paper using the sample of east European firms from BEEPS to study FX borrowing by small firms. They focus on the determinants of foreign currency borrowing by small firms between 2002 and 2005, and find that foreign currency borrowing is more strongly correlated with firm-level foreign currency revenues than with country-level interest rate differentials[10].

This chapter differs from their paper in two dimensions. First, I examine the impact of foreign currency borrowing on firm-level growth as well as investment rather than just the determinants of currency choice. Therefore, the foreign currency dummy variable is not only used as the dependent variable but also as a right-hand side variable in regressions. Second, I use interest rate data at the firm level to document the interest rate differential between local currency loans and foreign currency loans, rather than studying the effect of country-level interest rate differentials on foreign currency borrowing. I control for country-level interest rate differentials using country-year fixed effects. The results show that foreign currency borrowing indeed reduces interest rates at the loan level across financially constrained firms.

[10]Following their methodology, I also examine on determinants of FX borrowing using the recent 2012-2013 data in this chapter to extend their study.

2.3 BEEPS Firm-level Data

Firm-level data was obtained from the Business Environment and Enterprise Performance Survey (BEEPS). The European Bank of Reconstruction and Development (EBRD) and the World Bank jointly conducted this survey in 2002, 2005, 2008 and 2013, and it is available through World Bank Enterprise Survey database[11]. This firm-level survey is based on face-to-face interviews with managers, with the goal being to collect information about the business environment and how it affects the performance of plants across emerging economies.

Data coverage

BEEPS includes countries in east Europe and central Asia, most of which are transition countries. The list of countries and the number of firms interviewed in each country are reported in Table 2.1. The number of firms covered in each country is roughly proportional to the total number of firms in that country. Interviewed firms in each country are carefully selected to be representative of the targeted population. The sampling methodology is stratified random sampling with replacement [12].

Table 2.2 presents the share of employment accounted for by firms belonging in three size categories in 10 selected countries. I compare the distribution in the BEEPS survey sample with the sample in Amadeus[13]. For the 10 selected countries

[11]BEEPS is a repeated cross-sectional data, not a panel data, but the survey collects historical data on firms' sales and foreign currency borrowing. Recent round BEEPS data of 2012-2013 is available online on December 2014.

[12]Appendix 3 provides detailed discussion on the representativeness of this survey.

[13]The employment shares across firm sizes in Amadeus come from Larrain and Stumpner (2013).

Table 2.1: Number of observations and share of foreign currency borrowers: By country

Country	Obs.	FX% in loans	Country	Obs.	FX% in loans
Albania	732	69%	Latvia	652	24%
Armenia	896	28%	Lithuania	681	29%
Azerbaijan	900	17%	Moldova	887	29%
Belarus	848	28%	Montenegro	154	14%
Bosnia	743	39%	Poland	1,930	16%
Bulgaria	1,853	27%	Romania	1,396	40%
Croatia	1,160	29%	Russia	2,111	21%
Czech Republic	861	7%	Serbia	900	18%
Estonia	662	29%	Slovakia	665	18%
Macedonia	736	42%	Slovenia	687	26%
Georgia	747	64%	Tajikistan	736	25%
Hungary	1,151	24%	Turkey	2,475	28%
Kazakhstan	1,379	27%	Ukraine	1,908	23%
Kyrgyzstan	610	41%	Uzbekistan	926	16%
			Total	29,386	25%

Source: BEEPS: 2002, 2005 and 2009

covered by Amadeus, the comparison shows that BEEPS achieves representativeness in terms of the size of firms.

Variables

The survey contains a variety of firm-level information, such as share of revenue from exporting, foreign ownership percentage, share of investment financed by debt, loan applications, and so on. Definitions of main variables are presented in Table 2.3. Table 2.4 provides brief summary statistics on the share of firms by their size, ownership, and other characteristics, and by country. The survey tried to achieve representativeness in terms of the size of firms. Specifically, around 70% of the firms surveyed are "small" (less than 20 workers), 20% of the firms surveyed are

Table 2.2: Employment distribution across different size bins

Country	Source	1-49 employees	50-249 employees	250+ employees
Bulgaria	BEEPS	0.08	0.30	0.62
	Amadeus	0.12	0.26	0.61
Czech Republic	BEEPS	0.04	0.26	0.70
	Amadeus	0.08	0.29	0.63
Estonia	BEEPS	0.20	0.32	0.48
	Amadeus	0.32	0.37	0.30
Hungary	BEEPS	0.05	0.28	0.67
	Amadeus	0.04	0.36	0.59
Latvia	BEEPS	0.10	0.41	0.48
	Amadeus	0.06	0.40	0.54
Lithuania	BEEPS	0.12	0.35	0.53
	Amadeus	0.10	0.35	0.55
Poland	BEEPS	0.06	0.15	0.79
	Amadeus	0.03	0.30	0.67
Romania	BEEPS	0.18	0.22	0.60
	Amadeus	0.20	0.27	0.53
Russia	BEEPS	0.03	0.17	0.80
	Amadeus	0.08	0.19	0.72
Ukraine	BEEPS	0.04	0.16	0.80
	Amadeus	0.01	0.15	0.84

Note: This table reports the employment distribution across different size bins for 10 countries in the BEEPS dataset in 2002 and 2005, and in the Amadeus dataset during 1996-2005.

Table 2.3: Key Variable definitions

Variable name	Definition	Source
Loan characteristics		
Currency denomination	1=loan in FX, 0=loan in local currency	BEEPS
Collateral	1=loan is collateralized, 0 otherwise	BEEPS
Maturity	maturity of loan (in months) at lending date	BEEPS
Interest rate	Interest rate reported, in percentage	BEEPS
Firm characteristics		
FX borrower	1=having an outstanding FX loan, 0 otherwise	BEEPS
Export share	share of revenue from exporting activity	BEEPS
Foreign ownership	% owned by foreigners	BEEPS
Debt finance	share of investment financed by debt	BEEPS
No. of employees	Firm size: <100 (small); >100 (large)	BEEPS
Years of operation	age of firm	BEEPS
Sales	Total annual sales last fiscal year (in logs)	BEEPS
Investment	Total investment last fiscal year (in logs)	BEEPS
Sector	Classification by sector (ISIC_code)	BEEPS
Macro conditions		
Depreciation	depreciation of local currency vs. Euro, in %	IFS
Inflation	consumer price inflation, in %	IFS
Peg	1=country with peg regime, 0 otherwise	AREAER

Data source: BEEPS: Business Environment and Enterprise Performance Survey in 2002, 2005 and 2008 by EBRD and World Bank. IFS: International Financial Statistics of the IMF. AREAER: Annual report on Exchange Arrangements and Exchange Restrictions of the IMF.

"medium", and only around 10% of the firms surveyed are "large" (more than 100 workers). Only 6% of surveyed firms are public listed firms, 30% of surveyed firms have a positive exporting share in revenue, and 11% of surveyed firms are foreign owned (more than 50% foreign ownership).

The main advantage in this survey data is that it covers not only stock-market listed but also *non-listed firms* in emerging European economies, and it also reports the currency denomination of each firms' loans on their books.[14] 94% of the firms

[14]In the 2005, 2008 and 2012 survey, firms only report the currency denomination of their last loan (the latest loan), In 2002 survey, firms report the share of FX borrowing in the stock of debt.

Table 2.4: Summary statistics: firm characteristics

Country	Small	Large	Public listed	Private	Sole proprietorship	Exporter	Foreign-owned
Albania	0.74	0.07	0.00	0.42	0.30	0.27	0.12
Armenia	0.79	0.07	0.03	0.36	0.37	0.19	0.08
Azerbaijan	0.69	0.11	0.10	0.21	0.53	0.11	0.11
Belarus	0.71	0.11	0.07	0.44	0.27	0.26	0.11
Bosnia	0.61	0.10	0.14	0.33	0.39	0.35	0.09
Bulgaria	0.74	0.10	0.05	0.56	0.26	0.32	0.11
Croatia	0.65	0.14	0.09	0.51	0.31	0.43	0.10
Czech	0.76	0.08	0.03	0.48	0.33	0.35	0.12
Estonia	0.74	0.10	0.10	0.51	0.08	0.36	0.15
FYR Macedonia	0.74	0.10	0.04	0.40	0.30	0.36	0.11
Georgia	0.75	0.08	0.06	0.34	0.18	0.17	0.09
Hungary	0.72	0.08	0.01	0.28	0.12	0.35	0.16
Kazakhstan	0.73	0.09	0.04	0.43	0.23	0.10	0.08
Kyrgyzstan	0.63	0.10	0.14	0.33	0.28	0.17	0.13
Latvia	0.74	0.10	0.01	0.41	0.17	0.29	0.14
Lithuania	0.68	0.10	0.04	0.64	0.21	0.36	0.10
Moldova	0.65	0.10	0.09	0.53	0.20	0.24	0.10
Montenegro	0.83	0.10	0.03	0.25	0.62	0.14	0.05
Poland	0.75	0.07	0.06	0.10	0.43	0.27	0.09
Romania	0.65	0.10	0.03	0.71	0.02	0.22	0.12
Russia	0.66	0.12	0.12	0.43	0.15	0.19	0.08
Serbia	0.65	0.15	0.11	0.27	0.40	0.37	0.12
Slovakia	0.68	0.10	0.09	0.32	0.21	0.38	0.12
Slovenia	0.71	0.13	0.07	0.38	0.22	0.55	0.10
Tajikistan	0.62	0.10	0.12	0.08	0.30	0.12	0.06
Turkey	0.70	0.10	0.03	0.84	0.05	0.69	0.03
Ukraine	0.71	0.10	0.07	0.41	0.25	0.22	0.30
Uzbekistan	0.73	0.10	0.11	0.09	0.36	0.13	0.11
Total	0.71	0.10	0.06	0.43	0.25	0.30	0.11

Note: The table presents statistics on the share of firms by characteristics, by country. See Table 2.1 for the number of surveyed firms in each country. Source: BEEPS: 2002, 2005 and 2009

surveyed in data sample are non-listed firms. Since the sample of listed firms is a biased sample of large privileged firms, a broader coverage enables us to conduct research across the entire economy, not just the prime listed firms as in much of the previous literature. However, the major shortcoming of this survey is that very few financial statement variables are recorded, compared to the data available for listed firms from other sources. It is not possible to obtain financial statement data for the this sample of firms from standard sources. Less than 10% of the firms surveyed report that they have issued private or public equity. Therefore, I have to focus on the characteristics of firms, and analyze the effects of FX borrowing across subsets of firms.

Loan currency

Most importantly for my analysis, the BEEPS surveys ask whether firms have borrowed in foreign currency. Most of the foreign currency borrowings is in Euros or US dollars. Table 2.1 shows the shares of foreign currency borrowers among total firms in each country. Across all countries, 25% of the observations have borrowed in foreign currency. The share of FX borrowers varies from 7% to 69% across countries. Liability dollarization appears to be associated with more rigid exchange rate regimes on average. For example, countries with currency boards or rigid pegs (e.g. Estonia and Latvia) had a larger share of FX borrowing than countries with floating exchange rates (e.g. Czech Republic and Slovakia)[15].

[15]See Rosenberg and Tirpak (2008) for determinants of FX borrowing in the new EU member states.

In BEEPS 2005, 2009 and 2013, loan information is available in 5430 firms. For each firm with at least one loan, BEEPS asks for detailed information about *the most recent loan*, including currency denomination, whether collateral is provided, maturity in months, and reported interest rate. This is one limitation of the dataset since there is no information about the foreign currency share in total loans. [16] Table 2.5 displays the characteristics of firms with local and foreign currency loans. The tables suggests that firms with foreign currency loans differ systematically from those with only local currency loans. Firms with foreign currency loans are more likely to have revenue from exporting activity, and foreign owners. There is no clear relationship between loan currency and whether the firm is small (less than 100 employees). Table 2.5 also provides statistics on loan characteristics. Collateral requirements for firms do not seem different between firms with local or foreign currency loans. However, foreign currency loans have a significantly longer maturity (sample mean: 44 months vs. 31 months), are larger on average and have lower interest rates.

Credit demand and constraints

For the purpose of estimating the liquidity easing channel of foreign currency lending, I also focus on information about credit constraints faced by firms. The survey data allow me to directly observe firms' access to finance. Specifically, I observe whether firms' loan application was approved or turned down, and whether

[16]The survey information on the last loan may be more reliable than information on the debt stock, with the latter possibly based on the memory rather than on actual data. Similarly, the Survey of Small Business Finances (SSBF) also asks only the information on the last loan.

Table 2.5: Characteristics by loan currency (Sampling weights included)

	All Firms	Firms with loan	Firms with LC loan	Firms with FX loan
Observations	15,902	5,430	3,955	1,475
Exporter	0.18	0.25	0.22	0.34
Foreign firm	0.05	0.05	0.03	0.09
Small firm	0.87	0.81	0.81	0.82
Firm Age	14.75	15.83	15.60	16.45
Loan characteristics based on most recent loan				
	t-value	All loans	LC loans	FX loans
Collateralized	0.76	0.77	0.76	0.79
Interest rate	8.07***	6.20	6.68	5.10
Maturity	8.02***	34.68	30.80	44.42
Loan size	6.40***	1,030	442	2,468

Note: Loan size: in thousand Euros. Exchange rate data corresponds the conversion rate at the month when the loan is received. Maturity: in months.

