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Abstract

We study the relationship between finance and growth using a sample of 275 Chinese cities during 2009-2018. We exclude a large amount of bank loans to local governments through the local government financing vehicles (LGFVs). This allows us to construct a new and better financial development index which measures the level of loans extended by banks to enterprises and households. Estimates from both GMM and Instrument Variables approaches indicate that financial development in the form of higher loan to GDP ratio leads to lower economic growth rate. We find that discrimination in bank lending, housing market bubbles and an unbalanced growth between real and financial sectors account for this negative relationship between finance and growth.

JEL-Codes: O160, O180, O530, G210, N250.

Keywords: China, financial development, economic growth, banks, city.

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1 Introduction

In the wake of the 2007-2008 global financial crises, China has launched a series of policy steps and reforms designed to mitigate the negative impact of the financial crisis on its economic growth by boosting domestic investment. A massive fiscal stimulus programme worth four trillion RMB (equal to $586 billion) was initiated in November 2008 with appeals for the state-ruled banks to expand loans to the real economy. This policy shift backed by the massive stimulus plan of 2008 has not only helped China to recover quickly leading to strong growth but also has structurally shaped the Chinese growth model from an export-led one to an investment-led one. As a result, China's financial sectors, in particular its banking sector underwent a remarkable period of development and expansion. Notwithstanding the apparent strong economic growth since 2008, there has been concern about the ongoing banking woes in China, such as the unprecedented rapid growth rate in bank lending and particularly whether these lending activities have generated positive impact on the local economic growth in China.

In this study, we examine the finance-growth nexus using a panel dataset of 275 Chinese cities during the period 2009-2018. We construct a new financial development index which improves the measurement of the depth of China's financial institutions in particular its banking sector. The widely-used financial depth indicator of China has been the ratio of total loans in the financial system to GDP (see for example, Aziz and Duenwald (2002), H. Chen (2006), Hasan, Wachtel, and Zhou (2009), J. Zhang, Wang, and Wang (2012)). However, the loan-to-GDP ratio covers the information of a large amount of off-balance-sheet government loans, thus this ratio tends to overestimate the level of private loans relative to GDP. Our new financial

development index excludes the government-related loans from the total loans. This new index is a more accurate measurement of private loan to GDP ratio, which is positively correlated with the efficiency of financial services and hence financial intermediary development (Levine (1999) and Beck, Levine, and Loayza (2000)). To address the potential endogeneity in the finance-growth nexus analysis, we adopt both the two-step system generalized method of moments (GMM), as well as Instrumental Variable (IV) approaches with external instruments (i.e. the colonization index and bank density index).

Our findings suggest that in China financial development (in the form of higher loan to GDP ratio) negatively impacts local economic growth during a decade after the 2007-2008 global financial crises. This result can be partly justified by an earlier literature (see for example, Boyreau-Debray (2003b), Allen, Qian, and Qian (2005), Zhao and Gong (2021)) stressing that the state-ruled banking sector in China hinders economic growth. China's state-dominated banking sector often discriminates against private sector in granting loans, and as a result, the more productive private sectors (in particular, those small and medium sized enterprises) are unable to receive sufficient loans to invest and grow. We also explore other issues concerning the negative impact the financial system has on growth which is due to excess finance and capital misallocation. These issues have become increasingly serious for China since the global financial crisis (GFC). Specifically, one is related to the speculative bubbles in the real estate sector and the other is the fast growth of the financial sector relative to the growth of real sector.

Our empirical study contributes to the literature on China's finance and growth. Previously, related empirical studies based on regional data have shown mixed results.

On the one hand, some studies find that China's financial institutions development hinders GDP growth (Allen et al., 2005; Boyreau-Debray, 2003b; Guariglia & Poncet, 2008; Zhao & Gong, 2021). On the other hand, there is a positive role of financial development on economic growth, as financial efficiency has been evidently improved by the ongoing financial reforms in China (H. Chen, 2006; Hasan et al., 2009; Huang & Wang, 2011). We will not only provide the most recent empirical analysis of this topic, but also will explore the underlying mechanisms behind the finance-growth relationship.

