Shadow Banking and Misallocation: Evidence from Entrusted Loans

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Abstract

We study the role of shadow banking in capital allocation using detailed loan-level data from China. Motivated by evidence that entrusted lending surged with improved bank credit access, we develop a model where firms with preferential bank credit access act as intermediaries, lending to those with restricted access. While the model suggests that entrusted lending can enhance capital allocation by funding productive firms, it may also exacerbate the misallocation of new bank loans due to interest rate arbitrage. We conduct counterfactual analyses to evaluate entrusted lending's impact during China's 2009 credit boom, offering policy insights on capital allocation efficiency.

JEL Classifications: E50, G21, G32, O16, P34

Keywords: Entrusted loans; Shadow banking; Misallocation; State-owned Enterprises

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1 Introduction

Entrusted lending, the largest component of China's shadow banking system, plays a crucial role in the provision and reallocation of credit among firms and has garnered significant attention in the literature (e.g., Chen, Ren, and Zha (2018), Allen, Qian, Tu, and Yu (2019)). As depicted in Figure 1, entrusted loans represent, on average, 12 percent of total bank lending and 8 percent of overall social financing during the sample period.[1] Notably, the volume of entrusted loans has surged since 2009. This prevailing use of entrusted loans is deeply intertwined with the unique characteristics of China's financial system, particularly its dual-track structure and the incremental approach to interest rate liberalization. In this system, state-owned enterprises (SOEs) receive a significant share of bank loans at regulated, below-market interest rates, effectively benefiting from state subsidies. In contrast, the shadow banking sector operates, providing a conduit for credit to be extended at market-driven interest rates. Within this context, entrusted loans are typically issued by state-affiliated or politically connected private firms that enjoy access to low-cost bank credit. The recipients of these loans are often more efficient enterprises that, despite their productivity, face restricted access to traditional credit sources (e.g., Tian, Tu, and Wang (2024)).

This paper investigates the interplay between shadow banking and capital allocation efficiency, focusing on two goals. Firstly, we aim to dissect and quantify the impact of entrusted lending on the credit allocation and transmission. Given that SOEs generally have easier credit but often exhibit lower productivity levels, entrusted lending provides a mechanism to redirect capital to more productive private firms. Quantifying the reallocation of credit from state to private sectors has not been extensively studied in the previous literature and holds substantive implications for both economists and policymakers. For instance, policymakers may be interested in estimating the volume of credit that could potentially be shifted from the state to the private sector through policy interventions that ease financial restrictions on SOEs, thereby facilitating broader credit expansion.

A key strength of our paper is the utilization of highly confidential loan-level data from a major Chinese commercial bank, which affords a rare glimpse into capital allocation efficiency. By leveraging this borrower-lender paired data on entrusted lending, we offer direct micro-level evidence that credit has been redistributed from firms with low productivity but high credit access to those with high productivity yet restricted credit access. Nevertheless, a significant challenge in micro-level empirical research is the difficulty in directly observing the aggregate magnitude of such shadow banking credit reallocation, which limits our capacity to

[1] Total social financing measures the aggregate amount of funds provided by China's domestic financial system to the real economy, including but not limited to: bank loans, entrusted loans, corporate bonds, and equity. Data is from the People's Bank of China

address broader macroeconomic policy implications. To bridge this gap, this paper constructs a structural model that allows us to estimate the extent of credit redistribution between the state and private sectors.

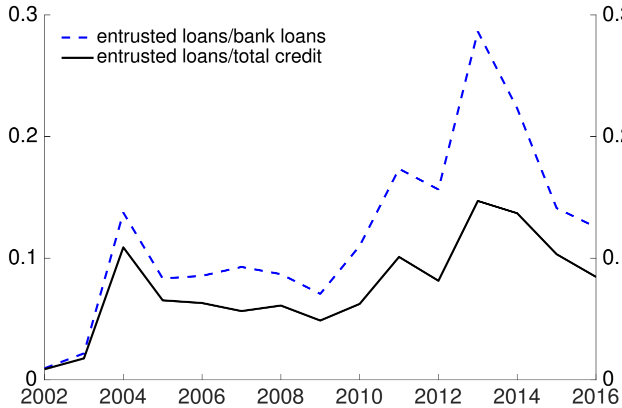

Figure 1: **Aggregate Entrusted Loans as a Percentage of Bank Loans and Total Social Financing**

Secondly, our study delves into the policy implications derived from the model. In response to the 2008 global financial crisis, Chinese government implemented an extensive stimulus program in 2009, encompassing both fiscal and credit expansions. While this initiative was pivotal in hastening China's economic recovery, it also precipitated a series of unintended effects. Although existing literature has examined the empirical outcomes of this stimulus on real and financial sectors (for example, Bai, Hsieh, and Song (2016), Cong et al. (2019)), Chen, He, and Liu (2020), and Chen, Gao, Higgins, Waggoner, and Zha (2023)), there remains a scarcity of quantitative analysis on its direct economic impacts. Our paper contributes to filling this gap by leveraging our structural model to account for credit transmission between firms, thereby enhancing our understanding of credit allocation dynamics during periods of stimulus.

To meet our objectives, we develop a two-sector equilibrium model with firm dynamics. The model differentiates between the state and private sectors based on their access to credit. We postulate that state-owned firms benefit from subsidized interest rates on bank loans, while private firms are subject to competitive rates and more stringent borrowing constraints. Despite these financial limitations, private firms are posited to be more productive than their state-owned counterparts. In the model's equilibrium, a portion of the credit extended to state firms is reallocated to private firms through the channel of entrusted lending. Our calibrated model indicates that during the 2009 credit stimulus, such indirect credit transmission from the state to the private sector via entrusted lending constituted approximately 15% of the total new bank credit introduced into the economy.

To further our analysis, we conduct two counterfactual exercises aimed at elucidating two macroeconomic phenomena observed in the aftermath of the 2009 stimulus program: a decline in the efficiency of capital allocation, as indicated by an increase in the standard deviation of the logarithmic Marginal Revenue Product of Capital (MRPK), and the divergence of leverage between state-owned and private sector firms.

We decompose the credit stimulus into two distinct phases to discuss the distinct pathways through which the stimulus program influenced credit distribution among firms. Initially, in the stimulus year of 2009, there was a substantial expansion of bank credit, with our estimates indicating an approximate 16% increase in the detrended credit growth rate within the manufacturing sector.[2] Subsequently, post-2010, the stimulus efforts transitioned into a form of partial financial liberalization characterized by eased credit constraints for state-affiliated firms, in contrast to the persistently stringent conditions faced by unconnected private firms.[3]

In the first counterfactual exercise, we show that capital misallocation increased after the 2009 bank credit expansion, mainly through the channel of lower interest rate and the amplification effect of entrusted lending. More specifically, when the supply of bank loan increases, the market interest rate of bank loan decreases. Given a lower interest rate, low-productivity firms with non-binding financial constraints increase their borrowing, but high-productivity firms with relatively binding constraints borrow less. As a result, new credit has been allocated toward less productive firms, and hence the MRPK dispersion increases. This is the channel of lower interest rate and is the main cause of the rising MRPK dispersion.[4] The amplification effect of entrusted lending is induced by the entrusted loan lender's interest rate arbitrage behavior. When the bank credit becomes cheaper, the profit of interest arbitrage increases, and the lender of entrusted loan has a higher incentive to borrow and resell the credit. Therefore, bank credit is further allocated towards low-efficiency SOEs which are the

[2]Based on the calculation by Chen, He, and Liu (2020), about 4.7 trillion RMB extra new bank loans were extended to the Chinese economy in 2009, within which the local government obtained roughly 2.3 trillion of extra new bank loans, the non-residential sector (mainly manufacturing) received about 1 trillion of extra new bank loans, and the rest 1.4 trillion went to the residential sector (mainly in the form of mortgage loan). It should be noted that in the baseline model we focus only on credit allocation of the manufacturing sector. We extend the model to include the government sector in Section 5.2.

[3]The 2009 stimulus program was largely financed by local government financing vehicles (LGFVs), which borrowed and spent on the behalf of local governments. However, after the official stimulus program ended in 2010, those LGFVs continued to operate, and have been increasingly used to help government-favored firms' access to credit. According to Bai, Hsieh, and Song (2016), it was a partial financial liberalization in the sense that connected firms received special assistance in obtaining cheap funds, while unconnected firms did not.

[4]A similar mechanism of a lower interest rate leads to a higher dispersion has been studied by Gopinath et al. (2017).

net lenders of entrusted loans.

In the second counterfactual exercise, we quantitatively examine the impacts of the partial financial liberalization on capital allocation by extending the model illustrated in Bai, Hsieh, and Song (2016).[5] We show that after a partial relaxation of the borrowing constraint for SOEs, financial resources are redirected from credit-deprived private firms to SOEs. While the leverage of SOEs increases, the leverage of private firms decreases due to crowding out effects arising from higher marginal cost of bank lending. We also demonstrate the sensitivity of crowding out effects with respect to the marginal cost of bank lending. With a calibrated value for the marginal cost of bank lending, the model can explain the increase in between-sector MRPK dispersion observed in the data, but it cannot fully predict leverage divergence between state-owned and private firms.

Related Literature This paper first contributes the studies on shadow banking and monetary policy in China. Chen, Ren, and Zha (2018) show that China's rising shadow banking was inextricably linked to banks' balance-sheet risk and hindered the effectiveness of monetary policy on the banking system during the period of monetary policy contractions. While Chen, Ren, and Zha (2018) focus on banks' risk-taking behaviors, such as purchasing the beneficiary rights of entrusted loans and incorporating them onto their balance sheets, our study examines the real effects of entrusted lending, specifically the credit reallocation between the state sector and the private sector. We concentrate on the entrusted lending prior to 2012, during which entrusted loans were primarily made among industrial firms.[6] Additionally, Chen, Gao, Higgins, Waggoner, and Zha (2023) show that infrastructure investment significantly weakened the transmission of monetary policy to credit allocated to private firms while enhancing the monetary effects on loans to state-owned firms. The interaction between fiscal and monetary policies is crucial for understanding the preferential credit access state-owned firms enjoyed during the stimulus period. However, we do not delve into the causes of the privileged access behind state-owned firms to bank credit; instead, we explore the consequences of such credit allocation. Using both macro and micro-level evidence allows us to shed new light on how shadow banking impacts capital allocation.

Our paper also relates to the literature on misallocation and financial frictions. Pioneered by Rogerson et al. (2004) and Hsieh and Klenow (2009), research on misallocation has documented various sources, such as financial frictions, capital adjustment costs, uncertainty, and firm-specific distortions (e.g., due to economic policies or other institutional features). How-

[5] Bai, Hsieh, and Song (2016) conjecture that connected firms' borrowing could crowd out funding to unconnected firms by raising the bank's marginal cost of lending.

[6] In Appendix C, we provide empirical evidence that the banks' risk-taking behaviors emphasized in Chen, Ren, and Zha (2018) mainly happened after 2012.

ever, the literature does not identify any particular factor, such as financial friction alone, that can fully account for the magnitudes of misallocation found in data (e.g., Midrigan and Xu (2014)). Bai et al. (2018) develop a heterogeneous-firm model with two types of financial frictions: default risk and a fixed cost of issuing loans. They find that their model can explain around 50 percent of the dispersion in the marginal product of capital within Chinese private manufacturing firms. In contrast, we focus on elucidating the role of shadow banking in capital allocation rather than explain the misallocation observed in the Chinese data. This perspective provides fresh understanding into the dynamics between banking policies and capital allocation.

Additionally, Bleck and Liu (2017) develops a model to analyze the financial interaction between two sectors (real estate versus others) with different degrees of financial friction under credit expansion. We adopt a similar model structure, incorporating the production in real sectors. Chang et al. (2019) build a two-sector DSGE model in which SOEs are financed by government-guaranteed bank loans, subject to reserve requirements, while private firms rely on unregulated "off-balance sheet" financing. Their calibration shows that optimal reserve requirement adjustments can complement interest rate policy in maintaining macroeconomic stability and improving welfare. Liu, Wang, and Xu (2021) demonstrate that interest-rate liberalization may reduce aggregate productivity and welfare unless other policy reforms are implemented to alleviate SOEs' distorted incentives or improve private firms' credit access.[7] An important distinction of our paper is that we concentrate on the financial linkage between firms with different levels of financial access, aiming to understand the real effects of entrusted lending in credit allocation.