Table 2.6: Main reason for not applying for loan

Main Reason	Obs.	Type
No need for a loan	7481	no need loan
Application procedures are complex	666	constrained
Interest rates are not favorable	1889	constrained
Collateral requirements are too high	421	constrained
Size of loan and maturity are insufficient	114	constrained
Did not think it would be approved	190	constrained

Data source: BEEPS (2012).

firms are discouraged from applying for bank credit. One survey question asks: "What is the main reason for not applying for any line of credit or loan?". Table 2.6 lists the main reasons. Firms are classified as having no need for a loan or credit constrained based on the answers. The answers suggest that high interest rates are the main barrier to loan applications. Table 2.7 presents a summary by country of the shares of firms that need a loan, and the share of constrained firms among sample firms that needed credit.

Table 2.7: Summary statistics: credit demand and constraints

Country	BEEPS 2005		BEEPS 2008		BEEPS 2012/13	
	Need loan	Constrained	Need loan	Constrained	Need loan	Constrained
Albania	0.68	0.32	0.45	0.46	0.40	0.81
Armenia			0.59	0.36	0.56	0.40
Azerbaijan			0.56	0.80	0.54	0.83
Belarus			0.75	0.37	0.62	0.61
Bosnia	0.76	0.20	0.78	0.40	0.48	0.43
Bulgaria	0.65	0.37	0.59	0.55	0.52	0.66
Croatia	0.78	0.16	0.65	0.39	0.52	0.62
Czech	0.56	0.43	0.54	0.36	0.38	0.32
Estonia	0.60	0.23	0.54	0.30	0.41	0.35
FYR Macedonia	0.68	0.57	0.59	0.51	0.44	0.53
Georgia			0.64	0.42	0.45	0.39
Hungary	0.78	0.29	0.41	0.32	0.54	0.60
Kazakhstan			0.61	0.51	0.50	0.76
Kyrgyzstan			0.65	0.66	0.54	0.61
Latvia	0.70	0.27	0.59	0.48	0.30	0.77
Lithuania	0.71	0.32	0.61	0.27	0.52	0.66
Moldova			0.71	0.43	0.46	0.60
Montenegro	0.56	0.30	0.78	0.52	0.69	0.76
Poland	0.68	0.46	0.55	0.48	0.42	0.55
Romania	0.72	0.34	0.64	0.42	0.62	0.45
Russia	0.77	0.41	0.72	0.47	0.58	0.66
Serbia			0.77	0.41	0.64	0.41
Slovakia	0.62	0.24	0.53	0.42	0.41	0.50
Slovenia	0.72	0.11	0.64	0.16	0.50	0.29
Tajikistan			0.62	0.51	0.45	0.64
Turkey			0.64	0.29	0.51	0.37
Ukraine			0.68	0.53	0.64	0.80
Uzbekistan			0.62	0.67	0.32	0.43
Total	**0.70**	**0.34**	**0.63**	**0.45**	**0.53**	**0.59**

Note: The table presents statistics on the share of firms who declare a desire for bank loans and the share of these firms that are constrained.
Source: BEEPS: 2005, 2009 and 2012/13

2.4 Empirical Strategy

2.4.1 Probability of Having a FX Loan

I examine determinants of loan currency in the following empirical model. The dependent variable $Pr(FX\,Loan)_{i,j,t}$ is the probability that a firm i in country j has a foreign currency denominated loan conditional on receiving a loan at time t (the sample only includes firms that have a loan):

$$Pr(FX\ Loan)_{i,j,t} = \alpha_{j,t} + \beta_1 FirmControl_{i,j} + \beta_2 LoanControl_{i,j,t} + \varepsilon_{i,j,t} \quad (2.1)$$

where $FirmControl_{i,j}$ is a vector of characteristics of firm i in country j, $LoanControl_{i,j,t}$ are the characteristics of the loan taken by firm i in country j at time t, and $\varepsilon_{i,j,t}$ is the error term. The variable $\alpha_{j,t}$ represents sector, country or country-sector fixed effects.

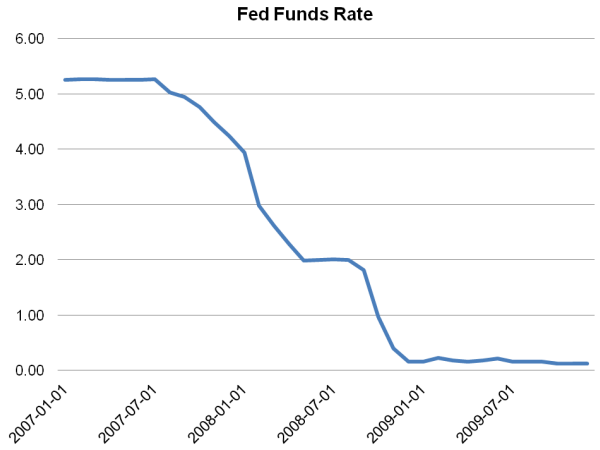
A firm's decision to take a foreign currency loan should be related to the currency denomination of its revenues. I use three indicators to proxy for firm's revenue currency denomination: *Exporter, Sales to multinationals* and *Foreign firm.* The dummy variable *Exporter* equals one if the firm exports and zero if the firm obtains revenue only from domestic sales. Finally, the probability of a firm receiving a foreign currency loan may depend on loan characteristics such as maturity and collateralization. Therefore I include loan-level variables *Maturity* and *Collateral* as controls in my empirical exercise.

2.4.2 Interest Rate Differential on Loans: Is FX Borrowing Cheaper?

Low interest rates on major hard currencies (e.g. US dollar) provide a major incentive for firms to substitute foreign currency credit for local currency credit. Figure 2.2 plots the Fed Fund Rate (FFR) between Jan-2007 and Dec-2009. The rate goes down from 5.3% in July 2007 to almost zero in January 2009. This sharp decline in dollar rates could be viewed as an exogenous global liquidity shock to emerging markets such as East Europe. This decline did translate to cheaper rate on foreign currency loans.

The transmission of global monetary ease to these emerging economies starts with low short-term rates, low bond yields and pressure for currency appreciation, and contributes to a rapid growth in foreign currency credit to firms in East Europe. I study how interest rate differentials at the micro level responded to the international environment with low US interest rates. The important empirical question is: can borrowing in foreign currency indeed reduce firms' interest rate, and does this benefit firms even taking depreciation risk into consideration?

Figure 2.2: Low interest rate in US dollar since 2007



Source: FRED

In my firm-level dataset, each firm reports information about their most recent loan, including the interest rate, currency denomination, maturity and collateral requirement. I regress the reported interest rate on the currency denomination of each loan and firm and loan specific controls, using the specification in equation (2.2). To control for the fact that differences in interest rates between domestic and foreign currency loans may reflect the expected rate of currency depreciation, I adjusted domestic currency interest rates for expected currency depreciation by using one-year ahead currency forecast data from Bloomberg. The dependent variable $Adj.\,Interest\,rate_{i,c,j,t}$ is the depreciation adjusted real interest rate for firm i, in country c, in sector j and at time t:

$$\begin{aligned} Adj.\,Interest\,rate_{i,c,j,t} &= \beta_1 Foreign\,Currency_{i,c,j,t} + \beta_2 Firm\,Control \\ &\quad + \beta_3 Loan\,Control + \phi_{j,t} + \varphi_{c,t} + \varepsilon_{i,c,j,t} \end{aligned} \tag{2.2}$$

where *"Foreign Currency"* is a dummy variable to differentiate loans with different currencies, and *"firm control"* and *"loan control"* are sets of control variables at

the firm/loan level. Specifically, I include *sales* and *years of operation* as firm-level control variables to capture the impact of size and existing history on the terms of borrowing.[17] I also consider *"foreign ownership"* as a firm level measure of access to liquidity, especially during financial crisis. Foreign-owned firms are likely to have better access to international markets and are less constrained, because they can draw funds from the parent company through internal capital market lending. Less financially constrained firms would be more likely to borrow at a lower interest rate. For loan specific variables, I add the *maturity of the loan* to the regression, since generally interest rates would depend on maturity. Additional controls on *collateral* capture the effect of collateral requirements on interest rates. [18] Country-year and sector-year fixed effects are included in the estimation.

2.4.3 Growth, Investment and FX Exposure

The impact of FX lending on firm's performance before the crisis

I use *sales growth* and *investment rates* as measures of real economic performance of firms. In the BEEPS dataset, firms report the growth in sales and investment in the last three years before the survey date. The 2008-09 survey collects the data from a period of ease global liquidity [19]. My estimation strategy is based on the following identification assumptions: (1) Low yields in hard curren-

[17] Larger and older firms are expected to pay a lower interest rate.

[18] The survey data from BEEPS asks which type of collateral was required: Land or Building, Equipment, Accounts Receivable, Personal Assets or Other collateral.

[19] This wave of survey collects 2007 data, when the East Europe is still in the credit boom before the 2008 crisis

cies lead to easier financial conditions in emerging markets, so that foreign currency credit supply increased before the 2008 crisis; (2) Foreign firms or exporting firms all else equal may have more "access to external finance"; (3) As non-tradable sector firms have little FX revenues compared to tradable sector firms, FX borrowing in the non-tradable sector is more likely to cause currency mismatch. The vulnerabilities from currency mismatch might prevent such firms from additional borrowing that could translate to a higher growth rate.

Sales and investment data is available in the 2008 survey. The survey reports the value of sales and investment in 2007, as well as the the values in 2004 for the same firm. So I can construct data on three-year growth in sales and investment between 2004-2007 for each firm. I run regressions using cross-sectional data in 2007 while using the change between 2004 and 2007 as the performance measurement. I estimate the following equation:

$$\Delta ln(Sales_{i,c,j,t}) = \beta FX_{i,c,j} + \gamma X_{i,c,j} + \phi_{j,c} + \varepsilon_{i,c,j} \tag{2.3}$$

where the dependent variable $\Delta ln(Sales_{i,c,j,t}) = ln(Sales)_{i,c,j,t} - ln(Sales)_{i,c,j,t-3}$ refers to the three-year sales growth before the survey date, for firm i, in country c, in sector j and at time t. [20] The other equation I estimate is:

$$Investment\,rate_{i,c,j} = \beta FX_{i,c,j} + \gamma X_{i,c,j} + \phi_{j,c} + \varepsilon_{i,c,j} \tag{2.4}$$

where the *"Investment rate"* is calculated as investment divided by the previous year's capital stock. In the two equations above, *"FX"* is a dummy indicating whether the firm has borrowed in foreign currency in 2004. X is a set of firm-specific

[20] Since this is cross-sectional data, I dropped the time script t here.

control variables, including sales in 2004, foreign ownership and age of firms. *"Foreign ownership"* can be included as a continuous variable or as a dummy for foreign ownership (for a threshold of 10% foreign ownership). I also include sector-country fixed effects in this estimation.

To focus on firms with "currency mismatch", I estimate equations (2.3) and (2.4) using the sub-sample of firms in the non-tradable sector (or non-exporters). Although I do not have data on currency composition of revenue, firms with FX borrowing in the non-tradable sector (or non-exporters) are more likely to have revenue in domestic currency and thus have currency mismatch. Here I define a firm as a "non-exporter" if its export share in sales is less than 10%.

Two major channels of the impact of FX lending are discussed earlier in this chapter. One is lowering of the user cost of capital (the price of borrowing) and the other is the easing of liquidity constraints (the amount of borrowing).[21] I can test the relevance of the latter channel via allowing heterogeneous effects of FX borrowing for various sub-groups of firms, with presumably different levels of liquidity constraints. Small, domestic and non-trading firms are usually regarded to be more liquidity constrained. Therefore, to test the importance of the liquidity constraint channel, I estimate specifications with interaction terms of the indicator variable for FX borrowing with measures of firm size, foreign ownership or exporting status.

[21] The failure of UIP results in lower user cost for foreign currency loans.

FX borrowers perform worse in crisis time?

The recent published 2012-2013 BEEPS survey data allows me to examine the impact of FX borrowing on firm outcomes in the aftermath of recent financial crisis, instead of just in tranquil times. Sales growth rates from 2008 to 2011 are available, which provides the possibility to study FX lending dynamics and vulnerabilities from currency mismatch. The balance sheet channel affects all firms indebted in foreign currency. A firm is affected if it had foreign currency loans in 2008, while the FX borrowing dummy takes value zero for all those who had no FX loans in 2008. Specifically, I estimate the following cross-sectional regression to test whether FX borrowers have a worse performance in 2011 compared with 2008[22]:

$$\Delta ln(Sales_{i,c,j,t}) \quad = \quad \beta_1 FX_{i,c,j} \times Z_{i,c,j} + \beta_2 FX_{i,c,j} + \gamma Z_{i,c,j} + \phi_{j,c} + \varepsilon_{i,c,j} \quad (2.5)$$

The left-hand side variable $\Delta ln(Sales_{i,c,j,t})$ is the sales growth of firm i, in country c, in sector j between 2008 and 2011 (within-firm variation). On the right-hand side, I interact several firm characteristics Z with the FX borrowing dummy, which equals one if the firm has a foreign currency loan in 2008. I include country-sector fixed effects. Firm characteristic vector Z includes firm's size, foreign ownership and exporting status.