Our study is also related to the financial stability literature. Empirical studies in the last decade have shown that excess finance may be bad for economic growth. Is this conclusion applicable to China? China's financial system has an intrinsic feature of financial repression due to its state-ruled nature. During the initial stage of its economic reform in the late 20st century, the government-ruled system enabled China to maintain a remarkable growth rate by reducing market failures and financial risks (Huang & Ge, 2019; Huang & Wang, 2011). However, with the process of greater financial liberalization, can China manage to reduce its capital misallocation problem or will this problem become worse? Recent concerns about the capital misallocation in China indicate that the financial regime that worked quite well during the initial stage of economic reform may no longer deliver similar outcomes in recent years. We add to this line of studies by exploring plausible mechanisms concerning the negative role of banks in building-up systemic financial risks in China.

As the largest emerging country, China's experience may be instructive for other emerging economies with equivalent economic potential. Unlike other capitalist countries, emerging countries including China, commonly encounter weak legal and

financial institutions. With its growing significance in the global value chain and international capital flows, China's economic growth and financial stability are crucial for itself, as well as for the rest of the world.

The rest of this paper is organized as follows. Section 2 reviews the finance-growth nexus literature. Section 3 describes the empirical model and the data, and presents the baseline OLS regression results. Section 4 addresses the endogeneity issues and presents the GMM and IV results. Section 5 provides several robustness checks. Section 6 discusses possible explanations related to the negative finance-growth relationship we find. Section 7 concludes this paper.

2 Literature review

Financial intermediaries are crucial determinants for economic growth as they facilitate the savings-investment process. Many theoretical frameworks have been employed to examine finance-growth nexus. One key dispute is: does the development of financial institutions has a favourable impact on economic growth? Since the emergence of endogenous growth theory in 1980s, economists' attitude on the role of financial development has varied greatly, and their views can be summarised as optimistic and sceptical ones. The optimistic view describes a positive effect of financial development on growth. This is because well-developed financial systems may: (1) mobilize savings and optimize the allocation of capita (Bencivenga & Smith, 1991; Levine, 1997); (2). facilitate information sharing and reduce agency costs (Blackburn & Hung, 1998); (3). facilitate diversification and management of risk (Greenwood & Jovanovic, 1990; Sahay, Čihák, N'Diaye, & Barajas, 2015). There is a large empirical literature documenting the positive effect of financial liberalization on

economic growth. See multi-country studies such as Beck and Levine (2004), Ranciere, Tornell, and Westermann (2006) , Quinn, Schindler, and Toyoda (2011).

There is also a growing literature which stresses the uncertainty about the general validity of a positive link between financial development and economic growth. Rousseau and Wachtel (2011) reveal that the facilitating effect of financial development on growth becomes weakened in recent years in comparison to earlier studies which focus on 1960-1989 period. It raises concern about the recent excessive financial deepening in conjunction with increasing inflation and financial instability, which in turn results in growth-reducing financial crises (see also Allen and Gale (2004), Allen and Carletti (2006), Festić, Kavkler, and Repina (2011), Gennaioli, Shleifer, and Vishny (2012)).

There is also evidence on the non-linearity for the finance-growth nexus. Based on cross-country data, Arcand, Berkes, and Panizza (2015), Law and Singh (2014), and Samargandi, Fidrmuc, and Ghosh (2015) all recognize that financial development only helps growth up to a certain point, after which additional financial deepening starts to hurt growth.

One important mechanism underlying this non-linear relationship is the credit misallocation. For example, S. G. Cecchetti and Kharroubi (2015) argue that high-collateral but low-productivity programmes are given preference when applying for bank loans. They establish a model where the financial sector expands faster than the real economy and conclude that too much finance can disturb R&D-intensive industries with high financial dependence.

Another mechanism is linked to the fact that financial sector might generate high costs (see Santomero and Seater (2000)). Related, Philippon and Reshef (2012) find that, after 1985, the ongoing financial liberalizations result in a rise in skill intensity, job complexity, and wages in financial industries. This has contributed to attracting highly skilled human capital into the financial sector at the expense of other sectors of the US economy.