Our paper also contributes to the empirical literature on entrusted lending in China. Allen, Qian, Tu, and Yu (2019) document the unique characteristics of entrusted loans, identifying two types – affiliated and non-affiliated. Non-affiliated loans typically involve much higher interest rates than affiliated loans and official bank loan rates. Both types involve firms with privileged access to cheap capital channeling funds to less privileged firms, with activity increasing when credit is tight. Chen, Ren, and Zha (2018) link the firm-level data of entrusted loans with the trustees, primarily banks, who arrange the loans. They explore the role of banks in entrusted lending and use it to illustrate banks' risk taking behaviors. Tian, Tu, and Wang (2024) demonstrate that through entrusted lending, capital is redirected from less productive but easily financed lending firms to more innovative but financially underprivileged borrowing firms. Our paper extends this literature by offering

[7]Wang et al. (2016) construct a similar model to show that the dual-track liberalization approach—introducing the market shadow bank track along side of the control bank credit track—can lead to efficiency gain through correction of credit misallocation and reduction in capital idolization. Pareto improvement can be achieved as banks and SOEs participate in shadow banking and share the efficiency gain.

new loan-level evidence that highlights the role of entrusted lending in capital allocation.

Finally, motivated by empirical findings on loan-level data, we develop a quantitative model to explore the allocation effects of the stimulus program. Our model's predictions align with the empirical evidence of Cong et al. (2019), which indicates that new credit was disproportionately allocated toward SOEs. We advance their findings by quantifying the exact amounts of credit allocated to state-owned firms and private firms, and more importantly, by measuring the extent of reallocation from state firms to private firms. Our model supports Deng et al. (2014)'s emphasis on the "state-control" of the Chinese economy, suggesting that it could potentially increase the transmission efficiency of credit stimulus. Moreover, we quantify the crowding-out channel proposed by Bai, Hsieh, and Song (2016), demonstrating the sensitivity of the crowding-out effect to the marginal cost of bank lending. This quantification not only provides practical support for existing studies but also offers valuable policy implications, highlighting the nuanced dynamics of credit allocation in China's economy.

The remainder of the paper is structured as follows: Section 2 presents macro- and micro-level empirical evidence of entrusted lending. Section 3 introduces the model. Section 4 offers the quantitative analysis. Section 5 conducts two counterfactual exercises. Finally, Section 6 concludes the paper.

2 Empirical Evidence of Entrusted Lending

In this section, we describe the characteristics of entrusted lending at both the micro and macro levels. The micro-level evidence supports the assumptions of our model, while the macro-level evidence underpins the broader implications of our theoretical framework. Our goal is to highlight the role of shadow banking (entrusted lending) in credit allocation and outline a scenario where firms with privileged access to bank credit act as intermediaries by channeling funds to entities with limited access but higher productivity.

2.1 Macro-Evidence of the Chinese Economy

We begin by describing the background of China's four-trillion RMB stimulus program in 2009 and then summarizing the macroeconomic facts. The discussion of the stimulus program in this section draws on previous studies by Bai, Hsieh, and Song (2016), Chen, He, and Liu (2020), Cong et al. (2019) , and Chen, Gao, Higgins, Waggoner, and Zha (2023).

Bank Credit Expansion In response to the 2008 global recession, the Chinese government announced a four-trillion RMB fiscal stimulus program to be implemented in 2009. The program was largely financed through the local government financing vehicles (LGFVs), with the main sources of funds coming from banks. Concurrently, alongside the fiscal package, the government encouraged commercial banks to increase their credit supply to the real economy. The central bank employed two main instruments. First, in the last quarter of 2008, the PBOC lowered reserve requirement ratio for commercial banks from 17.5% to 13.5% for medium-sized and small banks, and from 17.5% to 15.5% for large banks. Second, the PBOC reduced the prime lending rate from 7.47% to 5.31%.

According to the estimate by Chen, He, and Liu (2020), a total of 4.7 trillion RMB in extra new bank loans was extended to the Chinese economy in 2009. This “abnormal” new bank loan amount (4.7 trillion RMB) is the difference between the actual new bank loans in 2009 (9.6 trillion RMB) and the estimated normal new bank loans for 2009 (4.9 trillion RMB, based on the average bank loan/GDP ratio from 2004 to 2008). Given that the total outstanding bank loans were 30 trillion RMB at the end of 2008, the actual expansion rate of bank loans in 2009 was about 32%, while the abnormal (detrended) expansion rate was approximately 16%.[8]

Partial Financial Liberalization Although there was a substantial expansion of bank credit to the industrial firms during the stimulus period, the allocation of credit was significantly biased towards SOEs. Cong et al. (2019)) provide empirical evidence that SOEs, which display lower marginal product of capital at the outset of the program, experienced a larger increase in firm borrowing compared to private firms during the stimulus years.

Furthermore, the disproportionate allocation of credit persisted after the end of the stimulus program in 2010. In response to concerns about inflation and an overheated real estate market following the massive economic stimulus, the People’s Bank of China began tightening the money supply and restricting bank loans in the second half of 2010. Commercial banks were prohibited from expanding loans to risky industries such as real estate and min-

[8]However, this is the aggregate credit expansion to the whole economy. Our paper focuses on the industrial firms. Thus, we next turn to estimate the abnormal growth rate of bank loans of the manufacturing sector. Using individual loan data from the China Banking Regulatory Commission, Gao, Ru, and Tang (2021) show that the new loans to manufacturing sector increased from around 4.3 trillion in 2008 to 6.2 trillion in 2009. Given the outstanding bank loan of manufacturing sector was 7.9 trillion in 2010, the expansion rate of bank loans to manufacturing sector was close to 32%, if assuming the annual growth rate of outstanding loan is 15%. The PBOC published loan data by industry only after 2010. We estimate the loan outstanding of 2008 using the number in 2010, by assuming that the annual growth rate of outstanding loans of the manufacturing sector equals the growth rate of the total outstanding loans of the whole economy. Since we do not have a complete time series of new loans issued to the manufacturing sector, we cannot calculate the detrended expansion rate directly. As a result, we use the abnormal expansion rate of total bank loans to the whole economy (16%) as a proxy for the detrended expansion rate of the manufacturing sector. As a robust check, if we use the estimate of Chen, He, and Liu (2020) that extra new bank loans received by the non-residential sector (mainly manufacturing) was about 1 trillion RMB, the detrended growth rate of bank loans of the manufacturing sector was also about 16%.

ing. This tightening of bank lending placed enormous financial pressure on firms in these risky industries, thereby spurring a strong demand for external financing. This demand has been a significant driving force behind the rapid growth of shadow banking.[9]

Simultaneously, LGFVs continued to operate after the stimulus program ended in 2010. Despite several attempts by the central government to limit local governments' ability to obtain new funds via LGFVs, these efforts had little success.[10] With the tool of LGFVs, local governments used their access to financial resources to facilitate favored firms' access to capital. Connected firms received special assistance from local governments in obtaining low-cost funds and in circumventing central bank lending regulations, while unconnected firms did not. As described by Bai, Hsieh, and Song (2016), this was a case of partial financial liberalization: financial constraint of connected firms were relaxed, but those of unconnected firms remained unchanged or even tightened.

The Real Effects To investigate the impacts of the partial financial liberalization on firm financing, we plot the leverage of SOEs and private firms in Figure 2. In calculating leverage, we use aggregate data of industrial firms from the National Bureau of Statistics (NBS), as firm-level data for year 2009 and 2010 are missing. The ownership classification of firms is also obtained from the NBS. A striking finding from Figure 2 is the divergence in leverage between SOEs and private firms after 2008. The leverage of state-owned sector increased dramatically, while the leverage of non-state-owned sector declined. The average leverage of the SOE sector was 0.56 during 2005-2008 and increased to 0.61 during 2009-2015. In contrast, the average leverage of the private sector was 0.59 during 2005-2008 and decreased to 0.54 during 2009-2015.

To examine the impacts of credit policies on capital allocation, we calculate the MRPK dispersion using a balanced panel of Chinese industrial firms from 2005 to 2013.[11] Table 1 reports the results. The average standard deviation of $\log(MRPK)$ was 0.87 during the sample period of 2005-2008, and it increased to 0.94 during the sample period of 2011-2013. This indicates that MRPK dispersion increased by 0.07 standard deviations following the 2009 stimulus program. Additionally, the between-sector (SOE vs. POE) dispersion increased by 0.014 standard deviations.

[9] Chen, He, and Liu (2020) argue that it is the four-trillion-yuan stimulus package fueled by bank loans that has led to the rapid growth of shadow banking activities in China. The local governments in China financed the stimulus plan mainly through bank loans in 2009, and resorted to non-bank debt financing after 2012 given the mounting rollover pressure from bank debt coming due. However, entrusted lending is not the main refinancing tool for local governments.

[10] Bai, Hsieh, and Song (2016) describe how local governments found new ways to skirt the regulations.

[11] The year of 2009 and 2010 is missing in the data. Bai, Hsieh, and Song (2016) use the same dataset and find a similar pattern of the MRPK dispersion.

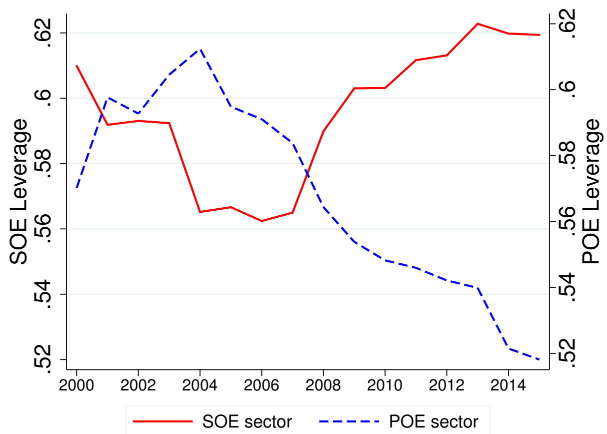

Figure 2: **The Divergence of Firm Leverage**

To sum up, the macro-facts that we intend to target/explain are as follows:

1. There was a 16% detrended bank credit expansion for industrial firms in 2009, and the new credit had been disproportionately allocated to state sector firms. After the 2009 credit expansion, the LFGVs continued to facilitate favored firms' access for cheap credit.

2. After the massive policy interventions, the leverage of state sector increased while that of private sector decreased, and the MRPK dispersion of industrial firms increased by 0.07 standard deviations.

Table 1: **The Rising of MRPK Dispersion**

	2005	2006	2007	2008	2011	2012	2013
sd(log($MRPK_{all}$))	0.89	0.86	0.87	0.86	0.91	0.94	0.97
sd(log($MRPK_{btw}$))	0.21	0.20	0.20	0.20	0.21	0.21	0.23

2.2 Loan-Level Evidence

To substantiate our conceptual framework, we employ granular loan-level data to empirically test three core hypotheses: First, SOEs received a higher amount of bank credit compared to non-SOEs during the credit expansion period. Second, entrusted loan lenders, particularly those with enhanced access to bank loans, tended to increase their provision of entrusted lending subsequent to credit expansion. Third, high productivity firms (non-SOEs) obtained a greater volume of entrusted loans in the post-credit expansion period.

Entrusted loans constitute a form of inter-firm lending wherein direct borrowing and lending between commercial enterprises is prohibited in China. Instead, entrusted loans require the involvement of a trustee—a qualified financial institution tasked with facilitating the loan transaction. Notably, the trustee's role is restricted to facilitating the transaction and does not extend to determining the recipients or the terms of the loan. The trustee earns a commission for its services without assuming any loan-related risks.[12]

Our loan-level dataset is obtained from a major Chinese commercial bank. Acting as a qualified trustee, the bank maintains records of entrusted lending transactions, encompassing details such as the identities of lenders and borrowers and loan characteristics such as amount, interest rate, and duration. Additionally, the bank collects essential financial data on both borrowers and lenders—including assets, liabilities, sales, inventory, and cash—enabling us to gauge the operational efficiency and financial leverage of each firm. Importantly, our dataset offers a unique advantage: the bank extends conventional bank loan services to both entrusted borrowers and lenders, enabling us to identify an exogenous change in the bank credit accessibility of the entrusted loan lender.

Starting with the complete set of loan-level data from the bank, we undertake the following procedures to compile the dataset for our empirical analyses. Initially, we identify entrusted lending transactions by leveraging the loan identity features specific to entrusted loans, excluding affiliated loans—transactions occurring within the same firm group. Over the entire sample period spanning from 2002 to 2018, we identify a total of 36,204 entrusted lending transactions, accounting for 0.76% of the bank's overall loan transactions, with a cumulative value of 196.9 billion Yuan, representing 2.14% of the bank's total loan portfolio. In Figure 3, we plot the time-series of entrusted loans facilitated by the bank. Our transaction-level data indicates a similar pattern to the total entrusted loans time series (Figure 1), showing an increase in entrusted lending post-2009 and reaching a peak around 2014. In Table 2, we present the summary statistics of entrusted loans and the associated interest rate. The average amount of entrusted loan is 54.39 million, and the average interest rate is about 8.31%.