[22]Currently, investment data is only available for 2008 survey and not for 2012 survey, so I have to use sales growth as performance measure.

2.4.4 Propensity Score Matching

In order to address limitations of the linear regressions (assumption on linear treatment effect) described in sections 2.4.2 and 2.4.3, I implement a propensity score matching procedure (PSM) designed to explicitly match firms that are similar in their likelihood of borrowing in foreign currency. The basic idea is to simulate a randomized experiment, in which "treated" and "control" firms are paired. Then I compare the means, across the treated and the control groups, of the outcome variables of interest.

Specifically, the propensity matching procedure follows three steps. First, I use a logit model to estimate the probabilities of FX borrowing, i.e. propensity scores, for the full sample and currency mismatch sample (no FX revenue). The logit is based on firm characteristics and industry-country fixed effects. Second, I group observations into intervals with similar propensity scores (propensity score strata), and test whether the means of each right-hand side variable are equal across treated and non-treated units within each stratum. Third, I construct the relevant control group for each treated firm using a proximity measure based on propensity scores, and compare the mean of the outcome variables of interest. For the proximity measure, I use the kernel matching estimator proposed by Heckman et al. (1998).

2.5 Empirical Results

2.5.1 Which Firms Borrow in Foreign Currency?

Following the empirical strategy in Section 2.4.1, Table 2.8 provides estimation results for Equation (2.1), in which FX loan dummy is regressed on firm and loan characteristics using a Probit model. Columns (1) to (3) report results for the whole sample and for sub-sample of small firms and large firms, respectively. Small firms are defined as firms with less than 100 employees.

Generally speaking, the estimates displayed in Table 2.8 confirm that foreign currency borrowing is systematically related to indicators of foreign currency revenue. Exporters and foreign firms are more likely to obtain foreign currency loans. Moreover, I find a significant positive correlation between size (in terms of annual sales) and the probability of FX borrowing. The age of the firm has no additional effect once I control for sales. Finally, I find that loans with a longer maturity are more likely to be in a foreign currency, implying that banks are particularly reluctant to lend long-term in local currency. Only 25% of loans with less than one year maturity are denominated in foreign currency, while 35% of three-year loans are in FX. The coefficient on *Collateral* is only significant for large firms, where loans with a collateral requirement are more likely to be in local currency.

Table 2.8: Firm-level determinants of FX borrowing

Dependent variable	$Prob(loan\ in\ foreign\ currency)$		
Sample	All firms	SME	Large firms
	(1)	(2)	(3)
Exporter	0.40***	0.39***	0.40***
	(0.069)	(0.081)	(0.153)
Foreign firms	0.43***	0.55***	0.46***
	(0.12)	(0.15)	(0.22)
ln(sales)	0.088***	0.086***	0.131***
	(0.017)	(0.022)	(0.046)
ln(age)	-0.01	-0.02	0.01
	(0.055)	(0.064)	(0.135)
Collateral	-0.068	-0.001	-0.363*
	(0.081)	(0.092)	(0.205)
Maturity	0.005***	0.005***	0.006***
	(0.001)	(0.001)	(0.002)
Observations	3389	2726	580
Adjusted R-squared	0.294	0.304	0.295
Country-sector fixed effect	Yes	Yes	Yes

Notes: This table reports the firm-level and loan-level determinants of foreign currency borrowing in a probit model. The dependent variable is a dummy equal to 1 if the loan is denominated in foreign currency. Firm-level characteristics include exporter dummy, foreign firm dummy, sales, firm age. Loan-level characteristics include whether collateral is required and the maturity (in months). Each regression includes country-sector fixed effect. Robust standard errors in parentheses*** p<0.01, ** p<0.05, * p<0.1.

2.5.2 Violation of Uncovered Interest Rate Parity

Can foreign currency borrowing enable firms to borrow at a lower interest rate? Table 2.9 reports the results of estimating equation (2.2), for the samples of all firms, small firms and large firms. The estimates suggest that interest rates on foreign currency loans are between 1.9% to 2.3% lower than the interest rates on domestic currency loans. This effect is significant at the 1% level in all specifications, and the difference between foreign and domestic currency interest rates is larger among small firms compared to large firms. Getting access to foreign currency loans could help small firms more than large firms in emerging Europe. In addition, larger firms pay a lower interest rate as expected.

Another important control variable is foreign ownership. In columns (1) to (3), the "foreign ownership" measure can take any value between 0 and 100 representing the percentage of capital owned by foreign investors at the survey date. In columns (4) to (6), "Foreign-owned" is a dummy that takes the value of one if the company is majority owned (more than 50%) by a foreign investor and zero otherwise. I find evidence that foreign owned firms on average have a lower interest rate (e.g. 0.94% lower in Column 1 and 0.62% lower in Column 4). However, the effect is not significant in the sub-sample of small firms. This supports the assumption that the cost of credit is lower for foreign-owned firms than domestic firms, both for exporters and non-exporters, after controlling for firm size and age and other collateralization

requirements.[23]. Since a high currency depreciation rate would translate to a higher real interest rate paid by a foreign currency borrower, in the table I have adjusted the reported interest rate by adding the local currency depreciation rate ε if the loan is borrowed in foreign currency (in other words, I use $r^* + \varepsilon$ to include the depreciation risk). I still find that foreign currency borrowing is a cheaper source of credit, which implies $r > r^* + \varepsilon$.

2.5.3 The Impact of FX Lending Before the Crisis

Sales growth

First, I investigate whether borrowing in foreign currency contributed to higher sales growth before the crisis. The results for Equation (2.3) are shown in Table 2.10. The key variable *"FX"* is a dummy whether the firm has borrowed in foreign currency in 2004. Regression results indicate that firms with FX borrowing generally enjoy a higher sales growth rate. Columns (2) and (3) show the results for the sub-samples of non-tradable sector firms and non-exporting firms, which are more likely to have a currency mismatch. Specifically, column (2) uses the sample of firms who report a larger than 50% revenue share from the non-tradable sector, while firms in column (3) have export shares less than 10%. The results are relatively robust across the three columns. On average, firms with foreign currency borrowing have a higher three-year sales growth rate by 6% to 7%. In addition, the results show younger

[23]I tried another regression based on the sample of exporters and non-exporters, and get a similar result as in Table 1

Table 2.9: Interest rate and Foreign currency borrowing

Dependent variable	Interest rate on loan reported in BEEPS survey, adjusted for expected depreciation					
Sample	All	Small firms	Large firms	All	Small firms	Large firms
	(1)	(2)	(3)	(4)	(5)	(6)
foreign currency dummy	-2.17***	-2.23***	-1.93***	-2.19***	-2.25***	-1.99***
	(0.27)	(0.30)	(0.67)	(0.27)	(0.30)	(0.67)
log of sales	-0.40***	-0.28***	-0.60***	-0.42***	-0.29***	-0.61***
	(0.07)	(0.10)	(0.18)	(0.07)	(0.10)	(0.18)
log of firm's age	-0.11	0.043	-0.2	-0.092	0.051	-0.17
	(0.15)	(0.19)	(0.29)	(0.15)	(0.19)	(0.29)
maturity of loan	-0.0038	-0.0063*	-0.00087	-0.0036	-0.0062*	-0.00025
	(0.00)	(0.00)	(0.01)	(0.00)	(0.00)	(0.01)
foreign_ownership (0-100)	-0.0094**	-0.0082	-0.011			
	(0.00)	(0.01)	(0.01)			
foreign_owned dummy				-0.62*	-0.51	-0.60
				(0.35)	(0.44)	(0.67)
collateral: land_building	0.43*	0.49*	0.73	0.42*	0.49*	0.73
	(0.24)	(0.29)	(0.61)	(0.24)	(0.29)	(0.61)
collateral: equipment_	-0.56*	-0.69*	0.017	-0.54*	-0.67*	0.026
	(0.32)	(0.38)	(0.61)	(0.32)	(0.38)	(0.61)
collateral: account receivable	0.22	0.93*	-1.47	0.22	0.94*	-1.48
	(0.86)	(0.55)	(2.22)	(0.86)	(0.55)	(2.24)
Observations	2,345	1,723	622	2,345	1,723	622
Adjusted R-squared	0.546	0.569	0.528	0.545	0.569	0.526
Country-year fixed effect	Yes	Yes	Yes	Yes	Yes	Yes
Sector-year fixed effect	Yes	Yes	Yes	Yes	Yes	Yes

Notes: This table reports interest rate differences between the loans denominated in local currency and foreign currency, based on loan-level data reported by firms in BEEPS survey. Results are reported for the whole sample, and subsamples of large and small firms. Foreign ownership, firm size and firm age are included as firm-level control variables. Maturity and collateral requirement are used as loan-level control variables. Country-year and sector-year fixed effects are controlled. Robust standard errors in parentheses. Significant level: *** p<0.01, ** p<0.05, * p<0.1.

Table 2.10: Sales growth and FX borrowing

Dependent variable	Sales growth rate in 2004- 2007		
Sample	All firms	Non-tradable sector	Non-exporters
	(1)	(2)	(3)
FX	6.74***	6.82**	6.00**
	(2.12)	(3.36)	(2.42)
Foreign	0.016	0.017	-0.007
	(0.037)	(0.057)	(0.052)
Firm size (log)	0.62	0.45	0.52***
	(0.52)	(0.73)	(0.59)
Firm age (log)	-3.86***	-4.81***	-3.65***
	(1.13)	(2.11)	(1.50)
Observations	2793	1404	2016
Adjusted R-squared	0.194	0.217	0.242
Country-sector fixed effect	Yes	Yes	Yes

Notes: This table reports the results on the impact of foreign currency borrowing on sales growth rate before the crisis (2004-2007). Results are reported for the whole sample, and subsamples of non-tradable sectors, non-exporters, as currency mismatch is more relevant for firms with no foreign currency revenue. Foreign ownership, firm size and firm age are included as control variables. Robust standard errors in parentheses. Significant level: *** p<0.01, ** p<0.05, * p<0.1.

firms are associated with a higher growth rate in sales before the financial crisis in 2008.

Investment rate

The results for the investment rate in equation (2.4) are shown in Table 2.11. The results indicate that firms with FX borrowing in 2004 on average have a higher investment rate. Access to foreign currency credit could translate to a higher investment rate in the credit boom period before 2008. Columns (2) and (3) show the result for the sub-sample of non-tradable sector firms and non-exporting firms, which are more likely to have a currency mismatch. Specifically, column (2) uses the

sample of firms who report larger than a 50% for share of revenue from non-tradable sector, while firms in column (3) have export shares less than 10%.

The result in column (1) shows that on average, the investment rate of firms that took foreign currency loans to finance their investment was around 7% higher compared to firms without dollar debt. The coefficient for foreign ownership is not significant. It implies that the investment rate in foreign-owned firms who hold FX debt is not significantly different from the rate in domestic firms who hold FX debt. Once the firm can get access to foreign currency credit, foreign ownership has no additional effect on firm's investment.

For non-exporters, FX borrowers have a higher investment rate by 8.1% as shown in column (3). The coefficients for control variables show that firms with larger sales in 2004 and younger firms have a higher investment rate before the financial crisis in 2008. In addition, there is evidence that more financially constrained firms (firms that are both small and non-exporters) could benefit more from access to FX loans. FX borrowers among small and non-exporters have a higher investment rate by 8.5% as shown in column (4). This suggests that the liquidity easing channel was at work. This evidence is consistent with the findings in Ranciere et al. (2010).

2.5.4 Propensity Score Matching Results

To better test the relationship between foreign currency borrowing and terms of borrowing or firm's performance, I implement a propensity score matching method

Table 2.11: Investment rate and FX borrowing

Dependent variable	Investment rate in 2007			
Sample	All firms	Non-tradable sector	Non-exporters	Small and Non-exporters
	(1)	(2)	(3)	(4)
FX	7.11***	6.89***	8.07***	8.47***
	(2.12)	(2.33)	(2.84)	(2.69)
Foreign	-0.027	-0.032	-0.026	-0.036
	(0.039)	(0.053)	(0.054)	(0.059)
Firm size (log)	1.10***	2.05***	1.61***	1.10**
	(0.47)	(0.65)	(0.43)	(0.67)
Firm age (log)	-7.13***	-6.55***	-5.82***	-2.21***
	(0.96)	(1.17)	(1.23)	(0.76)
Observations	2779	2074	2000	1632
Adjusted R-squared	0.216	0.245	0.197	0.261
Country-sector fixed effect	Yes	Yes	Yes	Yes

Notes: This table reports the results on the impact of foreign currency borrowing on investment rate in 2007, the last year before the crisis. Results are reported for the whole sample, and subsamples of non-tradable sectors, non-exporters and small and non-exporters. Small firms are defined as firms with less than 100 employees. Robust standard errors in parentheses. Significant level: *** p<0.01, ** p<0.05, * p<0.1.

(PSM) as discussed in Section 4 to deal with selection bias. The PSM estimation is based on propensity scores estimated from a logit regression of FX borrowing on firm-level characteristics and industry-country fixed effects[24].

Table 2.12 presents differences in means between the treated group (with an FX loan) and the control group (without an FX loan) for interest rate, maturity, growth in sales, growth in employment, growth in investment. These differences in means measure the average treatment effect on the treated group. In columns (4)-(6), I use the subset of small and non-exporter firms to target firms with "currency mismatch", since these firms have little foreign currency revenue.