The finance-growth nexus studies in China also show mixed results. The majority of existing studies use regional data (either at the provincial or city level) and explore the research question on whether financial development at local level benefits local economic growth. Some studies based on the sample covering the ongoing financial reforms since mid-1990s tend to find that financial development contributes to China's strong economic expansion. Since the financial reforms initiated in 1994, the reforms increased the efficiency and independence of the banking sector through channels such as interest rate liberalization, loosening restrictions on ownership takeovers, and market entry deregulation. For example, Chang, Jia, and Wang (2010) focus on the period when financial reforms went into operation during 1995-2003, and reveal that financial liberalization is a key driver for economic growth during this period. They further argue that the positive effect is mainly driven by the formal banking system, while the development of the informal financial sector is less and even negatively correlated with GDP growth. J. Zhang et al. (2012) explore the finance-growth nexus after China's access to the World Trade Organization (WTO) which created a large number of opportunities in China's tradeable sector and was followed by a greater degree of structural financial reforms. They use a variety of indicators of financial development at city-level and confirm that financial development played an important role to support the rapid growth in China during the six years after its entry

to WTO. Similarly, Yao (2010) finds a positive finance-growth relationship during 2002-2006 by employing the GMM approach. The author attributes this positive relationship to the improvement of banks' independence in loan decision-making.

Empirical studies based on other periods of China's economy do not seem to support the positive finance-growth nexus hypothesis and many of them find a significantly negative relationship in China. For example, H. Chen (2006) shows that credit expansion has no benefits for economic growth at provincial level during1985–1999 due to inefficient financial intermediaries[3]. Boyreau-Debray (2003a) also uses province-level data and even find that financial intermediation has a negative impact on local economic growth over 1990–1999 (see also Allen et al. (2005), Hasan et al. (2009)). Zhao and Gong (2021) use the GMM approach and provides more recent evidence on the negative relationship at city level during 2007-2014.

These scholars all point out a fundamental problem in China. As China's legal and banking systems are too weak to enforce sound governance, financial development cannot possibly play a positive role. They attribute the negative influences to the strong government intervention. In the state-ruled banking sector, banks have to support loss-making state-owned enterprises disregarding the needs of more productive private corporations. This is ultimately bad for economic growth (see, for example, Aziz and Duenwald (2002), Boyreau-Debray (2003a)).

Guariglia and Poncet (2008) seem to confirm the view that it matters for China whether financial development is driven by government intervention or by market forces. They employ two separate sets of financial development indicators, and

[3] However, mobilization of savings and the substitution of loans for budget appropriation play a positive role in growth. Other studies such as Liu and Li (2001) and Aziz and Duenwald (2002) support the positive finance-growth relationship, but they do not use very robust empirical methodology.

demonstrate that during 1989-2003, the indicators measuring politically financial intervention hindered economic growth, whereas the market-driven financial development indicators were favourably associated with growth.

There is little empirical evidence on the finance-growth nexus in China for the period after the global financial crisis even though China has already established itself as a significant participant in the world financial system and its investment-led economy now depends heavily on the financial sector. To our knowledge, there are exceptions such as Zhao and Gong (2021) who have done some analysis based on the period of 2007-2014. One of the purposes of our paper is to fill this gap in the empirical research by using the most recent data. Furthermore, existing studies mainly focus on the relationship between financial development and growth, and simply attribute the negative growth effect of financial development to the distorting state-ruled nature. We aim to explore various mechanisms working behind the finance-growth nexus.

3 OLS model, data, and basic results

3.1 Basic OLS model

This study is based on panel data from 275 prefecture-level cities in China during 2009-2018. Unlike the previous studies using provincial data, we employ city-level data which contains more local information. We focus on the period after the global financial crisis as China's economic stimulus program during 2008-2009 causes

some distortions in the financial market in China[4], such as aggravating the problem of capital misallocation.

To empirically test how finance affects growth, our basic regression model is:

Equation 1

$$\boldsymbol{GDPGro_{c,t} = \alpha + \beta * FinDev_{c,t} + \gamma * X_{c,t} + \vartheta_t + \mu_c + \varepsilon_{c,t}}$$

Where $GDPGro_{c,t}$ is the GDP growth rate of city c in year t. μ_c and ϑ_t stand for city and year fixed effects, respectively.

$\boldsymbol{FinDev_{c,t}}$ proxies for the level of financial development at the city level. The ratio of total loan to GDP is a widely-used financial depth index measuring the development of China's financial system (see for example, Boyreau-Debray (2003a), H. Chen (2006), Hasan et al. (2009), J. Zhang et al. (2012)). However, as argued earlier, this measure tends to overestimate the level of loans to enterprises and households. To account for China's unique politico-financial institution, we construct a new financial depth index which appropriately measures the financial depth for enterprises and households. We will discuss this in Section 3.2.