From the transaction-level data of entrusted lending, we identified 19,171 unique borrower-lender pairs, 10,186 unique lenders, and 13,271 unique borrowers. Since some borrower-lender

[12]Practical exceptions to this regulatory framework exist, albeit within a regulatory grey area. For instance, certain commercial banks have acquired beneficiary rights associated with entrusted loans, effectively incorporating them into their balance sheets. Refer to Chen, Ren, and Zha (2018) for a comprehensive discussion on how liquidity-constrained banks have integrated shadow banking products into their balance sheets. However, as detailed in Appendix C, instances of such risk-taking behavior by banks occurred post-2012. Our analysis exclusively focuses on entrusted lending scenarios where banks do not serve as the ultimate lenders.

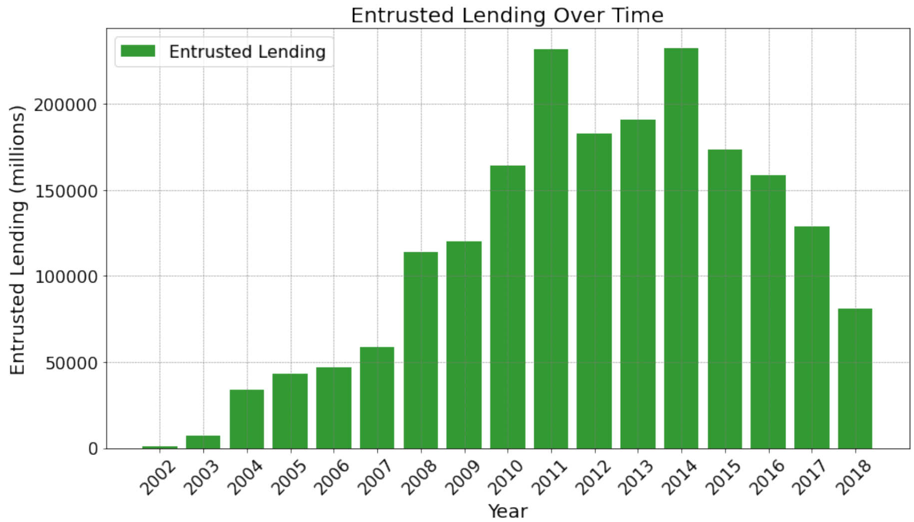

Figure 3: **Time series of entrusted loans from the bank**

Table 2: **Summary statistics of transaction-level entrusted loans**

Entrusted lending	Mean	Median	Max	Min	Obs
Amount (million)	54.39	7.40	5000.00	0.01	36204
Interest rate (annual)	8.31%	7.49%	24.00%	0.60%	32248

pairs have multiple transactions within a year, we aggregate transactions at the pair-year level for the purpose of empirical regressions, resulting in a total of 25,660 pair-year observations. Subsequently, we integrate the data with lenders' and borrowers' basic financial information and track their borrowing activities from the bank to create the final dataset for our empirical analyses. During the construction of the final dataset, we encountered data loss primarily due to missing firm-level financial information.

Table 3 presents the basic financial information of both lenders and borrowers.[13] The average size (total assets) of lenders amount to 11,456.58 million, while borrowers have an average total assets of 4,333.72 million. In term of real efficiency, the sales to assets ratio of entrusted lenders is 0.49, compared to 0.56 for borrowers. However, lenders exhibit higher profit ratio (0.05) than borrowers (0.03). Additionally, the leverage ratio of entrusted lender is 0.45, whereas borrowers has a ratio of 0.56. The average bank loan rate for lenders is 5.22%, while it is 6.05 % for borrowers. Moreover, our analysis indicates that 36.73% of entrusted lenders are state-owned enterprises (SOEs), whereas only 22.56% of entrusted borrowers fall under the category of SOEs.

[13]To lessen the influence of outliers, we winsorize all variables at the 1st and 99th percentiles.

Table 3: **Characteristics of entrusted loan (lender verse borrower)**

	Assets	$\frac{Sales}{Assets}$	$\frac{Profits}{Assets}$	$\frac{Liabilities}{Assets}$	Interest rate of bank loan	Fraction of SOEs
Lender	11456.58	0.49	0.05	0.45	5.22%	36.73%
	(7378)	(3737)	(4368)	(7362)	(3093)	(22739)
Borrower	4333.72	0.56	0.03	0.56	6.05%	22.56%
	(9987)	(3710)	(4440)	(9979)	(4257)	(25818)

Note: The number of observations is in parentheses.

Next, we utilize the bank credit supply shock induced by the 2009 economic stimulus to identify the variations in bank credit availability to entrusted loan lenders and the consequent effects on entrusted lending. Figure 4 provides an overview of the lending relationships. We hypothesize that entrusted lenders with strong banking relationships are more likely to expand their provision of entrusted loans in response to a positive bank credit supply shock. This hypothesis is grounded on the premise that firms with solid banking connections are better positioned to take advantage of increased credit availability, thereby enabling them to extend additional loans.

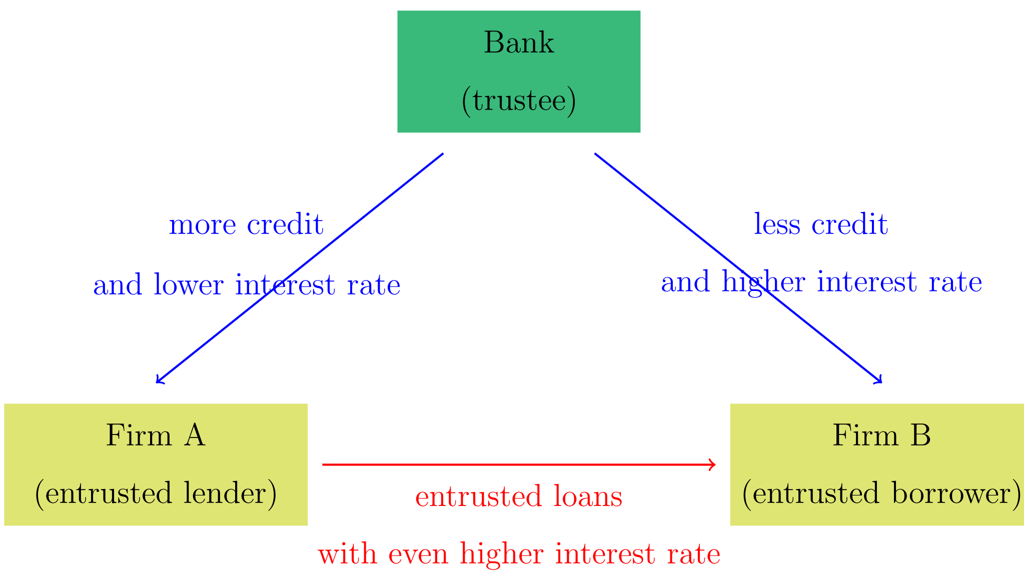

Figure 4: **Credit Reallocation**

Hypothesis 1: *SOEs received a higher amount of bank credit compared to non-SOEs during the credit expansion period.*

$$y_{i,t} = \alpha + \beta_1 SOE_i + \beta_2 shock_{2009} + \beta_3 SOE_i \times shock_{2009} + X_{i,t} + \eta_i + \theta_t + \epsilon_{i,t} \quad (1)$$

This empirical analysis employs a firm-level regression that encompasses all firms, both borrowers and lenders. The dependent variable, $y_{i,t}$, represents the ratio of bank loans to total assets for firm i in year t, where $y_{it} = \frac{\text{bank loans}_{i,t}}{\text{assets}_{i,t}}$. For the classification of firms, an indicator variable SOE_i is assigned a value of 1 if a firm is state-owned, and 0 otherwise. A credit shock variable is introduced where $shock_{2009} = 1$ for observations from the year 2009 onward, reflecting credit stimulus impacts starting that year. X_{it} represents other firm-level control variables, including cash and inventory. To account for unobservable individual-specific attributes that could affect the entrusted loans, firm fixed effects η_i and year fixed effects are included for each firm in the analysis. Therefore, we are interested in the value and significance of β_3.

As demonstrated in Table 4, the coefficient of the interaction between SOE and the shock variable is positive and statistically significant. Specifically, as depicted in Column 3, SOEs received an additional 0.041 units of bank credit per unit of assets compared to non-SOEs. This finding aligns with our initial hypothesis that SOEs obtained a higher amount of bank loans following the credit expansion.[14]

Table 4: **H1: Bank loans after credit stimulus (all firms)**

	$bankloan_{i,t}$ (1)	$bankloan_{i,t}$ (2)	$bankloan_{i,t}$ (3)
$SOE_i \times shock_{2009}$	0.025^{***}	0.020^{**}	0.041^{***}
	(0.009)	(0.009)	(0.004)
Controls	No	No	Yes
Firm Fixed Effects	Yes	Yes	Yes
Year Fixed Effects	No	Yes	Yes
Observations	1,132,398	1,132,398	728,313
Adj. R-squared	0.558	0.560	0.586

Note: Robust standard errors are in parentheses.

Hypothesis 2: *Entrusted loan lenders, particularly those with enhanced access to bank loans, tended to increase their provision of entrusted lending subsequent to credit expansion.*

$$y_{i,t} = \alpha + \beta_1 bankloan_{i,t-1} + \beta_2 y_{i,t-1} + \eta_i + \theta_t + \epsilon_{i,t} \tag{2}$$

To test the above hypothesis, we use a dynamic panel to conduct firm-level regressions

[14] Our results also hold if we replace SOEs with entrusted loan lender. In other words, entrusted loan lenders obtained a greater amount of bank credit following the credit expansion. Table 18 in the Appendix presents the corresponding result.

for entrusted lenders after 2009. The variable $y_{i,t}$ represents the ratio of entrusted loans to total assets for lender i in year t, formally expressed as $y_{i,t} = \frac{\text{entrusted loans}_{i,t}}{\text{assets}_{i,t}}$, indicating the scale of entrusted loans provided by SOE i, normalized by its total assets for that year. $bank_{i,t-1}$ calculates the normalized bank loans from the previous year, defined as $bank_{i,t-1} = \frac{\text{bank loans}_{i,t-1}}{\text{assets}_{i,t-1}}$, to measure the historical financial engagement of SOE i. η_i and θ_t refer to firm and year fixed effects, respectively.

Table 5: **H2: Entrusted loans after credit stimulus (lenders)**

	$entrusted_{i,t}$ (1)	$entrusted_{i,t}$ (2)	$entrusted_{i,t}$ (3)	$entrusted_{i,t}$ (4)
$bankloan_{i,t-1}$	0.235**	0.494***	0.495***	0.568**
	(0.107)	(0.160)	(0.176)	(0.230)
$entrusted_{i,t-1}$		−0.046		−0.039
		(0.142)		(0.059)
Firm Fixed Effects	Yes	Yes	Yes	Yes
Year Fixed Effects	Yes	Yes	Yes	Yes
Observations	748	394	439	268
Adj. R-squared	0.820	0.751	–	–

Note: Robust standard errors are in parentheses.

Table 5 presents the corresponding results. Columns (1) and (2) show OLS regression estimates, while Columns (3) and (4) include GMM-type instruments in the linear dynamic panel-data estimation. The estimate (e.g., Column (4)) suggests that an additional unit of bank credit received yesterday leads to a 0.568-unit increase in entrusted loans today. This is consistent with our second hypothesis.

Hypothesis 3: *High productivity firms (non-SOEs) obtained a greater volume of entrusted loans in the post-credit expansion period*

$$y_{j,t} \quad = \quad \alpha + \beta private_j + X_{j,t} + \theta_t + \epsilon_{jt} \tag{3}$$

This is a firm-level regression only for the borrowers after 2009. The variable y_{jt} is defined as the ratio of entrusted loans to total assets for borrower j in year t, represented as $y_{jt} = \frac{\text{entrusted loans}_{jt}}{\text{assets}_{jt}}$. This ratio measures the extent of entrusted loans borrowed by borrower j, normalized by its total assets for the given year. Additionally, $private_j$ is assigned a value of 1 if a firm is not a state-owned firm, and 0 otherwise. X_{it} represents other firm-level control variables, including cash and inventory, to adjust for various firm-specific factors that might influence the outcomes. Year fixed effects are also included.

Table 6: **H3: Entrusted loans after credit stimulus (borrowers)**

	$entrusted_{j,t}$
$private_j$	0.045***
	(0.006)
Controls	Yes
Year Fixed Effects	Yes
Observations	5,133
Adj. R-squared	0.01

Note: Robust standard errors are in parentheses.

Table 6 indicates that private firms receive a greater volume of entrusted loans during the post-credit expansion period. Specifically, private firms obtained an additional 0.045 units of entrusted lending per unit of assets compared to SOEs, confirming our third hypothesis.

In summary, the empirical findings above demostrate that SOEs obtained a substantial portion of bank credit after the credit expansion and served as intermediaries in disbursing entrusted loans to private firms. These observations provide crucial foundations for our theoretical model.