The matching results show that interest rates are 2.5% lower for firms with FX borrowing. Focusing on the currency mismatch sample (small and non-exporter firms) leads to a higher difference in interest rates between treated and control firms (3.1% vs. 2.5%). Borrowing in foreign currency is also associated with 14 months longer in loan maturity.

2.5.5 Sales Growth in the Aftermath of Crisis

To capture the balance sheet effects caused by currency depreciation during the crisis, I measure the difference in sales growth from 2008 to 2011 across affected and unaffected firms, where I measure FX borrowing in 2008. To control for foreign currency revenue, exporting status and foreign ownership are introduced among the control variables, and I also include interactions of these controls with FX borrowing

[24]The control variables in the logit regression include: foreign ownership, exporter dummy, log of sales, log of age as well as industry-country fixed effect.

Table 2.12: Propensity score matching estimation results

Sample	All firms			Small and Non-exporters		
Variables	Mean treated group (1)	Mean matched control group (2)	Difference treated-matched ATE (3)	Mean treated group (4)	Mean matched control group (5)	Difference treated-matched ATE (6)
Interest rate on last loan	11.37	13.83	-2.46***	11.35	14.41	-3.06***
			(0.45)			(0.43)
Maturity on last loan	43.78	29.26	14.52***	44.27	29.90	14.36***
			(2.55)			(2.50)
Mean growth in sales (2004-07)	0.193	0.147	0.047***	0.192	0.152	0.040**
			(0.021)			(0.021)
Mean growth in employment (2004-07)	0.189	0.225	-0.036	0.190	0.210	-0.020
			(0.040)			(0.039)
Mean investment rate (2007)	0.232	0.207	0.025	0.228	0.242	-0.014
			(0.071)			(0.071)
	Treated	Control	Total	Treated	Control	Total
Observations	366	1004	1370	359	876	1,236

Notes: The PSM estimation is based on propensity scores estimated from a logit regression of foreign currency borrowing on firm-level characteristics and industry-country fixed effects. ATE: average treatment on treated. Standard errors are in parentheses. Significant level: *** p<0.01, ** p<0.05, * p<0.1

Table 2.13: Balance sheet effects: impact of FX loans during crisis

Dependent variable	sales growth within the firm		
with interaction terms	(1)	(2)	(3)
FX	-7.70***	-4.77***	-5.09***
	(3.36)	(1.53)	(1.58)
FX×firm size	0.89***		
	(0.27)		
FX×dummy: foreign owned		4.83***	
		(1.33)	
FX×dummy: exporter			3.36***
			(1.02)
Observations	3570	3570	3570
Adjusted R-squared	0.070	0.077	0.073
Country-sector fixed effect	Yes	Yes	Yes

Notes: This table reports the results on the impact of foreign currency borrowing on sales growth rate during the crisis time. The dependent variable is the within-firm sales growth rate between 2008 and 2011. FX is a dummy for whether the firm has borrowed in foreign currency. Robust standard errors in parentheses*** p<0.01, ** p<0.05, * p<0.1.

dummy. The results for Equation (2.5) are presented in Table 2.13. Only the results for main parameters of interest are reported, and sales, exporter and foreign-owned variables are also included without interactions.

As shown in Table 2.13, I find there is a negative and significant impact of foreign currency borrowing on the sales growth rate during the crisis period. This is consistent with the country-level data, as countries with a higher share of FX debts before the crisis suffered a deeper recession in the recent financial crisis in 2008-2010. The coefficients on interaction terms also show that larger, foreign and exporting firms with FX loans suffered a smaller decline in sales growth than other firms with FX loans. For foreign owned companies, the balance sheet effect practically disappears.

2.6 Conclusion

The productive sector in developing countries needs external finance to fund investments that contribute to output growth. FX borrowing has become an important source of external finance. Before the recent financial crisis, the share of FX loans exceeded that of domestic currency loans in many eastern Europe countries. This chapter shows that lower interest rates in foreign currency loans give firms an incentive to borrow in dollars rather than domestic currency. As a result of the sizable interest rate differentials, FX borrowing was a rather common phenomenon, even for small non-exporter firms.

However, the cheaper foreign currency debt comes at the cost of currency mismatch risk on the borrower's balance sheet. My results show that these risks are not significant in the pre-crisis period. I find that firms with currency mismatch exhibit faster sales and investment growth during this period. In addition, I use the recent round of survey data to cover the immediate run-up and aftermath of the recent financial crisis. The recent period is particularly interesting for studying FX lending dynamics and vulnerabilities from currency mismatch in this region. Results show that foreign currency credit is associated with a lower sales growth rate between 2008 and 2011. An interesting avenue for future work is to investigate whether FX lending is largely supply driven. Is FX lending in Eastern Europe driven by domestic banks or foreign bank subsidiaries with access to FX funding? Bank level data are needed to answer these questions from the supply side.

Chapter 3: Can Monetary Expansion Keep Zombie Firms Alive? Evidence from China (co-authored with Wei Guo and Calvin Dun Jia)

3.1 Introduction

Following the collapse of the bubble economy in the early 1990s, Japan experienced a decade of economic recession. During this period, many Japanese banks continued to lend to otherwise insolvent firms ("zombie firms"). As China's growth has slowed after the global financial crisis, an army of "zombie firms" has also emerged. The term "zombie firms", as first mentioned in literature by Kane (1987), refers to firms that would go bankrupt due to poor earnings and heavy indebtedness but survive only with external support from governments or the financial sector. The government wants to keep zombie firms alive because it worries about the rampant unemployment and loss of tax revenue when these firms are wiped out. The banks are willing to lend because they do not want to see their earnings fall when forced to record losses and make provisions for bad debts.[1] Both the government and the banks try to help these firms in the hope that there will be a market rebound soon.

[1]This is similar to Japan's zombie lending experience in the 1990s.

Unfortunately, zombie firms can hold back economic recovery in China. Their existence is likely to prevent resources from being reallocated to more productive industries and firms, resulting in an uneven playing field and making stimulus policy less effective. Although China's stimulus plan triggered an unprecedented credit flow to the real economy through the banking system, it could be the case that zombie firms absorbed more credit flow relative to healthy firms. Senior leaders in China have pledged to phase out poor-performing zombie enterprises. Closing companies with overcapacity is a priority of the government's "supply-side reform" strategy. But before the implementation of reforms, we should understand what zombie firms look like in China, who are they, what are the distortionary effects of zombie firms?

Historically, the distortionary effects of zombie firms on healthy firms have been analyzed mainly in the context of the Japanese economy in the 1990s (Caballero et al. (2008); Peek and Rosengren (2005); Hoshi (2006)). These studies have focused on forbearance lending, which helped inefficient firms, as the main reason that zombie firms were kept alive. Recently zombie firms have been discussed in several studies in a number of countries, including Korea (Bank of Korea, 2013), the United Kingdom (Bank of England, 2013), Southern Europe (Acharya et al. (2016)), and OECD countries (Adalet McGowan et al. (2017)). But there is little systematic research on the issue of zombie firms in China, despite its importance for policy making.

In this chapter, we use a large representative panel data of Chinese manufacturing firms over 1998-2013 to conduct a systematic study of zombie firms in China. First, we calculate the share of the "zombie firms" in China by applying a modified framework based on Caballero et al. (2008) as a definition for zombie firms. We

find that the overall percentage of zombie firms in China reached around 10%-20% during 2005 to 2013. We also show that the prevalence of and resources sunk in zombie firms have risen following the stimulus plan after the financial crisis.

Second, after describing the summary statistics, we investigate the effects of identified monetary shocks on the performance of zombie firms, to see if expansionary monetary shocks help zombie firms to survive and expand. We find that the monetary stimulus plan after the crisis tend to push banks to distribute bank loans and capital in favor of zombie firms. The performance of zombie firms (in terms of employment and output growth, credit access and investment rate) is more responsive to the policy stimulus relative to non-zombie firms. Third, we study the crowd-out effects from the existence of zombie firms. Generally, we find that the existence of zombie firms inhibits the performance of non-zombie firms, consistent with the Japanese literature. After controlling for cyclical influences at the city-industry level, within-industry analysis shows that a higher share of industry capital sunk in zombie firms tends to crowd-out the credit access and investment rate of the typical non-zombie firm. Assuming a causal relationship, our estimates imply that a 1% increase in an industry's zombie share would be associated with a 0.3% decline in short term borrowing and around a 0.5% decline in the investment rate for a typical non-zombie firm. Besides limiting the expansion of healthy incumbent non-zombie firms, market congestion generated by zombie firms can also create barriers to entry. Consistent with the findings in a recent OECD report (Adalet McGowan et al., 2017), our results show that zombie congestion tends to widen the average TFP gap between zombie and non-zombie firms. This larger TFP gap arises since entrants

must clear a higher productivity threshold to survive in an environment with more zombie firms and lower market profitability, as zombie firms congestion may inflate wages and depress market prices and non-zombie market shares.

The next section describes the firm-level data and provides descriptive evidence on zombie firms in China. Section 3.3 outlines the empirical specification used to estimate the responsiveness and survival of zombie firms to stimulus plan, and to estimate the distortionary effects of zombie firms on non-zombie firms' performance and patterns of productivity-enhancing capital reallocation. Section 3.4 discusses the results. The final section provides concluding remarks and highlights the relevance of the findings for policy and future research.

3.2 Data and Identification of Zombie Firms

3.2.1 Firm-level Data

Our data for Chinese firms are from China Annual Surveys of Industrial Firms (CASIF) from 1998 through 2013. These surveys are conducted by the Chinese government's National Bureau of Statistics. CASIF is a (truncated) census of all non-state firms with more than 5 million yuan in revenue (about $600,000) plus all state-owned firms. The revenue cutoff threshold increases to 10 million yuan (about $1.2 million) in later years after 2007. The raw data consist of 100,000 - 150,000 firms before 2004 and grow to 200,000 - 300,000 firms in the years after 2004.

Firm-level data from 1998-2007 in this database has been widely used in the literature; see the detailed description in Chapter 1. This chapter is the first research to use the newly released data covering the later years from 2008 to 2013.

3.2.2 Definition of Zombie Firms

Previous studies proposed different methods for identifying zombie firms, ranging from less restrictive (firms with negative profits) to more restrictive (firms likely receiving subsidized credit, mainly focusing on listed firms). We follow Caballero et al. (2008) as a baseline criterion to identify a firm as a zombie if its interest payments are lower than its hypothetical minimum interest payments without any concessions. We try to use the same definition as they created for listed firms in Japan, but it is hard to replicate exactly with the variables available in Chinese firm-level data, as their definition requires very detailed information on the firm's debt distribution, in terms of bank loans and corporate bonds with different maturities. We modify their original definition based on listed firms in Japan to make it feasible for manufacturing census data in China, which is a much broader sample.

In addition, we refine the definition used in Fukuda and Nakamura (2011). They propose to additionally consider (1) insolvency and (2) "ever-greening" of loans, because identifying zombie firms based only on interest payment information is prone to the following two types of error. First, healthy firms would be wrongly identified as zombies if the interest rates they pay are below prime lending rates because of their low credit risk or political favors. Second, zombie firms could be wrongly

identified as non-zombies if they pay interest at market interest rates as a result of receiving new loans for the repayment of old loans ("ever-greening"). Here is the detailed three-step procedure used to identify zombie firms in the firm-level dataset.

Step 1: Estimate the minimum required net interest payment of firm i in year t, $R^*_{i,t}$, which is defined as:

$$R^*_{i,t} = r^{ST}_{t-1} SD_{i,t-1} + r^{LT}_{t-1} LD_{i,t-1} - R^{Adj}_{i,t} \tag{3.1}$$

where $SD_{i,t}$ denotes short-term debt minus accounts payable, taxes payable and other payable items which approximately measures short-term bank debt, and $LD_{i,t}$ denotes long-term liabilities. r^{ST}_t and r^{LT}_t are the average short-term and long-term prime rate in year t. Interest rates historically are regulated in China. The People's Bank of China has set the lower limit of lending rate as 0.9 times the benchmark rate until 2013, which is the prime rate. The last term, $R^{Adj}_{i,t}$ measures firm's interest earning from bank deposits. Specifically, $R^{Adj}_{i,t}$ is estimated as follows:

$$R^{Adj}_{i,t} = r^D_t (LA_{i,t-1} - AR_{i,t-1} - Inventory_{i,t-1}) \tag{3.2}$$

where LA, AR, $Inventory$ are, respectively, firm's liquid assets, accounts receivable, and inventory, and r^D is the one-year bank deposit rate.

Step 2: Comparing the actual net interest payment of the firm, $R^{Pay}_{i,t}$, and the minimum required net interest payment $R^*_{i,t}$, and standardizing using loans in the previous period ($B_{i,t-1} = SD_{i,t-1} + LD_{i,t-1}$), the interest rate gap is:

$$Gap_{i,t} = (R^{Pay}_{i,t} - R^*_{i,t})/(SD_{i,t-1} + LD_{i,t-1}) \tag{3.3}$$

Following Caballero et al. (2008), if $Gap_{i,t} < 0$, firm i has received subsidized borrowing, and we define the zombie indicator to be 1; otherwise the zombie indicator is 0.

Step 3: Refine the "zombie" definition following Fukuda and Nakamura (2011) to additionally consider insolvency and "ever-greening" of loans.