$X_{c,t}$ is a vector of city-level control variables which include $Initial\ GDP$ to capture the tendency for the convergence effect, $PopGro$ to control for the growth of the labour force, $GovtExp$ to capture city government size, $Openess$ to capture the degree of openness of the local economy, $Investment$ to measure investment in physical capital, $Education$ to measure human capital accumulation, $Inflation$ (at provincial level) to control for the stability of the macroeconomic and business

[4] Although a series of macroprudential polices have been initiated to relieve the negative effect of those expansionary policies, the problem of runaway credit growth is still serious during the post-crisis period, as indicated by the extremely high corporation leverage and asset prices bubbles.

environment. We also control for the land transfer income ($LandTrans$). It is an important indicator for economic development in China as most of its income is used for urban development. As an important source of government revenue, it also measures governments' debt-paying ability (Zhong & Lu, 2015), and thus influences government debt (i.e. $GovtDebt$, see the definition in Section 3.2).

Most of our data are obtained from the China City Statistical Yearbook. See Table 1 for the definition and sources of our variables, and Table 2 for their descriptive statistics. Table 2 also reveals considerable variation of the variables we use across different cities.

Table 1 Variable construction

Variable	Description	Sources
GDP	GDP in Billions of current RMB	China City Statistical Yearbook (CCSY)
$GDPGro$	The percentage of total GDP	CCSY
$Initial\ GDP$	The logarithm of initial GDP	CCSY
$FinDev^{original}$	The percentage of total loans by financial institutions to GDP	CCSY
$GovtCredit$	The percentage of government credit by financial institutions to GDP (Government credit is measured as LGFV credit)	Wind and author's construction
$FinDev$	The percentage of private credit by financial institutions to GDP (Private credit is the difference between total credit and government credit)	Author's construction
$PopGro$	The percentage of population growth rate	CCSY
$Openness$	The percentage of the sum of import and export to total GDP	CCSY
$Investment$	The percentage of total fixed asset investments to GDP	CCSY
$Education$	The percentage of students in the total population enrolled in secondary schools	CCSY
$GovtExp$	Ratio of government consumption to GDP in percentages	CCSY
$Inflation$	Annual change in CPI in percentages (provincial data)	China Statistical Yearbook
$LandTrans$	The percentage of land transfer income to GDP	China Land and Resources Statistical Yearbook

Table 2 summary statistics

Variable	Obs.	Mean	Std. Dev.	Min	Max
$GDPGro$	2724	9.972	4.081	-10.670	25.100
$GovtExp$	2724	19.212	11.590	4.523	169.900
$Openness$	2724	16.838	27.000	0.196	167.634
$Investment$	2724	78.160	28.450	17.264	173.412
$Inflation$	2724	2.233	1.515	-2.346	6.338
$LandTrans$	2724	4.267	3.224	0.192	13.655
$Education$	2724	10.476	3.627	1.260	46.472
$PopGro$	2724	0.416	3.897	-14.590	13.671
$FinDev$	2724	76.499	39.981	23.306	235.176
$FinDev^{original}$	2724	90.714	52.806	27.996	314.642
$GovtCredit$	2724	14.112	22.707	0.000	189.714

3.2 Measurement of financial development

The existing finance-growth literature uses the ratio of private credit to GDP as a proxy for financial development (see for example, Levine (1999), Beck et al. (2000)). The principle behind this indicator is that credit expansion in the private sector is positively associated with the efficiency of financial services and hence this indicator measures the development level of financial intermediary. The private credit used in the cross-country studies usually includes loans, nonequity securities, and trade credits and other accounts receivable. But China's finance heavily relies on loans (Song and Xiong (2018) and its statistical data does not provide information on non-loans financing to enterprises and households. As a result, the conventional financial development index for China is measured by the total outstanding claims of regulated financial intermediaries on non-financial enterprises and households, divided by GDP (see for example, Aziz and Duenwald (2002), H. Chen (2006), Hasan et al. (2009), J. Zhang et al. (2012)).

However, this financial depth index (denoted as $FinDev_{c,t}^{original}$ in this paper) overestimates the amount of enterprises and households loans as it includes a large amount of implicit government loans. Zhou (2017) sheds light on the situation and points out that China's local governments obtained a large number of off-balanced-sheet loans through their connected financing platforms, which is one of main causes for the extremely high corporation leverage during the post-GFC period. The local government financing vehicles (LGFVs) are government-controlled firms which can borrow from banks and spend on behalf of local government and have accumulated the majority of the off-balance-sheet government debt[5].