3 The Model

In the model, there are two types of firms: Firm A is defined as state-owned firms with privileged access to bank credit, and Firm B is defined as private firms with limited access to bank credit. We assume that Firm A has lower productivity than Firm B. In each period t, there is a γ measure of type-A firms, and a unit measure of type-B firms. In this model, we do not consider firm exit and entry, or changing in firm types.

3.1 Firm A

The technology with which firm i of type A operates is represented by the production function

$$y_{it} = z_{it}(K_{it}^{1-\alpha} L_{it}^{\alpha})^{\eta}, \tag{4}$$

where y_{it} denotes the amount of goods produced by firm i at time t; z_{it} is the idiosyncratic productivity shock faced by the firm; K_{it} and L_{it} represent capital and labor, respectively. α refers to the labor share, while η (with $\eta < 1$) is the degree of returns to scale.

Firm A has the access to bank credit with a subsidized interest rate $r_{st} = (1 - \tau)r_{mt}$, where r_{mt} is the market interest rate, and τ is the subsidy rate which captures direct interest subsidies and implicit guarantees from the government. To limit the borrowing of Firm A, banks impose a collateral constraint,

$$B_{it+1} \leq \theta_1 K_{it+1}, \tag{5}$$

where B_{it+1} is the amount of bank loans and θ_1 is the collateral rate. The capital K_{it+1} is served as the collateral. The economic interpretation of θ_1 not only refers to the fraction of capital that can be collateralized, but also reflects the credit rationing from the banks. One key assumption is that the collateral rate of state-owned firms (Firm A) is larger than that of private firms (Firm B).

In terms of asset accumulation, Firm A can accumulate physical capital according to the law of motion:

$$I_{it} = K_{it+1} - (1-\delta)K_{it}, \tag{6}$$

where I_{it} is the investment, and δ is the depreciation rate of capital. Firm A can also engage in providing entrusted loans to other firms and record them as financial assets F_t on its balance sheet. In equilibrium, entrusted loans earn an interest rate of r_{ft}. Table 7 demonstrates the balance sheet of Firm A.

Table 7: **The balance sheet of Firm A**

Assets	Liabilities
Physical capital K_{it}	Bank loans B_{it}
Financial assets F_{it}	Net worth $A_{it} = K_{it} + F_{it} - B_{it}$

The objective of Firm A is to maximize the discounted future dividend payouts. Given the subsidized interest rate of bank loans r_{st} and the interest rate of entrusted loans r_{ft}, Firm A makes individual decisions after observing the state variables K_{it}, F_{it}, B_{it}, and the productivity shock z_{it}. Denoting $V(K_{it}, F_{it}, B_{it}; z_{it})$ as the value of Firm A at time t and β_1 as the discount factor of the firm's owner, the value function of Firm A can be written recursively as follows:

$$
\begin{aligned}
V(K_{it}, F_{it}, B_{it}; z_{it}) &= \max_{K_{it+1}, F_{it+1}, B_{it+1}} : \Big\{ D_{it} + \beta_1 \mathbb{E}\big[V(K_{it+1}, F_{it+1}, B_{it+1}; z_{it+1})\big] \Big\} \\
\text{subject to:} & \\
\varphi(D_{it}) + I_{it} + F_{it+1} - (1 + r_{ft})F_{it} &= p_t y_{it} - w_t L_{it} + B_{it+1} - (1 + r_{st})B_{it} - \chi(F_{it}) - \phi(K_{it}) \quad (7) \\
y_{it} &= z_{it}(K_{it}^{1-\alpha} L_{it}^{\alpha})^{\eta} \quad (8) \\
I_{it} &= K_{it+1} - (1 - \delta)K_{it} \quad (9) \\
B_{it+1} &\leq \theta_1 K_{it+1}. \quad (10)
\end{aligned}
$$

D_{it} represents the dividend payout for firm i at time t. Should the dividend payout be negative ($D_{it} < 0$), the firm has the option to issue equity; however, this process incurs costs. These equity financing costs are encapsulated by the function $\varphi(D_{it})$. The variable w_{it} denotes the wages paid by the firm. Entrusted loans can be fraught with agency problems. For instance, some state-owned enterprises (SOEs) may extend entrusted loans to related parties, leading to asset tunneling. While our paper acknowledges these agency costs associated with entrusted loans, we do not explicitly model these costs structurally. Instead, we approximate them in a reduced form through the cost function $\chi(F_{it})$.[15] [16] Finally, accumulating capital is also costly, which is captured by the function $\phi(K_{it})$. All the functional forms will be specified in Section 4.

To streamline the model by reducing the number of state variables, in line with the approach taken by Buera, Kaboski, and Shin (2011) as well as Midrigan and Xu (2014), we assume that the firm chooses physical capital K_{it} and financial assets F_{it} after the realization of the shock z_{it}. Define $A_{it} = K_{it} + F_{it} - B_{it}$ as the net worth of the firm. With the new assumption regarding the timing of decisions, we only need to track A_{it} as a new state variable. Then, the modified firm's problem can be divided into two stages. First, at the beginning of period t, given the predetermined level of net worth A_{it} and the observed level of productivity z_{it}, the firm chooses capital K_{it}, labor L_{it}, and entrusted loans F_{it} to maximize its profit Π_{it}. This is equivalent to the static allocation problem in Hsieh and Klenow (2009), with the exception that the firm has an additional choice of entrusted loans. Second, after

[15] In accordance with legal requirements, all entrusted loans must involve a trustee, typically a bank, to oversee and service the loan. The trustee receives a fee for managing the loan but is not exposed to the loan's risk. To model the trustee's role, one could consider applying a haircut to the value of the entrusted loan, an approach that mirrors the reduced-form agency cost in our model. However, our dataset presents challenges in disentangling the agency costs from the premiums charged by the trustee. Therefore, we abstract the trustee's role from our model for simplicity. See also Chen, Ren, and Zha (2018) for studying the role of banks in intermediating entrusted loans.

[16] Additionally, the model does not distinguish agency costs from potential default costs of entrusted loans. The cost function $\chi(F_{it})$ captures all the costs associated with entrusted loans.

maximizing the profit, the firm then makes payout and saving decisions. It pays out D_{it} and saves A_{it+1} for the next period.

We rewrite the value function as follows:

$$\begin{aligned} V(A_{it}; z_{it}) &= \max : \Big\{ D_{it} + \beta_1 \mathbb{E}[V(A_{it+1}; z_{it+1})] \Big\} \\ &\text{subject to:} \\ \varphi(D_{it}) + A_{it+1} &= \Pi_{it}(A_{it}; z_{it}) + (1 + r_{st})A_{it}, \end{aligned} \tag{11}$$

where the profit function $\Pi_{it}(A_{it}; z_{it})$ is derived from the following problem:

$$\Pi_{it}(A_{it}; z_{it}) = \max : \Big\{ p_t y_{it} - w_t L_{it} - (r_{st} + \delta)K_{it} + (r_{ft} - r_{st})F_{it} - \chi(F_{it}) - \phi(K_{it}) \Big\}$$

subject to:

$$K_{it} \leq \frac{A_{it} - F_{it}}{1 - \theta_1}. \tag{12}$$

In the above equations, we substitute B_{it} by using the definition of net worth $A_{it} = K_{it} + F_{it} - B_{it}$, and substitute I_{it} by using $I_{it} = K_{it+1} - (1 - \delta)K_{it}$.

Denoting μ_{it} the Lagrangian multiplier of the borrowing constraint (12), the first order conditions of the firm's problem become

$$\frac{1}{\varphi'(D_{it})} = \beta_1 \mathbb{E}\left[\frac{1}{\varphi'(D_{it+1})} \left(1 + r_{st+1} + \frac{\mu_{it+1}}{1 - \theta_1} \right) \right] \tag{13}$$

$$r_{ft} = r_{st} + \frac{\mu_{it}}{1 - \theta_1} + \chi'(F_{it}) \tag{14}$$

$$\frac{\partial y_{it}}{\partial K_{it}} = r_{st} + \delta + \mu_{it} + \phi'(K_{it}) \tag{15}$$

$$\frac{\partial y_{it}}{\partial L_{it}} = w_t. \tag{16}$$

Equation (13) characterizes the firm's decision of net worth accumulation. Equation (14) delineates the supply of entrusted loans. Equation (15) and (16) summarize the choice of capital and labor, respectively. Notice that the borrowing constraint (12) is occasionally binding. When it does bind in the future, it influences the allocation of capital in the present.

3.2 Firm B

The production function of Firm B is specified as follows:

$$y_{jt} = z_{jt}(K_{jt}^{1-\alpha} L_{jt}^{\alpha})^{\eta}, \tag{17}$$

Firm B has the ability to borrow from banks, albeit with restricted access. Unlike Firm A that benefits from a subsidized interest rate, Firm B is subject to a competitive interest rate on bank loans. Furthermore, the collateral rate for Firm B is lower than that of Firm A, indicated by the inequality $\theta_2 < \theta_1$. In addition to bank loans, Firm B can also secure financing through entrusted loans. The borrowing constraints for bank loans and entrusted loans for Firm B are specified in the following equations, respectively:

$$B_{jt} \leq \theta_2 K_{jt} \tag{18}$$

$$F_{jt} \leq \zeta K_{jt} \tag{19}$$

The variable ζ is the collateral rate of capital when borrowing through entrusted loans.

Table 8: **The balance sheet of Firm B**

Assets	Liabilities
Physical capital K_{jt}	Bank loans B_{jt}
	Entrusted loans F_{jt}
	Net worth $A_{jt} = K_{jt} - B_{jt} - F_{jt}$

Table 8 presents the balance sheet of Firm B. The timing of Firm B's decisions is the same as that of Firm A. After the realization of the productivity shock z_{jt}, Firm B first chooses capital, labor, and entrusted loans to maximize its profits. Then, it makes dividend and saving decisions. The value function of Firm B can be written as follows:

$$\begin{aligned} V(A_{jt}; z_{jt}) &= \max : \left\{ D_{jt} + \beta_2 \mathbb{E}[V(A_{jt+1}; z_{jt+1})] \right\} \\ &\text{subject to:} \\ \varphi(D_{jt}) + A_{jt+1} &= \Pi_{jt}(A_{jt}; z_{jt}) + (1 + r_{ft})A_{jt}, \end{aligned} \tag{20}$$

and the profit function of Firm B is:

$$\begin{aligned}
&\Pi_{jt}(A_{jt}; z_{jt}) = &(21)\\
&\max: \Big\{ y_{jt} - w_t L_{jt} - (r_{ft} + \delta) K_{jt} + (r_{ft} - r_{mt}) B_{jt} - \phi(K_{jt}) \Big\}
\end{aligned}$$

subject to:

$$K_{jt} \leq \frac{A_{jt} + F_{jt}}{1 - \theta_2} \tag{22}$$

$$F_{jt} \leq \zeta K_{jt}. \tag{23}$$

Equation (22) is the borrowing constraint of bank loans, while Equation (23) is the borrowing constraint of entrusted loans.

The first order conditions are solved as follows:

$$\frac{1}{\varphi'(D_{jt})} = \beta_2 \mathbb{E}\Big[\frac{1}{\varphi'(D_{jt+1})}\Big(1 + r_{mt+1} + \frac{\mu_{jt+1}}{1 - \theta_2}\Big)\Big] \tag{24}$$

$$r_{ft} = r_{mt} + \frac{\mu_{jt}}{1 - \theta_2} - \xi_{jt} \tag{25}$$

$$\frac{\partial y_{jt}}{\partial K_{jt}} = r_{mt} + \delta + \mu_{jt} - \zeta \xi_{jt} + \phi'(K_{jt}) \tag{26}$$

$$\frac{\partial y_{jt}}{\partial L_{jt}} = w_t \tag{27}$$

where μ_{jt+1} is the Lagrangian multiplier of the constraint (22), and ξ_{jt} is the Lagrangian multiplier of the constraint (23). Equation (24) characterizes Firm B's decision of net worth accumulation. Equation (25) delineates the demand of entrusted loans. Equation (26) and (27) summarize the choice of capital and labor, respectively.

3.3 Equilibrium

There are three markets for bank loans, entrusted loans, and labor. The market clearing conditions are represented as follows:

$$\gamma \int B_{it}(r_{st}) + \int B_{jt}(r_{mt}) = \bar{B}_t \tag{28}$$

$$\gamma \int L_{it}(w_t) + \int L_{jt}(w_t) = \bar{L}_t \tag{29}$$

$$\gamma \int F_{it}(r_{ft}) = \int F_{jt}(r_{ft}) \tag{30}$$

where $\gamma \int B_{it}(r_{st})$ is the demand of bank loans for Firm A, and $\int B_{jt}(r_{mt})$ is the demand of bank loans for Firm B. The variable $\bar{B}_t$ is the supply of bank loans. Similarly, $\gamma \int L_{it}(w_t)$ and $\int L_{jt}(w_t)$ are the demand of labor for Firm A and Firm B, respectively, and $\bar{L}_t$ is the total fixed supply of labor. The net supply of entrusted loans for Firm A is $\gamma \int F_{it}(r_{ft})$ and the net demand of entrusted loans from Firm B is $\int F_{jt}(r_{ft})$. From the market clearing conditions, we can solve the equilibrium interest rate r_{mt} and r_{ft}, and wage rate w_t.