- First, we adjust firms' zombie indicator based on their profitability. If firm i is classified as a zombie in baseline criterion, but its profit is greater than the gap between the minimum required net interest payment and actual net interest payment, i.e. $Profit_{i,t} + R_{i,t}^{Pay} \geq R_{i,t}^{*}$, then we reclassify firm i as a non-zombie firm to correct the Type-1 error (False zombie).

- Second, to control for evergreen loans among non-zombie firms as defined in the baseline criterion, we provide the following modification. If (1) a firm's debt ratio is over 50% ($Total\,Debt/Total\,Asset > 50\%$: high-leverage); (2) actual annual profit is negative, where actual profit means book profit net of fiscal subsidies and tax rebates; and (3) debt is still increasing ($\Delta Total\,Debt > 0$: total outstanding debt at the end of year t is higher than the long-term debt at the end of year $t-1$), we reclassify this firm as a zombie to correct the Type-2 error (False non-zombie). That is, zombie firms are those that are capable of obtaining more debt although they are already highly leveraged and have no potential to repay that debt (negative profit).

- In addition, we also apply the continuity criterion. We impose a three-year restriction to capture a prolonged liquidity problem, which presumably stems

from a solvency problem. If firm i is defined to be a zombie for three consecutive years, then set zombie dummy to be 1. Otherwise, set it to be 0.

We apply this definition to the Chinese manufacturing census data, and find that the overall percentage of zombie firms has actually been quite high in recent years. Figure 3.1 plots the share of zombie firms over 1999 to 2013. Since the variable "accounts payable" is only available for years 2005-2013, we can not adjust for accounts payable in the calculation of short-term debt before 2005. Therefore zombie firm shares tend to be overestimated between 1999-2004, as the minimum required net interest payment is overestimated.

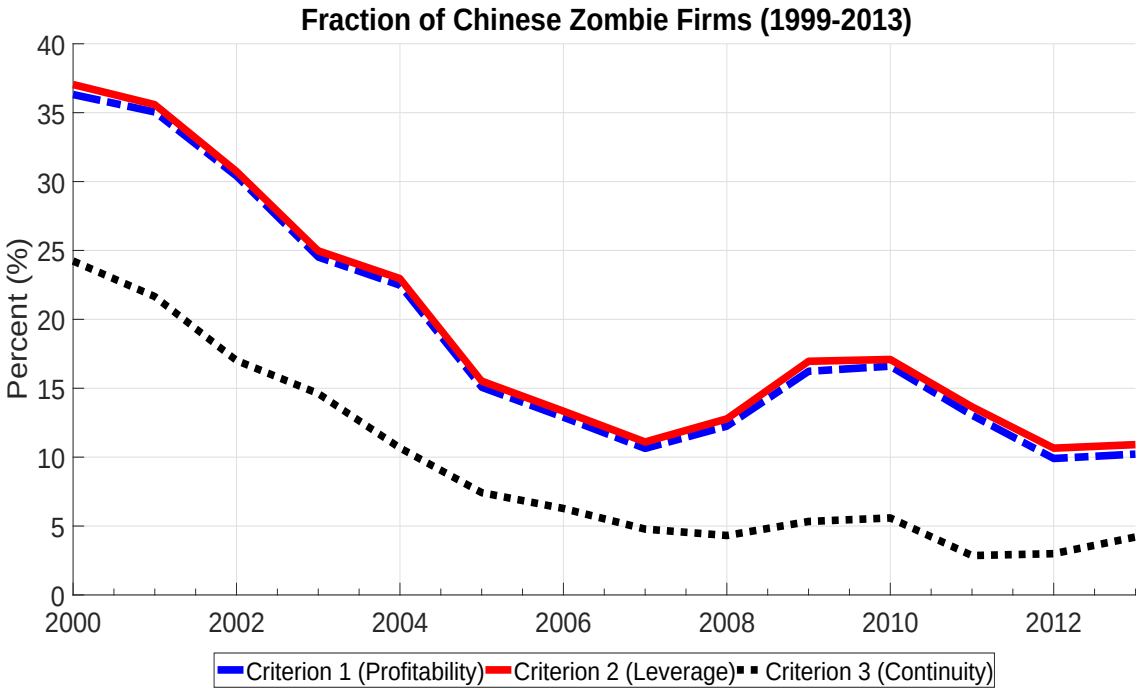
Therefore we focus on the period after 2004. Table 3.1 reports the zombie firm shares (according to the zombie definition criterion following Fukuda and Nakamura, 2011) in terms of number of firms and weighted by employment, debt and capital stock during 2005-2013. Although the zombie share declined before the crisis in 2005-2007, it increased from 13% to 19% after the stimulus plan in 2008.

Table 3.1: Proportion of zombie firms by year

Year	Total obs.	% Firms	% Employment	% Debts	% Capital
2005	278,490	18.0%	17.4%	22.0%	16.9%
2006	306,117	15.8%	14.9%	17.4%	13.7%
2007	341,516	13.1%	11.3%	13.3%	10.5%
2008	364,086	14.7%	13.1%	16.3%	12.8%
2009	225,666	19.4%	15.2%	15.1%	14.2%
2010	308,876	16.0%	13.2%	15.6%	12.0%
2011	292,975	14.8%	14.7%	15.7%	15.0%
2012	322,241	10.6%	12.6%	18.2%	17.9%
2013	319,839	10.8%	11.5%	15.1%	13.8%

Source: Authors' estimation. The last four columns report the proportion of zombie firms in terms of number of firms, employment, total debts and capital (fixed assets) among all the firms in the data sample.

Figure 3.1: Proportion of zombie firms by year



Source: Author's calculation. Criterion 2 is used as the benchmark zombie firm definition in this chapter.

We calculate the proportion of zombie firms for every two-digit level industry and find the proportion of zombie firms has significant industry heterogeneity. Table

Table 3.2: Industries with high proportion of zombie firms

Industry Code	Industry	Proportion
28	Manufacture of Chemical fibers	21.0%
14	Manufacture of foods	18.0%
40	Manufacture of Communication Equipment	17.9%
36	Manufacture of Special Purpose Machinery	17.8%
17	Manufacture of Textiles	16.4%
32	Smelting and Processing of Ferrous Metals	16.3%
25	Processing of Petroleum, Coking	16.1%

Source: Authors' estimation. Industry refers to 2-digit level detail according to NACE Rev.2, covering manufacturing sector (industry codes 06-42).

3.2 shows that the proportion of zombie firms is higher in heavy chemical industries. This is consistent with the fact that heavy chemical industries are strongly supported by governments of various levels, and they are the main borrowers in the financial markets. Therefore, both governments and banks are unwilling to see the collapse of these firms. Some labor-intensive industries also have a higher share of zombie firms, such as the "textile industry" and "manufacture of foods". Local governments try to support these firms due to their political responsibility for maintaining employment, since these firms hire a relatively large share of the local labor force.

3.2.3 Monetary Policy Shock in China

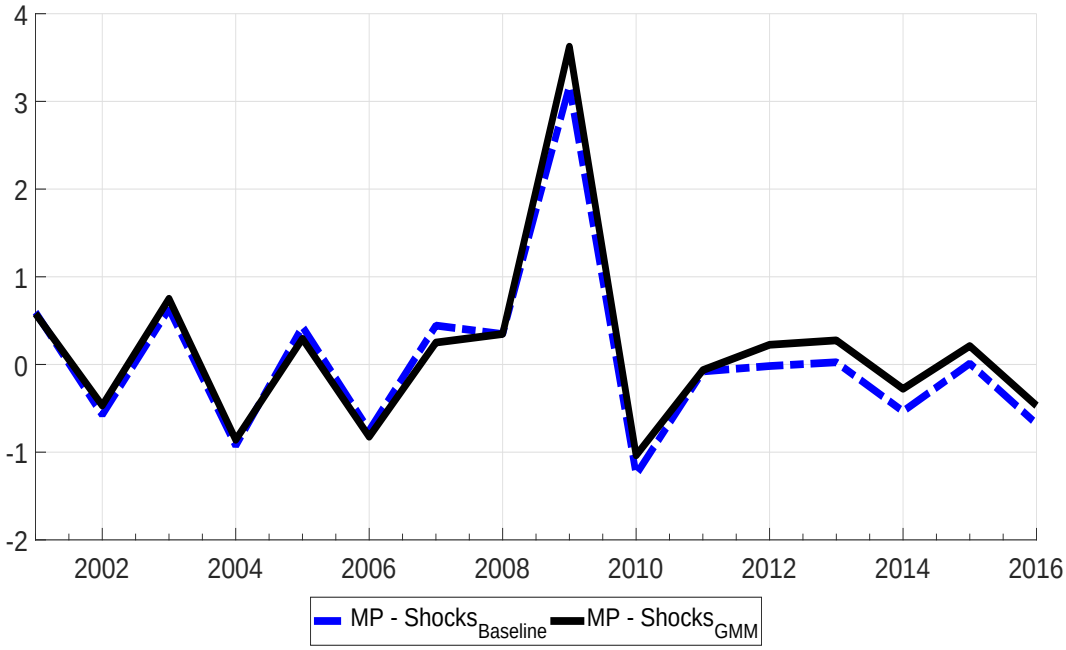
China's monetary policy is quantity-based, in contrast to the interest rate based policy in the US. One unique feature of monetary policy in China is their use of M2 growth as a policy instrument to stabilize macroeconomic fluctuations.[2] Furthermore, the Chinese financial system is dominated by commercial banks, and

[2]In 1999, the People's Bank of China officially switched monetary policy from controlling bank credit to controlling M2 growth.

the M2 growth rate is closely connected to the lending behavior of commercial banks. A higher M2 growth rate implies banks would lend more and there is a positive credit supply shock.

Following Chen et al. (2016), we estimated a monetary policy reaction function with asymmetric responses to output gaps using quarterly data ranging from 1999Q1 to 2016Q4, using the PBOC's stated main policy instrument, M2 growth. Similar to Chen et al. (2016), we find that M2 in China increases when GDP growth falls short the national target set by the central government while it slows down when the GDP gap is widened. We take the residuals from estimations with Markov Regime-switching as China's monetary policy shocks. For robustness, we also estimated a standard Taylor-type M2 growth reaction function to the inflation rate and the GDP growth rate using GMM. In Figure 3.2, we find the identified monetary policy shocks are extremely close to each other using either scheme. There was an expansionary spike of in monetary policy occurring in 2009. In the aftermath of the unprecedented stimulus in 2009, the central bank pursued contractionary monetary policy by tightening M2 supply after 2010.

Figure 3.2: M2 growth shocks in China



Note: Estimations based on quarterly data from 1999Q1 to 2016Q4

3.2.4 Descriptive Statistics

Table 3.3 presents the mean of key firm characteristics for all zombie firms and the corresponding statistics for all non-zombie firms included in our sample universe. To facilitate comparison, we also compute mean differences between these two sub-samples and report the p-values of t-tests. The table indicates that zombie firms are (on average) very different from non-zombie firms. Zombie firms on average are less productive (in terms of labor productivity) and have significantly higher levels of debt, higher leverage ratios (0.63 vs. 0.51), higher shares of long-term debt among all debts (10% vs 7%) and lower profitability ratios. In addition, zombie firms are more capital intensive (higher capital-to-labor ratio), more likely to be state-owned and older.

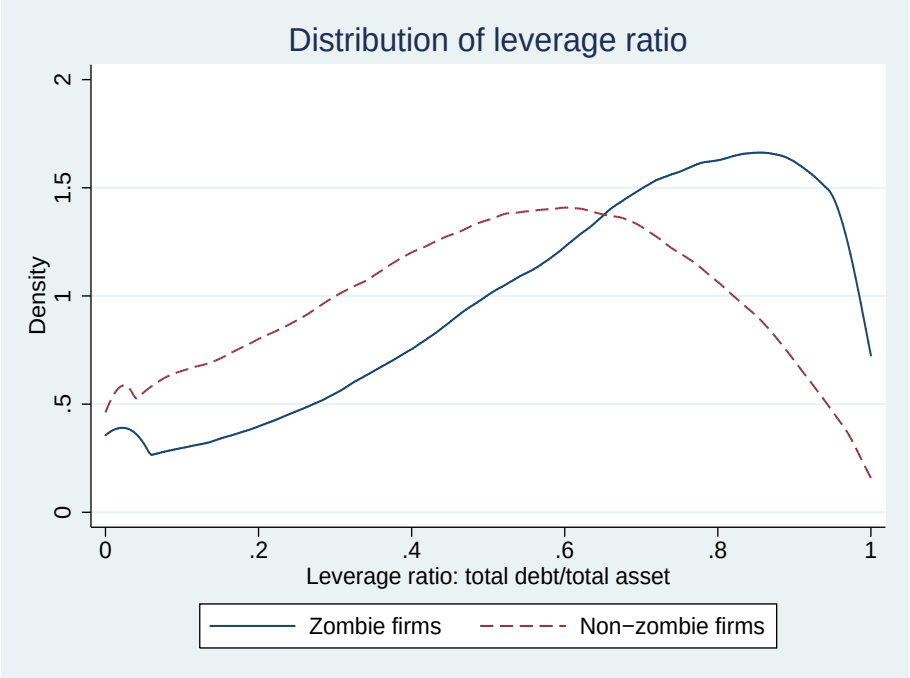
Table 3.3: Sub-sample mean comparison: zombie vs. non-zombie firms

Variables (mean)	Non-Zombies	Zombies	diff	p-value
Employment (log)	5.08	4.96	0.11	0.00
Output (log)	10.70	9.97	0.73	0.00
Labor productivity (log)	5.52	4.88	0.64	0.00
Capital/Labor (K/L ratio)	3.63	3.89	-0.26	0.00
Investment rate %	0.18	0.07	0.11	0.00
Short-term debt (log)	9.17	9.60	-0.43	0.00
Long-term debt (log)	2.45	3.42	-0.97	0.00
Long-term debt %	0.07	0.10	-0.03	0.00
Debt/Asset (Leverage)	0.51	0.63	-0.12	0.00
SOE dummy	0.03	0.13	-0.10	0.00
Profit rate %	0.06	-0.96	1.02	0.00
Firm age (years)	15.20	19.72	-4.52	0.00
Sample size	393,635	71,209		

Source: Authors' estimation. Sample covers 2005-2013 when we have accounts payable data available to adjust short-term debts.