We now define the equilibrium. A *stationary equilibrium* consists of allocations for Firm A, $K_{it}(z_{it}, A_{it})$, $B_{it}(z_{it}, A_{it})$, $F_{it}(z_{it}, A_{it})$, $L_{it}(z_{it}, A_{it})$, $D_{it}(z_{it}, A_{it})$, and $A_{it+1}(z_{it}, A_{it})$, allocations for Firm B, $K_{jt}(z_{jt}, A_{jt})$, $B_{jt}(z_{jt}, A_{jt})$, $F_{jt}(z_{jt}, A_{jt})$, $L_{jt}(z_{jt}, A_{jt})$, $D_{jt}(z_{jt}, A_{jt})$, and $A_{jt+1}(z_{jt}, A_{jt})$, a joint distribution $G_i(z_{it}, A_{it})$ for Firm A, a joint distribution $G_j(z_{jt}, A_{jt})$ for Firm B, and a set of prices r_{mt}, r_{ft}, w_t, that satisfy (i) taking prices as given, the policy functions solve the optimization problem of Firm A and B, (ii) the market clearing conditions, (iii) the firm distribution remains constant through time.

4 Quantitative Analysis

We parameterize the model to match the salient features of the Chinese economy, where low-productivity state-owned firms enjoy privileged access to cheap credit, while high-productivity private firms have limited access to credit. To achieve this, we calibrate the parameters of Firm A to match the data moments of state-owned firms and calibrate the parameters of Firm B to match the moments of private firms. Instead of calibrating all the parameters separately for each type of firm, we adopt the same set of parameters for both types, except for parameters that are crucial to identify the distinct features of the firms. Parameters that are separately calibrated include the level of productivity, the collateral rate, and the discount factor.

We utilize two datasets: the firm-level data from China's Annual Survey of Industry conducted by the National Bureau of Statistics (NBS data) and aggregate credit data from the People's Bank of China (PBOC data). The NBS data contains the balance sheet information of all industrial firms in China with sales revenue above RMB 5 million, allowing us to identify them as state-owned or non-state firms. We use the following firm-level variables: sales, total assets, total liabilities, capital, employment, wage, and ownership structure. The aggregate variables include the total amount of entrusted loans and bank loans, and their respective interest rates. To highlight the key mechanism of the model, we first calibrate a model with a fixed supply of bank loans, which we label as the benchmark model.

We classify parameters to two categories. The first category includes preference and technology parameters that are difficult to identify with our dataset. The second category includes key parameters that determine the allocation of credit and firm dynamics.

Preset Parameters The period is set to one year. The capital depreciate rate $\delta = 0.1$, and the span of control parameter is $\eta = 0.8$. We set the labor share $\alpha = 0.5$, as found in the literature (e.g., Bai, Hsieh, and Qian (2006)). In the model, Firm A is more patient than Firm B. The discount factor for Firm A is set to 0.9, and for Firm B, it is set to 0.8. Bai, Hsieh, and Qian (2006) identify a high and fairly stable aggregate rate of return to capital in China over the period 1978-2004, ranging from 20 to 25 percent in most years. Tang, Xu, and Zhang (2017) show that the rate of return increased during the period 2004-2010. As in Song and Wu (2014), we adopt a conservative value for the rate of return, implying a discount factor of 0.8 for private firms (Firm B), and 0.9 for state-owned firms (Firm A).[17] The persistence of productivity shock is set to $\rho_z = 0.7$, and the volatility of the shock is $\sigma_z = 0.4$. The benchmark interest subsidy rate for Firm A is set to 0.25. We also conduct sensitivity tests for these preset parameters. Table 9 presents that the list of preset parameters.

Table 9: **Preset Parameters**

Capital depreciation rate, δ	0.1
Decreasing returns to scale, η	0.8
Labor share, α	0.5
Persistence of productivity shock, ρ_z	0.7
Volatility of productivity shock, σ_z	0.4
The subsidy rate, τ	0.25
The discount factor of Firm A, β_1	0.9
The discount factor of Firm B, β_2	0.8

Calibrated Parameters Table 10 lists the calibrated parameters and moments. Specifically, we normalize the mean of Firm A's productivity $\bar{z}_1$ to 1 and calibrate the mean of Firm B's productivity $\bar{z}_2$ to 1.5, ensuring that the MRPK for Firm A is 50% less than that of Firm B. This calibration aligns with findings by Bai, Hsieh, and Song (2016), who estimate that the MRPK for state-owned firms is 50% lower than for private firms. The size measure

[17]Liu and Siu (2011) assess the impact of institutions on Chinese firms' corporate investment in an investment Euler equation framework, and shows that the model derived discount rate for a non-state firm is approximately 10 percentage points higher than that of an otherwise equal state firm. Notice that the discount factor difference in our model is large than 10%. The main reason is that we directly calibrate the discount factor to the firm's financial positions. The large difference is driven by the financing wedge between SOEs and POEs. All results in this paper are robust by using a different set of discount factor. For example, $\beta_1 = 0.9$ and $\beta_2 = 0.85$. See Table 19 in Appendix B.

γ is calibrated so that the capital share of Firm A in the model matches the revenue share of SOEs in the data.

Table 10: **Benchmark Calibration**

Parameters		
Productivity, $\bar{z}_2/\bar{z}_1$		1.5
The size measure, γ		1.35
The total supply of bank loans, $\bar{B}$		15.5
Collateral rate (bank loans of Firm A), θ_1		0.85
Collateral rate (bank loans of Firm B), θ_2		0.52
Collateral rate (entrusted loans), ζ		0.29
Agency cost of entrusted loans, ν		0.007
Equity financing cost, κ		0.005
Capital adjustment cost, ϕ		0.01
Target Moments (before 2008)	Data	Model
$\text{MRPK}_{poe}/\text{MRPK}_{soe}$	1.5	1.52
SOE share of revenue	0.32	0.32
Prime lending rate	0.04	0.04
Leverage (SOE)	0.55	0.55
Leverage (POE)	0.57	0.57
Entrusted loans/bank loans	0.15	0.15
Interest rate of entrusted loans	0.12	0.12
Financial assets ratio	0.20	0.22
Std of leverage	0.27	0.25

We calibrate the total supply of bank loans so that, in equilibrium, the interest rate for SOEs is 1.25 times the prime lending rate of 0.04.[18] The three collateral parameters—θ_1 (collateral rate for bank loans to Firm A), θ_2 (collateral rate for bank loans to Firm B), and ζ(collateral rate of entrusted loans)—are jointly calibrated to match the financial leverage of SOEs and private firms, as well as the aggregate ratio of entrusted loans to bank loans.

The agency cost function is specified as $\chi(F_{it}) = \frac{1}{2}\nu F_{it}^2$, where the parameter ν measures the size of agency frictions in providing entrusted loans. We calibrate ν to match the interest rate of entrusted loans. The supply equation of entrusted loans (14) implies that the interest rate of entrusted loans is increasing in the size of agency cost parameter ν.

The equity financing cost function is $\varphi(D_t) = D_t + \frac{1}{2}\kappa D_t^2$. The variable κ measures the

[18]The nominal benchmark lending rate of one-year loan was 7.47% at the end of 2007, and 5.31% at the end of 2008, 5.8% at the end of 2010, and 6% at the end of 2012. We deflate the nominal interest rate using the average CPI (3.41%) during the period of 2007-2013. Thus, the real benchmark lending rate was range from 4% to 1.9%. We choose 4% (before the credit expansion) as the prime lending rate in the model.

rigidity of adjusting equity. We calibrate the parameter κ to match the financial assets ratio of an average firm. A higher κ value indicates a stronger precautionary motive for holding financial assets.[19]

The capital adjustment cost function is $\phi(K_{it}) = \frac{1}{2}\psi K_{it}^2$. In the model, a firm's choice of capital is static and is made jointly with its choice of debt. Therefore, the capital adjustment cost should be broadly interpreted as the cost of adjusting the firm's balance sheet. We calibrate the capital adjustment cost parameter so that the volatility of financial leverage in the model matches the observed volatility in the data. A higher capital adjustment cost prevents the firm from frequently adjusting capital and debt, leading to lower volatility in balance sheet adjustment and, consequently, lower volatility in leverage.

4.1 Aggregate Implications

We next discuss the effects of entrusted lending on the aggregate capital allocation. We start by analyzing the allocation in the benchmark model, and then eliminate entrusted lending from this model to re-examine the credit allocation. Our analysis considers both within-sector allocation and between-sector allocations.

To measure capital misallocation, we use the MRPK dispersion, defined as the standard deviation of $\log(MRPK)$. In the model calibration, we do not target the level of the MRPK dispersion in the data. While our model incorporates financial friction and capital adjustment cost, it does not account for other idiosyncratic distortions, such as taxes and labor market regulations. The goal of this paper is not to explain the level of dispersion observed in the data, but to examine the impact of entrusted lending on capital allocation.[20]

The Role of Entrusted Lending To study the roles of entrusted loans in credit allocation, we consider a model without entrusted loans. Based on the benchmark model, we remove entrusted loans as a choice for both Firm A and Firm B. This means Firm A cannot provide entrusted loans, and Firm B cannot borrow through them. We then simulate the new model under the same parameters of the benchmark model. In Table 11, we show the within-sector dispersion as well as the between-sector dispersion, for the model with and without entrusted loans.

Entrusted loans improve significantly capital allocation. Without entrusted loans, the overall MRPK dispersion increases from 0.379 to 0.438, a 16% rise. Additionally, the leverage

[19] Financial assets in the data is defined as liquid assets minus inventory. In the current calibration, we include account receivables in the financial assets, and account payables in the total liabilities. In an alternative way, we can subtract trade credit, and redefine the ratio of financial assets and financial leverage.

[20] Gopinath et al. (2017) adopt a similar strategy of calibrating the model. The standard deviation of $\log(MRPK)$ in the their baseline model (0.26) is lower than in the data (0.88).

Table 11: **The Role of Entrusted Lending**

	Benchmark	Without Entrusted Loans	Percent Change
mean($MRPK_1$)	0.232	0.230	-1%
mean($MRPK_2$)	0.353	0.371	+5%
sd(log($MRPK_1$))	0.282	0.313	+11%
sd(log($MRPK_2$))	0.382	0.468	+23%
sd(log($MRPK_{all}$))	0.379	0.438	+16%
sd(log($MRPK_{btw}$))	0.191	0.205	+7%
mean(Leverage_1)	0.550	0.487	-11%
mean(Leverage_2)	0.571	0.300	-47%

of both firms decreases dramatically. On the one hand, entrusted loans serve as savings of financial assets, helping the lender to diversify its asset allocation. Without entrusted loans, the lender loses a financial instrument for maintaining a profitable portfolio, and thus reduces borrowing from banks and invests less. On the other hand, as sources of funds, entrusted loans offer an additional financing channel for borrowers. Consequently, both types of firms borrow less. The within-sector MRPK dispersion for Firm A increases from 0.282 to 0.313, an 11% rise, while the within-sector dispersion of Firm B increases from 0.382 to 0.468, a 23% rise.

Furthermore, entrusted loans facilitate the transfer of credit from less efficient firms to more efficient ones, thereby improving the between-sector capital allocation. Table 11 shows that without entrusted loans, the between-sector dispersion increases from 0.191 to 0.205, a 7% rise. It can be calculated that the improvement in between-sector allocation contributes approximately $\frac{0.205^2-0.191^2}{0.438^2-0.379^2} = 12\%$ of the total improvement in capital allocation.

The Interest Subsidy Firm A receives an interest rate subsidy for bank loans. All else being equal, this creates an arbitrage opportunity. Firm A can borrow from banks with a low interest rate and resell the credit to Firm B with a higher interest rate. However, entrusted lending involves convex agency costs, which limits Firm A's incentive to provide entrusted loans. Table 12 shows the equilibrium of entrusted lending for the scenarios with and without the interest rate subsidy for Firm A.

As shown in Table 12, capital allocation improves when the interest rate subsidy is eliminated. Without the interest subsidy, the within-sector dispersion of Firm A decreases from 0.282 to 0.276, a reduction of 2%. The between-sector MRPK dispersion decreases significantly from 0.191 to 0.179, a reduction of 6%. However, the overall dispersion only declines by 1%. This limits overall improvement due to the equilibrium effect. Removing the interest

Table 12: **The Interest Subsidy**

	Benchmark	Without Subsidy	Percent Change
mean($MRPK_1$)	0.232	0.234	+1%
mean($MRPK_2$)	0.353	0.350	-1%
sd(log($MRPK_1$))	0.282	0.276	-2%
sd(log($MRPK_2$))	0.381	0.388	+2%
sd(log($MRPK_{all}$))	0.379	0.374	-1%
sd(log($MRPK_{btw}$))	0.191	0.179	-6%
mean(Leverage_1)	0.550	0.541	-2%
mean(Leverage_2)	0.571	0.576	+2%
InterestRate(bank)	0.067	0.054	-19%
InterestRate(entrusted)	0.120	0.1202	+0.2%

subsidy leads to a lower equilibrium interest rate for bank loans, which, in turn, increases the dispersion.[21] Consequently, while the within-sector dispersion for Firm A decreases due to the removal of the interest subsidy, the within-sector dispersion for Firm B increases due to the equilibrium effect.

The average leverage of Firm A decreases from 0.55 to 0.54, while the average leverage of Firm B increases from 0.57 to 0.58. Without the interest rate subsidy, Firm A borrows less, leading to a 19% decrease in the equilibrium interest rate for bank loans. Consequently, Firm B borrows more from banks to accumulate capital. This increase in capital boosts Firm B's borrowing capacity, allowing it to borrow more through entrusted loans as well. The interest rate on entrusted loans rises due to the equilibrium effect. On one hand, the demand of entrusted loans increases. On the other hand, the supply of entrusted loans decreases because Firm A faces a higher borrowing cost.

5 Counterfactual Exercises

Before proceeding to the counterfactual exercises, let's recall the macro-facts that we aim to explain. First, there was a 16% expansion of bank credit for industrial firms in 2009, with the new credit disproportionately allocated to state-owned firms. Second, this credit expansion evolved into a form of partial financial liberalization: the financial constraints for government-connected firms were relaxed, while the constraints for unconnected firms either remained unchanged or became tighter. Third, following these policy interventions,

[21]The intuition is that, when the interest rate declines, low-productivity firms with non-binding borrowing constraints borrow more, while high-productivity firms with binding constraints borrow relatively less.

the leverage of the SOE sector increased, the leverage of the POE sector decreased, and the MRPK dispersion among industrial firms increased by 0.07 standard deviations.

We conduct two counterfactual exercises to examine the impacts of credit policies on capital allocation and firm leverage. In the first counterfactual exercise, we study the scenario where there is an expansion of bank loans. Using the benchmark model, we increase the supply of bank loans. Given that China had a lending rate floor during the sample period, a significant credit expansion could drive the equilibrium interest rate below this floor rate. Therefore, we consider two cases: 1) With a binding interest rate floor: The equilibrium interest rate cannot fall below the floor rate. 2) Without an interest rate floor: The equilibrium interest rate can fall freely below the previous floor rate.

In the second counterfactual exercise, we explore the effects of partial financial liberalization. Specifically, we relax the borrowing constraint of Firm A (the state-owned firms) while maintaining the borrowing constraint for Firm B (the private firms). This simulates the scenario where government-connected firms experience eased financial constraints, while the constraints on unconnected firms remain unchanged.

5.1 Credit Expansion

From the calculation in Section 2.1, there was a 16% bank credit expansion in 2009. To reflect this in our model, we set a credit expansion rate of 16%, meaning that we increase the total supply of bank loans by 16%. Our findings indicate that, under this scenario, the equilibrium interest rate would drop to 0.9%, which is lower than the regulated floor rate of 1.4%. It is necessary to note that in 2009, lending rates in China were still regulated, with with 1.4% being the minimum legal interest rate for borrowing.[22] As a result, Given this context, we then examine two scenarios: ene with a binding interest rate and one without a lower bound. Additionally, in Appendix B, we explore the effects of a smaller, 10% credit expansion for comparison.

Table 13 presents the results before and after the expansion of bank loans. Following the credit expansion, the interest rate on bank loans decreases, allowing both types of firms to increase their scale of production through additional borrowing. Consequently, both Firm A and Firm B borrow more and invest more.

However, the capital expansion through bank loans for Firm A is significantly larger than for Firm B, at 19% compared to 10%. This disparity arises because Firm A faced a relatively less stringent borrowing constraint for bank loans compared to Firm B prior to

[22]There was no lending rate ceiling since 2004, but existed a lending rate floor of 0.9 times the baseline rate until 2013. Based on the interest rate calculation of the previous footnote, the *lowest* real lending rate in 2009 was about 1.4%=5.31%*0.9-3.41%.

Table 13: **Credit Expansion**

		Binding Floor		Without Floor	
	Before	After	Changes	After	Changes
mean($MRPK_1$)	0.232	0.212	-9%	0.211	-9%
mean($MRPK_2$)	0.353	0.339	-4%	0.338	-4%
sd(log($MRPK_1$))	0.282	0.338	+20%	0.344	+22%
sd(log($MRPK_2$))	0.382	0.409	+7%	0.412	+8%
sd(log($MRPK_{all}$))	0.379	0.430	+13%	0.434	+15%
sd(log($MRPK_{btw}$))	0.191	0.218	+14%	0.221	+16%
InterestRate(bank)	0.067	0.014	-79%	0.009	-87%
InterestRate(entrusted)	0.120	0.121	+1%	0.121	+1%
mean(Bank loans B_1)	6.196	7.363	+19%	7.476	+21%
mean(Bank loans B_2)	7.136	7.831	+10%	7.888	+11%
mean(Entrusted loans F_1)	1.701	1.977	+16%	2.002	+18%
mean(Entrusted loans F_2)	2.296	2.669	+16%	2.702	+18%
mean(Leverage$_1$)	0.550	0.579	+5%	0.582	+6%
mean(Leverage$_2$)	0.571	0.592	+4%	0.595	+4%
mean(Capital K_1)	7.289	8.663	+19%	8.795	+21%
mean(Capital K_2)	13.72	15.06	+10%	15.17	+11%
mean(Output Y_1)	5.424	6.000	+11%	6.052	+12%
mean(Output Y_2)	15.70	16.56	+5%	16.63	+6%

the credit expansion. The eased constraints for Firm A allowed it to leverage the credit expansion more effectively, resulting in a more substantial increase in its capital investment. This asymmetry highlights the differential impact of credit policies on firms with varying degrees of financial access, underscoring the role of borrowing constraints in shaping the capital allocation dynamics within the economy.

Capital misallocation increases after the credit expansion. The overall MRPK dispersion rises from 0.379 to 0.430, an increase of 0.051 standard deviations, accounting for $73\% = \frac{0.051}{0.07}$ of the increase observed in the data. Specifically, the within-sector MRPK dispersion increases by 20% for Firm A and 7% for Firm B. This finding is consistent with Gopinath et al. (2017), who report that lower interest rates lead to higher dispersion. The intuition behind this is that when interest rates decline, low-productivity firms with non-binding borrowing constraints are able to borrow more. In contrast, high-productivity firms with binding constraints do not experience the same increase in borrowing. Consequently, the within-sector MRPK dispersion increases as the allocation of capital becomes less efficient, with more capital flowing to less productive firms.

Furthermore, the between-sector dispersion increases by 14%, contributing about $27\% = \frac{0.218^2-0.191^2}{0.43^2-0.379^2}$ of the total dispersion increase observed in the model. To understand the economics behind the increase, we decompose the allocation of the new bank loans. We investigate how the new bank credit is distributed between Firm A and Firm B and how additional credit is transmitted from Firm A to Firm B. Figure 5 illustrates that Firm A receives approximately 64% of the new bank credit, while Firm B receives 28%.[23] This suggests that the allocation of new credit is not proportional, given that Firm A benefits from more favorable financing conditions. Additionally, it is noteworthy that 8% of the new credit remains unused due to the binding interest rate floor, preventing it from being allocated efficiently.

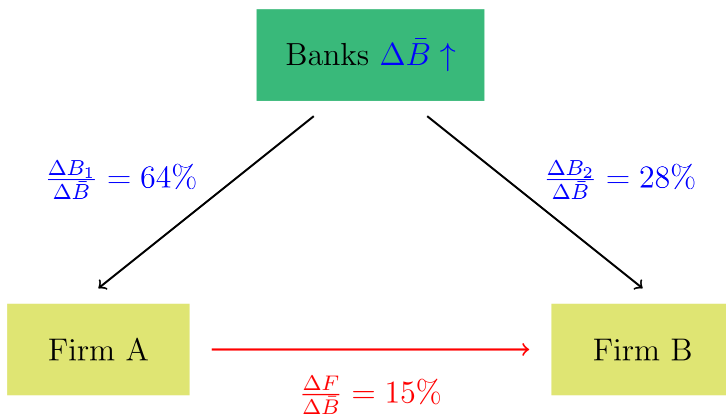

Figure 5: **The decomposition of new credit**

In addition to the bank lending channel, there is an indirect credit transmission, i.e., entrusted lending, from Firm A to Firm B, which accounts for 15% of the new credit. This indirect credit transmission improves the capital allocation because Firm B is more productive. However, overall, Firm A ends up with 49% of the new credit, and Firm B with 43%. Therefore, even when considering the credit transfer through entrusted lending, the new credit remains disproportionately allocated to Firm A, leading to an increase in between-sector dispersion.[24]

Credit Expansion without Entrusted Lending The next question we address is: If entrusted lending is not allowed, what is the impact of the credit expansion on capital allocation? This scenario differs from the one studied in Section 4.1, where we considered the

[23]In a stationary state before the credit expansion, Firm A receives 54% of the total outstanding credit while Firm B receives the other 46%.

[24]Notice that before the credit expansion the total output of Firm A is 7.3 and that of Firm B is 15.7. Suppose credit was evenly allocated based on output, Firm A should receive $39\% = \frac{7.3*1.35}{7.3*1.35+15.7}$ and Firm B receive 61%.

absence of entrusted lending in a stationary state. Here, we focus on the transition from one stationary state to another and investigate whether entrusted lending amplifies credit transmission. By analyzing this transition, we can assess how the dynamics of capital allocation evolve in response to a credit expansion when the indirect credit channel of entrusted lending is removed. This allows us to isolate the effects of direct bank lending and understand the role entrusted lending plays in facilitating or amplifying the flow of credit in the economy.

Table 14 shows the amplification effects of entrusted lending. The first column reports the percent change of each variable after a credit expansion in the model with entrusted lending (for the case without an interest rate floor, as drawn from the last column of Table 13). The second column reports the results of the model without entrusted lending, calibrated with the same initial conditions as the model with entrusted lending. We also report each firm's shares of the new credit for both models.

Table 14: **The Amplification Effect of Entrusted Lending**

	With	Without
Δsd(log($MRPK_1$))	22%	14%
Δsd(log($MRPK_2$))	8%	7%
Δsd(log($MRPK_{all}$))	15%	10%
Δsd(log($MRPK_{btw}$))	16%	6%
Δmean(Capital K_1)	21%	10%
Δmean(Capital K_2)	11%	6%
Δmean(Output Y_1)	12%	5%
Δmean(Output Y_2)	6%	2%
Share of credit $\Delta B_1/\Delta \bar{B}$	70%	55%
Share of credit $\Delta B_2/\Delta \bar{B}$	30%	45%
Share of credit $\Delta F/\Delta \bar{B}$	19%	0%

These results highlight that entrusted lending exacerbates the change in MRPK dispersion, both in terms of percentages and absolute levels (although not explicitly reported in the table). In essence, the presence of entrusted lending exacerbates the adverse effects on capital allocation resulting from the credit expansion. Furthermore, the reactions of capital and output to the credit expansion are more pronounced when entrusted lending is considered, affecting both Firm A and Firm B. In short, entrusted lending intensifies the distortions in capital allocation induced by credit expansion, leading to a more pronounced misallocation of resources across sectors. Additionally, the stronger responses of capital and output underscore the amplifying role of entrusted lending in transmitting credit impulses through the economy.

The economic rationale behind this amplification effect becomes clearer when we dissect the allocation of new credit. With entrusted lending, 70% of new bank loans are channeled to Firm A, leaving only 30% for Firm B. In contrast, without entrusted lending, the allocation is more balanced, with 55% directed to Firm A and 45% to Firm B. This discrepancy indicates that entrusted lending exacerbates the disproportionate allocation of bank loans towards Firm A during a credit expansion.

Furthermore, entrusted lending enables credit to be transferred from Firm A to Firm B indirectly. This indirect mechanism encourages Firm A to increase its borrowing from banks. With the additional borrowing, Firm A amplifies its investment in capital and consequently resells more credit to Firm B. Conversely, for Firm B, entrusted lending allows for increased borrowing and subsequent investment in capital. Consequently, both types of firms exhibit stronger responses in terms of capital and output to the credit expansion when entrusted lending is present.