Figure 3.3 compares the distributions of the leverage ratio for zombie and non-zombie firms in 2005-2013 graphically. The leverage ratio distribution of zombie firms is largely located to the right of healthy firms, implying a significant difference between the leverage ratios of zombie firms and healthy firms. We will control for this leverage ratio difference in the next step of the empirical analysis.

Figure 3.3: The distribution of the leverage ratio: zombie vs. healthy firms



Note: Leverage ratio is defined as firm-level total debt (the sum of long-term debt and short term debt) divided by total assets. Zombie dummy is defined in section 2.2.
Source: Author's calculation based on Chinese Industrial Firm-level Data.

3.3 Empirical Framework

The empirical framework uses panel data constructed from China's manufacturing census across years to explore heterogeneous responses to identified monetary shocks, and the distortionary effects of zombie firms on the performance of non-zombie firms.

3.3.1 Heterogeneous Responses to Monetary Policy Shocks

It is important to understand which type of firms is more responsive to a given monetary policy shock. We consider the following specification to check if zombie

firms disproportionately benefit from expansionary monetary shocks:

$$Y_{icst} = \alpha_i + \delta_{cst} + \beta Zombie_i \times Monetary\, shock_{t-1} + \gamma X_{icst} + \varepsilon_{icst} \tag{3.4}$$

where Y_{icst} refers to firm-level outcomes for firm i, in city c, in sector s and in year t. Here we include the growth rate of four variables, employment, output, short-term borrowing, long-term borrowing and the level of investment rate. Policy stimulus could increase output and employment, which are the aims of government stimulus. Therefore, we will test the effect of policy stimulus on firms' output and employment growth. Possible misallocation would be reflected in differential changes in borrowing capacity across firms, so we test the differential impacts of policy stimulus on growth of short-term and long-term borrowing between zombie and non-zombie firms. The investment rate (I/K) is defined as changes in fixed assets plus depreciation divided by lagged fixed assets.

$Zombie_i$ is a time-invariant dummy equal to 1 if a firm is classified as a zombie firm in the first two years. Here I do not use firms' zombie status at time t since it is more endogenous to monetary shocks. Monetary shocks are represented by the M2 growth rate shock identified from the GMM framework described in section 3.2.3. Firm controls X_{icst} include firm age and firm size. The variables $Zombie_i$ and $Monetary\, shock_{t-1}$are dropped in the baseline model, which includes interacted city, industry and year fixed effects δ_{cst} as well as firm fixed effects α_i. We focus on the coefficient of the interaction term β, to examine if zombie firms were favored under policy stimulus after the financial crisis. Our hypothesis is that zombie firms have an advantage in competing for new credit supplied by the banking system (China's

quantity-based monetary policy works through bank lending). Robust standard errors are clustered at the city level.

3.3.2 How did Stimulus Affect the Prevalence of Zombies?

In addition to studying how zombie firms respond to policy shocks relative to non-zombie firms, we also investigate the marginal effect of government stimulus on the prevalence of zombies in the province (extensive margin). We apply the following probit model:

$$Prob(Zombie_{icst} = 1) = \beta Monetary\, shock_{t-1} + \gamma X_{icst} + \delta_{cs} + \varepsilon_{icst} \tag{3.5}$$

where $Zombie_{it}$ is the firm-level zombie dummy index, and monetary shocks are represented by the M2 growth rate shock. Firm controls X_{icst} include firm age and firm size. We control for city-industry fixed effects instead of the city-industry-year fixed effects as in the previous equation. The coefficient β reflects the impact of monetary shocks on formation of zombies.

3.3.3 Zombie Congestion and Non-zombie Firm Performance

Previous theoretical models suggest that zombie firms can adversely affect the performance of non-zombie firms (crowd-out effects) and contribute to low aggregate productivity growth. There are two key channels: (i) zombie firms crowd-out credit access and investment by typical non-zombie firms, (ii) zombie firms hinder efficient resource allocation and productivity growth, either by preventing more productive firms from expansion, or preventing new and more dynamic firms from replacing

inefficient incumbents. Here we test this hypothesis in the context of the Chinese economy. We estimate the following baseline specification following Caballero et al. (2008) on the panel data of Chinese firms:

$$Y_{icst} = \beta_1 nonZ_{icst} + \beta_2 nonZ_{icst} \times Z_{cst} + \gamma X_{icst} + \delta_{cst} + \varepsilon_{icst} \tag{3.6}$$

where Y_{icst} refers to a measure of firm-level outcome for firm i, in city c, in sector s and at year t. $nonZ$ is a firm-level dummy equal to 1 if a firm is a non-zombie firm, while Z is the share of capital sunk in zombie firms for each city and industry. Firm controls X_{icst} include firm age and firm size. Equation (3.6) also includes city-industry-year fixed effects δ_{cst} to control for unobserved time-varying city-industry specific macroeconomic or regional cyclical influences. These city-industry specific cyclical influences, including the overall business environment of operating in an industry in a given city for that year, could simultaneously raise the prevalence of zombie firms and adversely affect firm performance. Robust standard errors are clustered at the city level. We focus on the interaction term of the non-zombie dummy and the city-industry level zombie shares. β_2 will be negative for borrowing and investment rate regressions if zombie congestion reduces the ability or incentives for non-zombie firms to gain access to bank financing and increase investment.

3.3.4 Zombie Congestion and Capital Reallocation

In the previous specification, we test the effect of zombies on the performance of an average non-zombie firm. Here we move one step further to see if firm pro-

ductivity heterogeneity plays a role in the distortionary effect of zombies, following the specification in Adalet McGowan et al. (2017). We test if zombie congestion disproportionately reduces the ability of more productive firms to attract capital and expand. If this is the case, then the actual distortionary effects may be larger than those captured in the "average effect". Specifically, we consider the following panel regression on the sub-sample of non-zombie firms:

$$\Delta Capital_{icst} = \beta_1 TFP_{icst-1} + \beta_2 TFP_{icst-1} \times Z_{cst} + \gamma X_{icst} + \delta_{cst} + \varepsilon_{icst} \quad (3.7)$$

where $\Delta Capital_{icst}$ refers to the growth rate of the real capital stock for firm i, in city c, in sector s and at year t. TFP is the level of total factor productivity (TFP) measured following the method in Wooldridge (2009).[3] As in the previous equation, Z is the share of capital sunk in zombie firms and firm controls X_{icst} include firm age and firm size. The equation predicts that β_1 will be positive since firms with higher TFP should attract more resources and grow faster, while β_2 will be negative if the presence of zombie firms distorts the efficiency of capital reallocation. Capital growth rates in more productive firms are more sensitive to zombie congestion.

3.4 Empirical Results

3.4.1 Heterogeneous Effects of Monetary Stimulus

Table 3.4 presents the baseline estimates of equation (3.4), which analyzes the relative responsiveness to monetary policy shocks of zombie firms. We find

[3]Firm-level prices cannot be observed, so firm-level differences in (revenue-based) TFP may also reflect differences in market power. Results are also robust if we use the OLS Solow residual to measure TFP.

that zombie firms are more responsive to monetary shocks and they indeed have an advantage in competing for new credit and investment. Columns (1) and (2) show that a positive monetary shock narrowed the gap between zombie firms and non-zombie firms. Columns (3) and (4) show that under policy driven credit expansion, new credit was allocated disproportionately more towards zombie firms, both in short-term and in long-term borrowing. Following a positive M2 growth rate shock, zombie firms also have a relatively higher investment rate as shown in Column (5). Moving relatively more credit resources to zombie firms could be one unintended consequence of loose monetary policy.

In Table 3.4, we include both leverage and interaction of leverage and monetary shock in the same regression, to allow firms with different leverage ratios have differential responses to monetary shocks. As a robustness check, we divide the sample into high-leverage and low leverage sub-samples based on the firm-level leverage ratio, and divide the sample into state-owned and non-state-owned sub-samples based on firm's ownership. After we control for the leverage ratio and ownership, we still find that zombie firms were favored in borrowing and growth under policy stimulus after the financial crisis.

3.4.2 The Impact of Monetary Stimulus on Formation of Zombie Firms

Since we find that monetary stimulus helped improve the performance of zombie firms relatively more than that of non-zombies, we expect that on the one hand, there could be more zombie firms created by loose monetary policy. On the other

Table 3.4: Zombie firms under monetary policy stimulus

"Δ": growth rate	ΔEmp.	ΔOutput	ΔST Debt	ΔLT Debt	I_t/K_{t-1}
	(1)	(2)	(3)	(4)	(5)
$Zombie_i \times Monetary\,shock_{t-1}$	0.014***	0.023***	0.011*	0.066***	0.238***
	(0.002)	(0.005)	(0.006)	(0.018)	(0.026)
$Leverage_{it} \times Monetary\,shock_{t-1}$	0.005***	0.010***	-0.182***	-0.094***	0.082*
	(0.001)	(0.003)	(0.054)	(0.027)	(0.044)
Firm FE	Yes	Yes	Yes	Yes	Yes
City-industry-year FE	Yes	Yes	Yes	Yes	Yes
Firm age, size and leverage	Yes	Yes	Yes	Yes	Yes
S.E. Clustered by	city	city	city	city	city
Observations	652,793	652,793	652,793	652,793	505,806
R-squared	0.324	0.333	0.250	0.181	0.387

Note: *Zombie* is a dummy equal to 1 if a firm is classified as a zombie firm in the first two years in the sample. Monetary shocks are represented by the M2 growth rate shock identified from the GMM framework described in section 2.3. ST debt and LT debt refer to the short-term and long-term debt on the firm's balance sheet. I/K refers to the investment rate, defined as changes in fixed assets plus depreciation divided by lagged fixed assets. Dependent variables are growth rates of employment, output, short-term debt and long-term debt in Columns (1)-(4). The outcome variable is the level of investment rate in Column (5). Clustered standard errors (at city level) are reported in parentheses. Significance levels: * (p<0.10), ** (p<0.05), *** (p<0.01). Source: NBS Manufacturing Census Data.

hand, some zombie firms may switch into being non-zombies with the help of loose monetary policy. Table 3.5 suggests that current monetary stimulus is correlated with a higher share of zombie firms, while monetary stimulus in the previous period is correlated with a lower share of zombies. However, the effects are quite small.

Most of the firm-level control variables also have the expected signs. State-owned firms are more likely than private firms to become zombies, where the magnitude of the coefficient is larger than that of other control variables. The state sector receives better credit support. In addition, firms that are older, have a higher leverage ratio and are more capital intensive have a higher probability of obtaining zombie lending.

3.4.3 Zombie Congestion, Non-zombie Firm Performance and Capital Reallocation

Table 3.6 presents the baseline estimates of equation (3.6), which analyzes the distortionary effects of zombie congestion in terms of non-zombie firm's short-term debt and long-term debt growth, investment rate and level of total factor productivity (TFP).[4] Zombie shares are measured as the share of capital sunk in zombie firms at the city-industry level.[5] The interaction terms in Column (1) and (3) show that across cities, an increase in the zombie share at the industry level is associated with lower short-term borrowing (a proxy for bank loans) and a lower

[4]This is similar to empirical results of Table 1 in Adalet McGowan et al. (2017) for zombie firm study in OECD countries.

[5]Zombie shares defined by employment share provide similar results.

Table 3.5: Probit model: Determinants of zombies

	Zombie dummy	Zombie dummy
	(1) Lagged M2 shock	(2) Current M2 shock
$M2growth\ shock$	-0.008***	0.010***
	(0.001)	(0.002)
Firm size	0.002	0.002
	(0.002)	(0.002)
Firm age	0.028***	0.028***
	(0.002)	(0.003)
SOE dummy	0.201***	0.204***
	(0.011)	(0.011)
Leverage ratio	0.045***	0.043***
	(0.007)	(0.006)
Capital intensity	0.014***	0.015***
	(0.002)	(0.002)
City-industry FE	Yes	Yes
S.E. Clustered by	city	city
Observations	446,589	446,589
Adj. R-squared	0.094	0.095

Note: Each column reports the marginal effect coefficients estimates for a probit model of determinants of zombie firms. City-industry fixed effects are included. *Firm size* is measured by the log of total assets in the last period. *Leverage ratio* is defined as total debt divided by total assets. *Capital intensity* is measured by the log of capital to labor ratio at the firm level. Clustered standard errors (at city level) are reported in parentheses. Significance levels: * (p<0.10), ** (p<0.05), *** (p<0.01). Source: NBS Manufacturing Census Data.

investment rate for the average non-zombie firm. A 1% increase in industry zombie share would be associated with a 0.29% decline in short term borrowing and around a 0.53% decline in the investment rate for a typical non-zombie firm. The effects on long-term borrowing are not significant.