In summary, the amplification effect of entrusted lending during the credit expansion mirrors the financial accelerator effect studied in the previous literature. Essentially, Firm A acts as a financial intermediary in this context. While entrusted lending may exacerbate credit misallocation among firms during a credit expansion, it enhances the efficacy of the credit stimulus by magnifying the influence of credit expansion on output growth.

5.2 Partial Financial Liberalization

In the preceding section (Section 2.1), we discussed how, despite the official conclusion of the stimulus program in 2010, local governments continued to utilize their newfound access to financial resources to facilitate privileged access to capital for favored firms. Connected firms benefitted from special assistance provided by local governments, enabling them to obtain funds at lower costs and circumvent regulatory constraints imposed by the central bank. Conversely, private firms did not enjoy such privileges. Bai, Hsieh, and Song (2016) presented a static model illustrating how borrowing by connected firms could potentially crowd out funding for unconnected firms by elevating the marginal cost of lending for banks.[25]

In this counterfactual exercise, we extend the static model into a dynamic framework to quantitatively examine the effects of partial financial liberalization on capital allocation. To capture the mechanism of the potential crowding out effect, we modify the benchmark model by assuming a costly supply of bank loans. Specifically, we posit that connected firms (Firm A) are subjected to a fixed lending rate—the prime lending rate r_p, while non-connect firms

[25]Ru (2018) finds that China Development Bank's industrial loans to state-owned enterprises crowd out private firms in the same industry but crowd in private firms in downstream industries.

(Firm B) face a market rate r_m. This adjustment enables us to investigate how differential borrowing conditions impact capital allocation dynamics over time.

Next, we delve into the optimization problem faced by banks to derive the supply function of bank loans. We consider a representative bank that seeks to maximize profits by attracting deposits and extending loans. To streamline our analysis, we make the simplifying assumption that the deposit rate is equal to the prime lending rate. Additionally, we posit that the supply of bank loans to connected firms is influenced by the local government and is thus treated as exogenously determined, effectively taken as given by the bank. This assumption helps us focus on the decision-making process of banks regarding loan provision to unconnected firms, which are subject to market dynamics.

The bank's problem is presented as follows:

$$\max_{B_{2t}} : \left\{ r_{pt}B_{1t} + r_{mt}B_{2t} - r_{pt}\big(B_{1t} + B_{2t}\big) - \frac{\omega}{2}\big(\max\{B_{1t} + B_{2t} - \bar{B}_t, 0\}\big)^2 \right\}, \tag{31}$$

where B_{1t} and B_{2t} refer to the supply of bank loans to Firm A and Firm B, respectively. The term $r_{pt}B_{1t} + r_{mt}B_{2t}$ represents the revenue from selling loans; $r_{pt}\big(B_{1t} + B_{2t}\big)$ is the cost of raising deposits; and $\frac{\omega}{2}\big(\max\{B_{1t} + B_{2t} - \bar{B}_t, 0\}\big)^2$ is the cost of intermediating loans. $\bar{B}_t$ represents the regulated level of bank loans, serving as a threshold beyond which the actual supply of bank loans incurs a cost. The parameter ω measures the marginal cost of supplying an extra unit of loans. If $\omega = 0$, it implies that bank loans have an elastic supply at the prime interest rate r_p. Conversely, if $\omega = \infty$, the supply of bank loans is fixed at the target level $\bar{B}_t$. Otherwise, the supply function of bank loans exhibits an upward-sloping curve with respect to the market interest rate.

From the first order condition of the bank's optimization problem, we derive the supply function of bank loans, and combine it with the demand function of bank loans $B_{1t} + B_{2t} = \gamma \int B_{it}(r_{pt}) + \int B_{jt}(r_{mt})$, and then we have the new market clearing condition of bank loans:

$$r_{mt} = r_{pt} + \omega\left(\max\left\{ \gamma \int B_{it}(r_{pt}) + \int B_{jt}(r_{mt}) - \bar{B}_t, 0 \right\} \right). \tag{32}$$

As outlined in Bai, Hsieh, and Song (2016), partial financial liberalization entails relaxing the borrowing constraint of Firm A while maintaining the constraint of Firm B unchanged.[26] Specifically, we adjust the collateral rate of Firm A from 0.85 to 0.90 to match the increases in leverage in the state sector observed in the data. Table 15 presents the outcomes of a partial liberalization of Firm A's borrowing constraint for three cases of the bank's marginal

[26] In the Appendix B, we also consider the case of raising the interest subsidy rate of Firm A, that is, raising the level of implicit guarantees provided by the government, and we find that it has a weaker crowding out effect than that of raising the collateral rate of Firm A.

cost of lending: $\omega = 0, \omega = 0.03, \omega = \infty$. We first discuss the case of a fixed supply of bank loans ($\omega = \infty$), which potentially generates the most significant crowding-out effect, and then discuss the main differences between the three cases.

Table 15: **Partial Financial Liberalization**

	Before	After		
		$\omega = 0$	$\omega = 0.03$	$\omega = \infty$
sd(log($MRPK_1$))	0.295	0.300	0.300	0.300
sd(log($MRPK_2$))	0.395	0.396	0.387	0.364
sd(log($MRPK_{all}$))	0.391	0.396	0.397	0.399
sd(log($MRPK_{btw}$))	0.191	0.197	0.204	0.225
InterestRate(bank)	0.040	0.040	0.055	0.098
InterestRate(entrusted)	0.1205	0.1203	0.1200	0.1192
mean(Bank loans B_1)	6.468	6.979	6.979	6.979
mean(Bank loans B_2)	7.467	7.470	7.280	6.778
mean(Entrusted loans F_1)	1.826	1.828	1.753	1.587
mean(Entrusted loans F_2)	2.466	2.468	2.367	2.142
mean(Leverage$_1$)	0.553	0.595	0.601	0.617
mean(Leverage$_2$)	0.581	0.581	0.575	0.562
mean(Output Y_1)	5.564	5.627	5.627	5.627
mean(Output Y_2)	16.11	16.11	15.88	15.26
mean(Firm Value $V_1 + B_1$)	26.17	26.55	26.46	26.26
mean(Firm Value $V_2 + B_2$)	36.04	36.04	35.26	33.09

Credit Reallocation Following the partial liberalization, there is a surge in Firm A's demand for bank loans, leading to an increase in the interest rate of bank loans. The market interest rate escalates from 0.04 to 0.098. It is important to note that while the bank lending rate remains fixed for Firm A, the elevation in the market interest rate signifies the crowding-out effect triggered by the partial financial liberalization. Consequently, faced with higher interest rates on bank loans, Firm B curtails its borrowing from banks and reduces investments in capital. Moreover, as the pool of collateral assets diminishes, Firm B experiences a corresponding decline in its capacity to borrow through entrusted loans.

In terms of magnitude, the increase in Firm A's collateral rate from 0.85 to 0.90, a 6% rise, leads to an 8% surge in Firm A's borrowing, from 6.468 to 6.979. Conversely, Firm B's bank borrowing experiences a 9% reduction, declining from 7.467 to 6.778. Additionally, the volume of credit transferred from Firm A to Firm B decreases by 13%, dropping from 2.466 to 2.142.

Gains vs. Losses We next investigate the gains and losses of the partial financial liberalization. Examining the last column of Table 15, we observe that the output of Firm A registers a modest uptick from 5.564 to 5.627, reflecting a 1% increase. Conversely, Firm B experiences a decline in output, slipping from 16.11 to 15.26, marking a 5% decrease. Notably, the percentage increase in Firm A's output is overshadowed by the percentage decrease in Firm B's output. Moreover, scrutinizing the firm value (comprising debt plus equity) reveals nuanced outcomes: while the firm value of Firm A inches up by 0.3%, indicating marginal gains, the firm value of Firm B plummets by 8%, representing substantial losses. In essence, the gains accrued from the partial financial liberalization pale in comparison to the losses incurred, painting a scenario where the positive impacts are outweighed by the negative repercussions.

Efficiency of Allocation Upon implementing the partial financial liberalization, the efficiency of capital allocation experiences a downturn. The overall MRPK dispersion, a key metric of allocation efficiency, escalates marginally from 0.391 to 0.399, marking a 2% increase. More importantly, the efficiency losses stem from the between-sector dispersion, which surges by 0.034 standard deviations. Additionally, while the within-sector dispersion of Firm A increases, that of Firm B witnesses a notable decrease of 8%, attributable to the elevated interest rate of bank loans. Consequently, although there's only a modest increase in the total MRPK dispersion, the rise is predominantly fueled by the escalation in between-sector dispersion. This underscores the adverse impact of the partial financial liberalization on the efficiency of capital allocation, particularly manifested in the disparities across sectors.

The Divergence of Firm Leverage In the first counterfactual exercise (Section 5.1), the leverage of Firm A and Firm B both increases after a credit expansion, which contradicts with the data that there is a divergence of firm leverage. However, in this counterfactual scenario involving partial financial liberalization, the model targets the leverage of Firm A to calibrate the extent of the relaxation in its borrowing constraint, while the leverage of Firm B is determined by the model's predictions. Despite the adjustments, the last column of Table 15 reveals that while the leverage of Firm B does decrease marginally from 0.581 to 0.562 by 0.019, it still falls short of matching the observed decreases in the data (0.05). This suggests that the model's predictions fail to fully capture the magnitude of the divergence in firm leverage witnessed empirically.

The Marginal Cost of Bank Lending The magnitude of the crowding out effect depends on the parameter ω, the marginal cost of bank lending. When $\omega = 0$, there is no crowding out effect; instead, there is a slight crowding "in" effect facilitated by entrusted lending. This occurs because when Firm A enjoys better financing conditions, the marginal cost of supplying entrusted loans decreases. Consequently, the interest rate of entrusted loans drops, indirectly benefiting Firm B from the partial financial liberalization of Firm A. It is important to note that even without a crowding out effect, the MRPK dispersion increases because Firm A experiences a relaxation in its borrowing constraint while Firm B does not. When $\omega = 0.03$, a plausible value for the marginal cost of bank lending,[27] the between-sector MRPK dispersion increases by 0.013 standard deviations. This increment closely aligns with the observed value in the data (0.014).

Local Government Debt To study the crowding out effect more comprehensively, we incorporate local government debt into our analysis. The modified bank's problem becomes

$$\max_{B_{2t}} : \left\{ r_{pt}(B_{1t}+B_{gt})+r_{mt}B_{2t}-r_{pt}\big(B_{1t}+B_{gt}+B_{2t}\big)-\frac{\omega}{2}\big(\max\{B_{1t}+B_{gt}+B_{2t}-\bar{B}_t,0\}\big)^2 \right\}, \quad (33)$$

where B_{gt} is the amount of government debt.

In this modified problem, an increase in government debt would further crowd out private firms' borrowing. We estimate the change in government debt during the stimulus program, denoted as ΔB_{gt}. According to Chen, He, and Liu (2020), local governments obtained roughly 2.06 trillion RMB in extra new loans from commercial banks in 2009. We also calculate the change in the targeted level of bank loans, denoted as $\Delta \bar{B}_t$. During the stimulus period, the reserve requirement ratio for commercial banks was reduced by 2%. This reduction in the reserve requirement ratio released approximately 0.96 trillion yuan in liquidity, calculated as the total deposits (48 trillion yuan) multiplied by the reduction in the reserve requirement ratio (0.02). Thus, the net increase in bank loans is given by: $\Delta B_{gt} - \Delta \bar{B}_t = 2.06$ trillion - 0.96 trillion =1.1 trillion. This net increase of 1.1 trillion RMB represents 18% of the outstanding debt of the manufacturing sector at the end of 2008, which was 6 trillion RMB.

In this modified counterfactual exercise, in addition to raising the collateral rate of Firm A from 0.85 to 0.90, we require the bank to increase the net supply of bank loan by 18%. We also set the marginal cost of bank lending $\omega = 0.03$. As discussed earlier, when $\omega = 0.03$, the model without government debt can explain the increase of between-sector dispersion observed in the data.

Table 16 presents the results. Including government debt helps to explain the leverage divergence between the SOE sector and the POE sector. Specifically, the leverage of the POE

[27] It implies that when the excess demand of bank loans increases by 1 unit (by 6% of regulated level of bank loans), the interest rate of bank loans increase by 0.03.