The results suggest two issues. First, the prevalence of persistently weak zombie firms that do not exit the market could distort credit allocation by reducing bank credit to non-zombie firms, and the existence of zombie firms could hinder potential investment of healthy firms. Second, zombie congestion may reduce potential output growth by distorting productivity-enhancing reallocation, an issue mentioned by Adalet McGowan et al. (2017) in Section 5.2 for their study in OECD countries.

Column (4) shows that the TFP gap between zombie firms and non-zombie firms rises as the share of industry capital sunk in zombie firms rises, in line with the predictions of the model in Caballero et al. (2008). What is the possible explanation behind the widening TFP gap between zombie firms and non-zombie firms? First, distortions created by the presence of zombie firms depress productivity by preserving less productive zombie firms at the expense of more productive potential entrants. Second, since zombie firms create "congestion" and barriers to entry, the potential marginal entrants must clear a higher productivity threshold for entry to compensate for lower profitability caused by congestion.

Table 3.7 shows the results for equation (3.7), which estimates the sensitivity of the growth rate of firm's real capital stock and investment rate with respect to lagged firm TFP. The investment rate is similar to the capital growth rate, except that it includes maintenance investment to offset depreciation. We use the capital sunk in

Table 3.6: Zombie firms and non-zombie firm performance

Outcomes	ΔST Debt	ΔLT Debt	I_t/K_{t-1}	TFP
	(1)	(2)	(3)	(4)
$Nonzombie\,dummy_{it}$	0.291***	0.247***	0.479***	0.631***
	(0.038)	(0.034)	(0.048)	(0.038)
$Nonzombie\,dummy_{it} \times$	-0.292**	0.086	-0.528***	1.060***
$Industry\,zombie\,shares_{cst}$	(0.120)	(0.178)	(0.204)	(0.266)
City-industry-year FE	Yes	Yes	Yes	Yes
Firm age and size controls	Yes	Yes	Yes	Yes
S.E. Clustered by	city	city	city	city
Observations	426,448	426,448	317,734	458,599
Adj. R-squared	0.034	0.011	0.211	0.259

Note: Zombie shares refer to the share of industry capital sunk in zombie firms for each city and industry. ST debt and LT debt refer to the short-term and long-term debt (log-level) on the firm's balance sheet. I/K refers to the investment ratio. TFP is the level of total factor productivity measured following Wooldridge (2009). Firm size measured by lagged total assets and firm age are controlled. Clustered standard errors (at city level) are reported in parentheses. Significance levels: * (p<0.10), ** (p<0.05), *** (p<0.01). Source: NBS Manufacturing Census Data.

zombie firms to measure the zombie share. Results show that firms with higher TFP are able to attract more capital, which implies that capital reallocation is on average productivity-enhancing. However, the negative coefficient of the interaction term of lagged TFP and the industry zombie share suggests that a higher zombie share at the industry level is associated with less productivity-enhancing capital reallocation within industries. To sum up, zombie firms constrain the real capital growth of more productive firms, which reduces aggregate TFP via lower allocative efficiency.

3.5 Conclusion

In this chapter, we apply the framework from seminal studies of zombie firms in Japan to a broader panel data sample from the China Manufacturing Census between 1998 and 2013. We show that the number and the magnitude of undesirable

Table 3.7: Zombie firms and capital reallocation

Outcomes	real capital growth	investment rate
Sample: non-zombie firms	(1)	(2)
TFP_{it-1}	0.161***	0.701***
	(0.007)	(0.043)
$TFP_{it-1} \times$	-0.023***	-0.100***
$Industry\ zombie\ shares_{cst}$	(0.007)	(0.038)
City-industry-year FE	Yes	Yes
Firm age and size controls	Yes	Yes
S.E. Clustered by	city	city
Observations	2,089,000	1,386,945
Adj. R-squared	0.284	0.205

Note: Zombie shares refer to the share of industry capital sunk in zombie firms for each city and industry. I/K refers to the investment ratio. TFP is the level of total factor productivity measured following Wooldridge (2009). Firm size measured by lagged total assets and firm age are controlled. Clustered standard errors (at city level) are reported in parentheses. Significance levels: * (p<0.10), ** (p<0.05), *** (p<0.01). Source: NBS Manufacturing Census Data.

zombie firms increased sharply after China implemented an enormous monetary expansion right after the 2008 financial crisis. We find that these zombie firms are heavily indebted and are kept alive through continuous and distorted monetary and fiscal supports.

Next, we look at the differential responses of zombie firms and non-zombie firms to identified monetary shocks in China, in order to study how zombie firms alter the effectiveness of China's monetary policy and how monetary shocks affect the growth and survival of zombie firms. Our empirical evidence suggests that zombie firms disproportionately benefit from expansionary monetary shocks and accommodate most of the intended effects of monetary easing. This implies a trade-off between misallocation and stimulating economic policies. In addition, the prevalence of zombie firms can also crowd-out performance of non-zombie firms and exacerbate

resource misallocation even if there is no expansionary monetary shock. We show that a higher share of industry capital sunk in zombie firms is associated with lower credit access and investment rate for non-zombie firms, a larger TFP gap between zombie and non-zombie firms and less productivity-enhancing capital reallocation, measured as a decline in the ability of more productive firms to attract capital.

Appendix A: Appendix to Chapter 1

A.1 Data cleaning and summary statistics

Cleaning of basic reporting mistakes

Although the Chinese firm-level data has an original sample of more than 2,000,000 observations and contains rich information, a few variables in the dataset are noisy and could be misreported by some firms. I clean the sample for mismeasurement by using the following criteria. First, the key financial variables (such as total assets, net value of fixed assets, sales, gross value of industrial output) cannot be missing; otherwise those observations are dropped. Second, the number of employees hired for a firm must not be fewer than 8 people.[1]

In addition, following Cai and Liu (2009) and guided by General Accepted Accounting Principles, I delete observations if any of the following rules are violated: (a) the total assets must be higher than the current assets, (b) the total assets must be larger than the total fixed assets, (c) the total assets must be larger than the net value of the fixed assets, (d) the accumulated depreciation of fixed assets must

[1]Levinsohn and Petrin (2003) suggest including all Chilean plants with at least ten workers. Brandt, Van Biesebroeck, and Zhang (2012) suggest dropping firms with fewer than eight employees as such firms "register as self-employed individuals and operate under a different legal system". I follow the latter criterion that the number of employees must be larger than or equal to 8.

be larger than the current period depreciation, (e) a firm's identification number cannot be missing and must be unique, (f) a firm's sales must be no lower than RMB 1 million, (g) a firm's interest payment must be non-negative, and (h) paid-in capital cannot be negative or zero.

Further quality checks for manufacturing firms

Here I follow the online appendix in Gopinath, Kalemli-Ozcan, Karabarbounis and Villegas-Sanchez (2015) to examine the quality of variables for firms in China's manufacturing sector.

Net worth: I construct net worth as the difference between total assets and total liabilities. This variable should be equal to the shareholder's equity by accounting identity. I drop observations that violate this identity. This step drops 541 observations in my sample.

Capital stock: Capital stock is measured as the sum of tangible fixed assets and intangible fixed assets. Then I drop observations with missing or zero values for tangible fixed assets. This step drops 8,856 observations in my sample.

Capital-Labor ratio: I examine the quality of the capital to wage bill ratio variable. I drop observations with ratios higher than the 99.9 or lower than the 0.1 percentile. This step reduces the observations in my sample by 4,222.

Wage bill: I drop firm-year observations with missing, zero or negative values for the labor wage bill. This step reduces the observations in my sample by 9,508.

Value added: I construct value added as the difference between operating revenue and materials input, then I drop the negative values, which corresponds to 175,648 observations.

Winsorization

I winsorize the following variables at the 1 and the 99 percentile: value added, fixed assets, wage bill, operating revenue, materials, capital, total assets, total liabilities and shareholder's equity, to make the results less sensitive to outliers. I also winsorize at the 1 and the 99 percentile of my estimated firm productivity variables.

Summary statistics

Table A.1 presents summary statistics for the dataset after data cleaning in above steps. All entries in the table are in millions of RMB, except for employment. Value added, wage bill, total assets and liabilities are deflated with gross output price indices at the four digits industry level with a base year of 1998. The capital stock is deflated with the economy-wide price of investment goods. Statistics for both the whole country and the "opened cities" (defined as cities where foreign banks were allowed before the end of 2006) are provided. On average, these "opened cities" have a higher level of value added, wage bill and total assets, but not necessarily higher level of capital stock at firm level.

Table A.1: Summary statistics of selected variables

Sample	Statistic	Mean	Std. Dev.
All the cities	Value added	12.59	29.73
	Employment	280.71	1264.51
	Wage Bill	2.96	6.07
	Capital Stock	32.70	353.40
	Total Assets	52.84	138.11
	Total Liabilities	31.06	83.09
"Opened cities"	Value added	13.38	31.92
	Employment	259.26	850.30
	Wage Bill	3.54	6.84
	Capital Stock	31.63	34.80
	Total Assets	59.40	148.40
	Total Liabilities	33.70	87.53

Production function estimates

I estimate the value added production function separately for each two-digit industry j, to allow the elasticities of value added with respect to inputs to vary at the two-digit industry level:

$$log(VA_{it}) = d_t(j) + \beta_l(j)log(wl_{it}) + \beta_k(j)log(k_{it}) + log(TFP_{it}) + \epsilon_{it}$$

where $d_t(j)$ is a time fixed effect for each year, VA_{it} denotes real value added (nominal value added divided by the 4-digit output price deflator), wl_{it} denotes the real labor wage bill, and k_{it} denotes real value of fixed assets. In the above equation, $\beta_l(j)$ and $\beta_k(j)$ denotes the elasticity of value added with respect to labor and capital. These elasticities vary at 39 industries defined by their two-digit industry classification. To calculate firm-level productivity, I will choose the methodology

developed in Wooldridge (2009), which is extension of the Levinsohn and Petrin (2003) procedures (WLP method). Given estimated elasticities $\hat{\beta}_l(j)$ and $\hat{\beta}_k(j)$, firm (log) productivity is calculated as $log(TFP_{it}) = log(VA_{it}) - \hat{\beta}_l(j)log(wl_{it}) - \hat{\beta}_k(j)log(k_{it})$.

In Table A.2, I compare parameters estimated from three approaches: OLS, LP and Wooldridge-LP methods. I implement LP estimator using *"levpet"* command in Stata, and I follow the approach in online appendix of Petrin et al. (2011) for Wooldridge-LP estimation.

For labor elasticities, the OLS estimates exceed the other two estimates, confirming the theoretical OLS bias resulting from the correlation between unobservable productivity shocks and input levels. In addition, I find the LP estimates are significantly lower than the Wooldridge-LP estimates.

Table A.2: Production function estimation

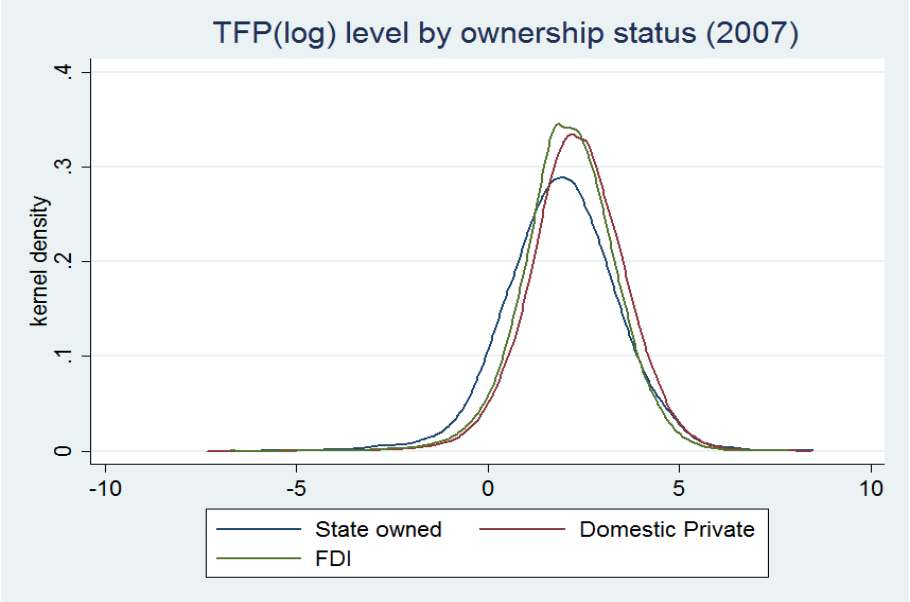
	Industry	**1. Food**	**2. Chemical**	**3. Machinery**	**All industry**
Method	Obs.	106,330	131,754	134,020	1,931,275
OLS	Labor $\hat{\beta}_l$	0.573	0.520	0.561	0.551
	Capital $\hat{\beta}_k$	0.181	0.233	0.211	0.230
	$\hat{\beta}_l + \hat{\beta}_k$	**0.754**	**0.753**	**0.772**	**0.781**
LP	Labor $\hat{\beta}_l$	0.135	0.193	0.204	0.235
	Capital $\hat{\beta}_k$	0.192	0.184	0.154	0.165
	$\hat{\beta}_l + \hat{\beta}_k$	**0.326**	**0.377**	**0.358**	**0.400**
WLP	Labor $\hat{\beta}_l$	0.536	0.475	0.539	0.574
	Capital $\hat{\beta}_k$	0.254	0.279	0.247	0.262
	$\hat{\beta}_l + \hat{\beta}_k$	**0.790**	**0.754**	**0.786**	**0.836**

Table A.3 presents summary statistics for the two elasticities and the sum estimated with Wooldridge-LP method. These estimated coefficients look reasonable as the sum of elasticities is around 0.80, and this is close to previous literature. Figure A.1 reports the distribution of estimated TFPs for state-owned firms, domestic private firms and foreign firms. Domestic private firms are generally more productive compared with state-owned firms.

Table A.3: Summary statistics of production function estimation

WLP method			
Coefficient	$\hat{\beta}_l + \hat{\beta}_k$	Labor $\hat{\beta}_l$	Capital $\hat{\beta}_k$
Mean	0.836	0.574	0.262
Median	0.839	0.581	0.254
Max	1.015	0.811	0.514
Min	0.609	0.289	0.142
Std. Dev.	0.099	0.130	0.071

Figure A.1: Estimated firm-level TFP



Source: Author's calculation based on Wooldridge-LP methods.

A.2 Size distributions

Size distribution in the firm-level dataset

Table A.4 shows the distribution of size class in China's manufacturing firm-level dataset. 88% of the sample are small/medium firms (<1000 employees), which accounts for 56% of employment share. Large firms (1000+ employees) account for the remaining 44% of employment in manufacturing sector.

Table A.4: Share of manufacturing firms by size class

	size class by employees				
(1) Num. of firms	**1-49**	**50-249**	**250-999**	**1000+**	Total firms
1998	20.1%	48.7%	24.7%	6.5%	152,198
2001	19.4%	53.2%	22.3%	5.1%	166,807
2004	24.7%	54.0%	17.0%	4.3%	277,449
2007	25.0%	55.4%	16.3%	3.2%	335,813
1998-2007	20.5%	50.0%	18.0%	11.5%	2,177,749
(2) Employment share	**1-49**	**50-249**	**250-999**	**1000+**	
1998	1.5%	16.3%	31.4%	50.9%	
2001	1.8%	20.2%	32.1%	45.9%	
2004	3.1%	26.0%	31.9%	39.0%	
2007	3.3%	26.8%	30.9%	39.0%	
1998-2007	2.4%	22.3%	31.6%	43.7%	
Comparison: 10 East European countries, 1996-2005					
Employment share	**1-49**	**50-249**	**250+**		
Amadeus	10.7%	29.4%	60.0%		
Eurostat	25.2%	31.2%	43.6%		

Notes: For employment distribution across firm size in Amadeus, see Larrain and Stumpner (2015)

Firm size and firm-level labor productivity

Here I provide descriptive evidence at the firm level to show the correlation of firm size and productivity. I find that small firms tend to be more productive than large firms. Specifically, I run the following regression[2]:

$$log(VA_{i,j,c}/N_{i,j,c}) = \beta_1 Size_i + \beta_2 log(Age)_i + \beta_3 Foreign_i + \beta_4 Exporter_i + \varphi_j + \delta_c + \varepsilon_{i,j,c}$$

where $VA_{i,j,c}/N_{i,j,c}$ is value added divided by employees of firm i in industry j and province (or city) c; $Size$ indicates either whether the plant is small, medium or large or the log number of employees; and $log(Age_i)$ is the log of the number of years during which the firm i has been operating; and $Foreign$ and $Exporter$ are indicators for foreign-owned firms and exporters. I also include industry and province (city) dummies.

Table A.5 shows the results under various specifications. All columns represent results where the log value added per employee is the dependent variable and standard errors are clustered at the province level. In columns (1) and (2) the definition of size is discrete, I include dummies for medium and large firms, and omitted "small" status is the benchmark. The coefficients associated with size are negative and significant in all columns. Small firms are associated with higher levels of productivity. I also find that, everything else equal, foreign firms tend to be more productive but exporters are not necessarily more productive, and are even less productive than non-exporters in 2007 in one specification.

[2]As in equation (1) in Garcia-Santana and Ramos (2012)

Table A.5: Correlation between firm size and productivity

Dependent variable	labor productivity: $log(VA/N)$			
Sample year	2007			1998-2007
	(1)	(2)	(3)	(4)
Medium size	-0.725***	-0.723***		-0.870***
	(0.052)	(0.052)		(0.047)
Large size	-0.910***	-0.911***		-1.181***
	(0.095)	(0.093)		(0.083)
Log Employees			-0.183***	
			(0.022)	
Foreign-owned		0.157***	0.186***	0.205***
		(0.038)	(0.038)	(0.037)
Exporter		-0.079**	-0.018	0.001
		(0.052)	(0.040)	(0.028)
Log Age		-0.008	0.020	-0.348***
		(0.021)	(0.022)	(0.029)
Industry FE	Yes	Yes	Yes	Yes
Province FE	Yes	Yes	Yes	Yes
Observations	325,130	325,130	325,130	1,284,361
R-square	0.156	0.159	0.165	0.178

Notes: Table A.5 shows firm-level regressions of log Productivity against Size of the firm. Robust standard errors in parentheses, clustered at the province level. *** p<0.01, ** p<0.05, * p<0.1.

A.3 Foreign bank's distributions of loans to different types of firms

The following table provides insights of foreign bank loan portfolios by revealing the percentage of loans to Chinese-based corporations, global corporations, home country corporations, Chinese banks and foreign banks. The numbers are based on responses in 2007 from 36 foreign banks in China, including 13 Asian banks, 17 European banks and 6 North American banks. Among the 36 banks that provided data, 29 banks had loans to Chinese corporations, 27 to global corporations and home country corporations, 29 to Chinese banks and 11 to other foreign banks.

Eight banks (Asian and European) had more than 50% of their portfolios allocated to global corporations. Table A.6 reports the average loan portfolio distribution among banks from Asia, Europe and North America.

The members of the foreign bank group by region are as follows.

(1) Asian banks: ANZ Banking Group, Business Development Bank, Dah Sing Banking Corporation, DBS, First Sino Bank, Hang Seng Bank, Industrial Bank of Korea, Korea Exchange Bank, Maybank, Mizuho Corporate Bank, OCBC, Shinhan Bank, The Bank of East Asia, Wing Lung Bank;

(2) European banks: ABN AMRO, BNP Paribas S.A., Calyon, Deutsche Bank, Dresdner Bank, Fortis Bank, HSBC, ING Bank, KBC Bank, Natexis Banque Populaires, Norddeutsche Landesbank, Rabobank, Raiffeisen Zentralbank Osterreich AG, Royal Bank of Scotland, Sanpaolo Imi Bank, Société Générale, Standard Chartered Bank, UBS;

(3) North American banks: Bank of America, Bank of Montreal, Bank of Nova Scotia, Citibank, JPMorgan Chase Bank, Royal Bank of Canada, The Bank of New York, Wachovia Bank.

Table A.6: Foreign bank loan portfolios

Customer type % of loan portfolio	(1) Chinese-based corporates	(2) Global corporates	(3) Home country corporates	(4) Chinese banks	(5) Foreign banks	(6) Other
Asian bank	19.38	24.85	44.85	6.38	2.69	1.85
European bank	31.06	37.06	22.71	6.76	1.82	0.59
North American bank	23.33	13.33	17.50	25.50	20.33	0.00

Source: PricewaterhouseCoopers survey. Foreign banks in China, May 2007. The information provided has been considered proprietary and remains confidential. Results are therefore presented in a "disguised" group format, in the form of regional groups of banks.

A.4 Foreign investments in domestic banks: IV regression

Foreign banking investments after deregulation

There are two major modes through which foreign banks can enter the Chinese banking market once a city is open for foreign investors. First, foreign investors can set up branches, Chinese-foreign joint venture banks or wholly foreign-funded banks. These are defined as foreign banks and provide loans to the Chinese market directly. Alternatively, foreign investors can purchase equity in an existing Chinese bank and become one of their foreign strategic investors (FSI). The bank is a Chinese bank with minority foreign ownership. In this way, foreign bank entry can have impact on Chinese banks and firms indirectly.

I collect information about strategic investments in Chinese banks, including the names of the Chinese bank and the foreign bank, deal size, year, month, and investment share (% of Chinese bank).[3] Table A.7 and Table A.8 list all the transactions between 2001-2007. The table suggests that after restrictions on foreign bank entry were relaxed, foreign banks began to gradually invest in Chinese domestic banks. Here I focus on the investment in city banks as shown in Table A.7, since these city banks are restricted to lend locally in given cities and therefore there are no spillover effects.

[3]The maximum total shares held by foreign investors in one Chinese bank are 20% for a single investor and 25% for all foreign investors, according to the law on commercial banks.

Table A.7: Foreign strategic investments in Chinese local banks

Date	City	Local bank	Foreign investor	Deal size	% share
Aug 2002	Shanghai	Pudong Dev. Bank	Citibank	$67 mil.	4.62%
Nov 2002	Nanjing	Bank of Nanjing	IFC	$27 mil.	15%
Dec 2002	Shanghai	Bank of Shanghai	HSBC	$62.6 mil.	8%
Dec 2002	Shanghai	Bank of Shanghai	IFC	$55 mil.	7%
Jan 2003	Xiamen	Xiamen International banks	Asian Dev. Bank	$16 mil.	10%
Mar 2004	Shenzhen	Ping An Bank	HSBC	$20 mil.	27%
Mar 2004	Fuzhou	China Industrial Bank	Hang Seng Bank	$125 mil.	15.98%
Mar 2004	Fuzhou	China Industrial Bank	Singapore Gov. Inv.	$42 mil.	5%
Mar 2004	Fuzhou	China Industrial Bank	IFC	$33 mil.	4%
Oct 2004	Xi'an	Bank of Xi'an	IFC	$19.9 mil.	12.5%
Oct 2004	Xi'an	Bank of Xi'an	Bank of Nova Scotia	$7 mil.	5%
Mar 2005	Beijing	Bank of Beijing	ING	$274 mil.	19.9%
Mar 2005	Beijing	Bank of Beijing	IFC	$70 mil.	5%
Apr 2005	Hangzhou	Bank of Hangzhou	Commonwealth Bank	$76 mil.	19.9%
Sep 2005	Tianjin	China Bohai Bank	Standard Chartered	$123 mil.	19.9%
Jan 2006	Ningbo	Bank of Ningbo	OCBC Bank	$70.7 mil.	12.2%
Mar 2006	Beijing	Huaxia Bank	Deutsche Bank	$330 mil.	13.98%
Sep 2006	Guangzhou	Guangfa Bank	GE Capital	$100 mil.	7.11%
Dec 2006	Chongqing	Bank of Chongqing	Dahsing Bank	$87 mil.	17%
Jun 2007	Qingdao	Bank of Qingdao	Intesa Sanpaolo Rothschilds	$50 mil.	19.5%

Source: Author's collection from bank websites and news.

Table A.8: Foreign strategic investments in Chinese national banks

Date	Chinese bank	Foreign investor	Deal size	% share
Nov 2003	China Mingsheng Bank	IFC	$3 mil.	1.22%
Aug 2004	Bank of Communications	HSBC	$1,747 mil.	19.9%
Aug 2005	Bank of China	RBS et al.	$3,100 mil.	10%
Aug 2005	Bank of China	Temasek	$1,550 mil.	5%
Sep 2005	China Construction Bank	Bank of America	$2,500 mil.	9%
Jan 2006	Industrial Commercial Bank of China	Goldman Sachs et al.	$3,780 mil.	10%

Source: Author's collection from bank websites and news.

IV regressions

Table A.9 reports the impact of city-level foreign investment in domestic banking on firm performance, using OLS and instrumental variable (IV) regressions. The instrument (IV) for foreign banking investment $log(FSI)$ is the city-level foreign bank deregulation indicator $FBank$, which is determined by the central government. On average, I do not find foreign investment in domestic banking lead a higher sales or investment level of domestic firms.

Table A.9: The average impact of foreign banking investment (FSI)

Dependent variable	$log(sales)$		$log(investment)$	
	OLS	IV	OLS	IV
$log(FSI)$	0.012**	0.014	0.002	0.021
	(0.005)	(0.015)	(0.012)	(0.025)
Firm FE	Yes	Yes	Yes	Yes
Industry-year FE	Yes	Yes	Yes	Yes
City FE	Yes	Yes	Yes	Yes
Observations	348,805	348,805	276,314	276,314
Adjusted R-squared	0.842	0.882	0.540	0.663

Notes: Coefficients from regressions of firm outcomes on city-level foreign strategic investment (FSI) in domestic banks using OLS and IV. The city-level foreign bank deregulation dummy is used as IV for city-level foreign strategic investment (FSI) in domestic banks. Standard errors, clustered at the city level, are reported in the parentheses. *** p<0.01, ** p<0.05, * p<0.1.

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