Table 16: **Partial Financial Liberalization (including government debt)**

	Before	After	Percent Change
sd(log($MRPK_1$))	0.295	0.300	+2%
sd(log($MRPK_2$))	0.395	0.356	-10%
sd(log($MRPK_{all}$))	0.391	0.401	+3%
sd(log($MRPK_{btw}$))	0.191	0.234	+23%
Interest rate of bank loans	0.040	0.1167	+192%
Interest rate of entrusted loans	0.1205	0.1192	-1%
mean(Bank loans B_1)	6.468	6.979	+8%
mean(Bank loans B_2)	7.467	6.416	-14%
mean(Entrusted loans F_1)	1.826	1.615	-12%
mean(Entrusted loans F_2)	2.466	2.181	-12%
mean(Leverage$_1$)	0.553	0.614	+11%
mean(Leverage$_2$)	0.581	0.540	-7%
mean(Output Y_1)	5.564	5.627	+1%
mean(Output Y_2)	16.11	14.95	-7%
mean(Firm Value $V_1 + B_1$)	26.17	26.29	+0.5%
mean(Firm Value $V_2 + B_2$)	36.04	31.97	-11%

In this table, we include government debt in the bank's optimization problem and set the marginal cost of bank lending $\omega = 0.03$.

sector decreases from 0.581 to 0.540, by 0.041, which is closer to the changes observed in the data (0.05). However, in this scenario, the model overshoots the between-sector dispersion. It also highlights the exacerbation of capital misallocation, particularly the increased between-sector MRPK dispersion. This underscores the complex dynamics of credit policies and government interventions on capital allocation efficiency.

5.3 Back to the Macro-Facts

To sum up the counterfactual exercises, let us revisit the macro-facts presented in Section 2.1. Table 17 summarizes the macro facts observed in the data and those predicted by the model. It is important to acknowledge that the Chinese economy during the sample period was far more complex than our model can fully capture. In this paper, we focus on two major events: the bank credit expansion during 2009 and the continued partial financial liberalization after 2010.

From the counterfactual exercises, we derive the following insights: 1) The primary driver of increased MRPK dispersion is the expansion of bank credit. This occurs through two main

Table 17: **Data vs. Model**

	Data	Credit Expansion	Partial Liberalization
Δsd(log($MRPK_{all}$))	0.07	0.051	0.008
Δsd(log($MRPK_{btw}$))	0.014	0.027	0.034
Δmean(Leverage$_1$)	0.05	0.029	0.064
Δmean(Leverage$_2$)	-0.05	0.021	-0.019

channels. One is lower interest rates: The credit expansion lowers interest rates, enabling firms with less restrictive borrowing constraints to expand more. One is entrusted lending amplification: Entrusted lending amplifies the impact by redistributing capital, albeit worsening overall capital allocation. 2) The divergence in firm leverage supports the mechanism of partial financial liberalization. However, the crowding out effect induced by this liberalization is modest and highly dependent on the marginal cost of bank lending.

6 Conclusion

In this paper, we develop a quantitative model to study the role of entrusted loans in credit allocation. While existing research, such as Chen, Ren, and Zha (2018), has examined the implications of entrusted lending in monetary policies, the literature has not yet explored its effects on resource allocation. Our findings indicate that entrusted lending significantly influences credit distribution among firms. According to our model calibration, entrusted lending improves aggregate capital allocation by 16% in a stationary state. However, it also amplifies capital misallocation during periods of bank credit expansion.

We perform two counterfactual exercises to analyze the model's implications: 1) Bank credit expansion: Following a bank credit expansion, MRPK dispersion increases primarily due to lower interest rates and the amplifying effect of entrusted lending. New loans are disproportionately allocated to state firms when entrusted lending is present, exacerbating the misallocation of capital. 2) Partial relaxation of borrowing constraints: When the borrowing constraints for state firms are partially relaxed, their leverage increases, while the leverage of private firms decreases due to a crowding-out effect. Financial resources are reallocated from credit-deprived private firms to state firms, leading to a decline in the efficiency of capital allocation.

Overall, our study highlights the dual impact of entrusted lending: it can enhance capital allocation in a stable environment but also exacerbate misallocation during credit expansions and partial financial liberalization.

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A Empirical Analysis

Figure 6 depicts the correlation between bank loans at time $t-1$ and entrusted loans at time t, indicating a positive association.

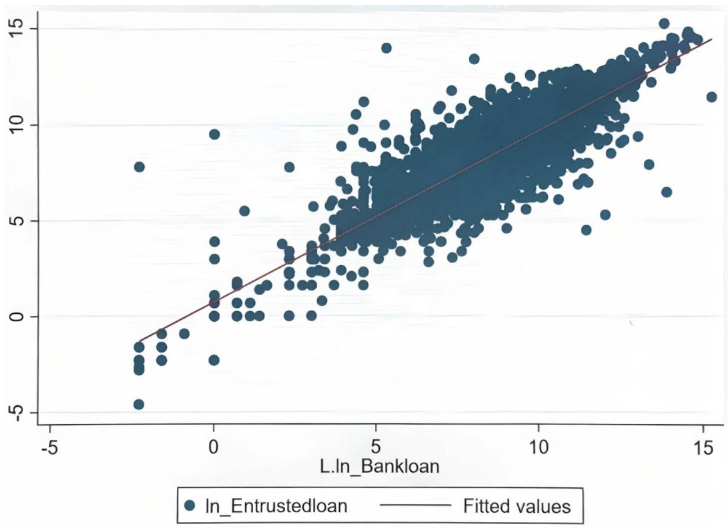

Figure 6: **The correlation between bank loans (t-1) and entrusted loans (t)**

Table 18 provides the robustness checks for the empirical test to Hypothesis 2. Column (1) presents the estimate with no data winsorization, while Column (2) presents the estimate of replacing the indicator SOE_i by $lender_i$. Overall, the result is consistent with that in Table 5.

Table 18: **Bank loans after credit stimulus (all firms)**

	$bankloan_{i,t}$ (1)	$bankloan_{i,t}$ (2)
$SOE_i \times shock_{2009}$	0.048***	
	(0.010)	
$lender_i \times shock_{2009}$		0.052***
		(0.009)
Controls	Yes	Yes
Firm Fixed Effects	Yes	Yes
Year Fixed Effects	Yes	Yes
Observations	672,822	672,822
Adj. R-squared	0.489	0.580

Note: Robust standard errors are in parentheses.

B Robustness Checks

Table 19: **The Discount Factor**

	$\beta_1 = 0.90$ $\beta_2 = 0.80$	$\beta_1 = 0.90$ $\beta_2 = 0.85$	$\beta_1 = 0.93$ $\beta_2 = 0.85$
mean($MRPK_1$)	0.224	0.227	0.229
mean($MRPK_2$)	0.347	0.344	0.341
sd(log($MRPK_1$))	0.304	0.294	0.290
sd(log($MRPK_2$))	0.392	0.374	0.391
sd(log($MRPK_{all}$))	0.399	0.382	0.382
sd(log($MRPK_{btw}$))	0.202	0.192	0.180
Interest rate of bank loans	0.045	0.054	0.067
Interest rate of entrusted loans	0.121	0.119	0.084
mean(Bank loans B_1)	6.652	6.450	6.363
mean(Bank loans B_2)	7.419	7.692	7.809
mean(Leverage$_1$)	0.562	0.583	0.553
mean(Leverage$_2$)	0.580	0.532	0.564
mean(Output Y_1)	5.657	5.555	5.511
mean(Output Y_2)	16.06	16.62	16.67
mean(Capital K_1)	7.826	7.589	7.487
mean(Capital K_2)	14.27	14.79	15.02
mean(Entrusted loans F_1)	1.811	1.453	1.755
mean(Entrusted loans F_2)	2.445	1.961	2.370

To make comparisons between models with different discount factors, we set $\bar{B}_t = 16.4$. All other parameters are the same as in the benchmark model.

Table 20: **Credit Expansion (10%)**

	Benchmark	Credit Expansion	Percent Change
mean($MRPK_1$)	0.232	0.218	-6%
mean($MRPK_2$)	0.353	0.343	-3%
sd(log($MRPK_1$))	0.282	0.319	+13%
sd(log($MRPK_2$))	0.382	0.400	+5%
sd(log($MRPK_{all}$))	0.379	0.412	+9%
sd(log($MRPK_{btw}$))	0.191	0.209	+10%
Interest rate of bank loans	0.067	0.031	-46%
Interest rate of entrusted loans	0.120	0.1208	+1%
mean(Bank loans B_1)	6.196	6.956	+12%
mean(Bank loans B_2)	7.136	7.610	+7%
mean(Leverage$_1$)	0.550	0.569	+4%
mean(Leverage$_2$)	0.571	0.585	+4%
mean(Output Y_1)	5.424	5.806	+7%
mean(Output Y_2)	15.70	16.30	+4%
mean(Capital K_1)	7.289	8.183	+12%
mean(Capital K_2)	13.72	14.63	+7%
mean(Entrusted loans F_1)	1.701	1.885	+11%
mean(Entrusted loans F_2)	2.296	2.545	+11%

In this table, we consider a 10% credit expansion, rather than 16%.

Table 21: **Partial Financial Liberalization (through interest subsidy)**

	Before	After	Percent Change
sd(log($MRPK_1$))	0.295	0.296	+0.3%
sd(log($MRPK_2$))	0.395	0.364	-8%
sd(log($MRPK_{all}$))	0.391	0.394	+1%
sd(log($MRPK_{btw}$))	0.191	0.221	+16%
Interest rate of bank loans	0.040	0.099	+148%
Interest rate of entrusted loans	0.1205	0.1194	-1%
mean(Bank loans B_1)	6.468	6.483	+2%
mean(Bank loans B_2)	7.467	6.748	-10%
mean(Leverage$_1$)	0.553	0.574	+4%
mean(Leverage$_2$)	0.581	0.560	-4%
mean(Output Y_1)	5.564	5.571	+0.1%
mean(Output Y_2)	16.11	15.21	-6%
mean(Firm Value $V_1 + B_1$)	26.17	26.91	+1%
mean(Firm Value $V_2 + B_2$)	36.04	33.04	-8%
mean(Entrusted loans F_1)	1.826	1.566	-14%
mean(Entrusted loans F_2)	2.466	2.115	-14%

In this table, we consider the case of raising the interest subsidy rate of Firm A, that is, raising the level of implicit guarantees provided by the government. The subsidy rate τ has been raised from 0.25 to 0.5.

C Decompose the funding sources of entrusted loans

In this section, we decompose the funding sources of entrusted loans and discuss the main difference between this paper and Chen, Ren, and Zha (2018). In Table 22, we show three funding sources of entrusted loans: wealth management products by commercial banks, assets under management by funds and brokers.[28] Those are entrusted loans funded by financial institutions rather industrial firms. It can be seen from Table 22, in the peak year of 2014, about 30 percent of the outstanding entrusted loans are funded by financial institutions. Chen, Ren, and Zha (2018) mainly focus on this part of entrusted loans, and they use it an example to illustrate banks' risk taking behaviors.

Table 22: **Decompose the funding sources of entrusted loans**

	2012	2013	2014	2015	2016
Entrusted Loans	5.9	8.2	9.3	10.9	13.2
Banks-WMP	0.16	0.30	0.36	0.34	0.64
Funds-AUM	0.0	0.21	0.75	1.35	1.08
Brokers-AUM	0.0	0.93	1.64	1.49	1.75
Percent	3%	18%	30%	29%	26%

Data Source: AMAC, CBWMRS, PBOC

Entrusted loans prior to 2012 were rarely funded by financial institutions. First, before 2013, funds and brokers were only allowed to invest in tradable (market) securities. In October of 2012, the CSRC issued new regulations that allow the asset management plans to invest in non-trade financial assets such as entrusted loans. Second, in 2012 the total amount of wealth management products was 7.1 trillion. If we assume that the ratio of wealth management products invested in entrusted loans was the same as that of 2013, it can be calculated that in 2012 only about 3% of entrusted loans were funded by financial institutions.

Moreover, entrusted lending had less to do with banks' risk-taking behavior prior to 2012. Chen, Ren, and Zha (2018) use banks' holding of ARI (account receivable investment) as a proxy of banks' risk-taking behavior of purchasing the beneficiary rights of entrusted loans and bringing them onto banks' balance sheet. In Table 23, we show that banks' new ARI

[28]The data sources are Asset Management Association of China (AMAC) and China Banking Wealth Management Registration System (CBWMRS).

holdings were almost zero before 2013. That is, banks were not much involved in taking the risk of entrusted loans before 2013.

Table 23: **Banks' ARI Holdings**

	2011	2012	2013	2014	2015	2016
New Entrusted Loans	1.30	1.28	2.55	2.17	1.59	2.18
New ARI Holdings	-0.05	0.01	1.36	2.22	3.42	0.87

Data Source: Wind, PBOC

In this paper, instead of studying banks' risk-taking behaviors as in Chen, Ren, and Zha (2018), we focus on the entrusted lending prior to 2012 and study the real effects of entrusted lending. That is, we study the entrusted lending between industrial firms.