We believe that the LGFVs' loan should be excluded from the calculation of the financial depth index due to the following two reasons. Firstly, LGFVs in China are endowed with implicit government guarantees and thus face less financing constraints than private enterprises and households (Huang, Pagano, & Panizza, 2020). Secondly, as many of the projects financed by LGFVs are related to social welfare (such as new public infrastructures and social housing), the state-dominated bank sectors in China are less independent in applying good risk management practices when expanding loans to LGFVs in the public sector than other firms in the private sector (Akimov, Wijeweera, & Dollery, 2009; C. Zhang, Zhu, & Lu, 2015).

Note that there is no public source providing explicit information on government debt in the form of LGFVs' bond issuances or loan obligations. Following Huang et al. (2020), we use the ratio of total LGFVs' loan to GDP to measure the implicit government credit ($GovtCredit_{c,t}$) that will be used to calculate our financial depth

[5] This LGFV debt is kept off the balance sheets of local authorities, and is not recognised by the central government. In 2018, the LGFV debt is more than twice the official recognised local government debt (CADTM 2022).

index. We take the advantage of the requirement that all organizations seeking approval to issue bonds in a particular year t should disclose their most recent and historical financial statement to the public (at least for the previous three years). In other word, if a company decides to issue a bond in year t, we can retrieve its debt-related information dating back to year $t-3$. We manually collect the bank loan data of LGFVs from their financial sheets listed in China Bond and the Wind Information Co. (WIND) database[6]. The bank loan liability of each LGFVs includes short-term debt, long-term debt, and noncurrent liabilities due within a year. Then, the local government-related bank loans ($GovtCredit_{c,t}$) in city c in year t is measured by aggregating the bank loans of all LGFVs headquartered in city c in year t. In Appendix 1, we show that the our LGFVs data is very similar to that of Huang et al. (2020). For the detailed construction of the off-balance-sheet government debt ($GovtCredit_{c,t}$) and the context of government LGFVs, also see Appendix 1.

Table 2 shows that the average government loans accounts for 14.1% of total GDP during 2009-2018. This is almost one sixth of the average total loan to GDP ratio (i.e. 90.7%). It indicates that the financial depth index $FinDev^{original}$ which includes $GovtCredit$, substantially overestimates the financial development level at local level. To adjust this, we remove the implicit government loans from the total loans, and construct a new financial development index, namely $FinDev_{c,t}$. The new index is computed as the difference between $FinDev^{original}$ and $GovCredit$.

[6] WIND (https://www.wind.com.cn/en/about.html) categorizes urban investment bond issuance (UIBs), namely LGFV bond issuance, in line with the ChinaBond (https://www.chinabond.com.cn/d2s/cbData.html). The UIB classification of ChinaBond is different from that of NAO. We choose ChinaBond (and thus WIND) due to: (1) market participants frequently use ChinaBond's classifications; (2) The data listed on NAO does not contain any prefectural-level information. In addition, the data for LGFV's liability reported by NAO is only available for June 2013.

3.3 OLS regression results

Table 3 shows the OLS estimates for Equation 1. It reveals a negative relationship between $FinDev$ and $GDPGro_{c,t}$, as well as between $FinDev^{original}$ and $GDPGro_{c,t}$. Our OLS regression results are contrary to the positive growth-driven function of financial development found in the finance and growth literature (see for example, Beck et al. (2000)). Our result suggests that the development of financial system (at least judging from its loan to GDP level) is not associated with higher local economic growth during the decade after the GFC in China. We discuss the specific reasons for the negative relationship in Section 6.

The coefficients of most control variables are consistent with what we have expected. In particular, there is a positive relationship between $GovtCredit$ and $GDPGro$. This finding is quite intuitive: China is at the development stage with a great demand for public infrastructures and service, thus the large loans leading to investment in these areas are associated with boosting local economic growth. Although the coefficients estimated by OLS are negative for trade openness and government expenditure, their coefficients become positive after correcting for endogeneity. We will show these results in section 4.

Table 3 Finance-growth nexus: OLS Estimates

Dep. Variable: $GDPGro$	**(1)**	**(2)**
$FinDev$	-0.030***	
	(0.003)	
$GovtCredit$	0.003	0.028***
	(0.007)	(0.006)
$FinDev^{original}$		-0.026***
		(0.003)
$Initial\ GDP$	-1.726***	-1.554***
	(0.483)	(0.482)
$GovtExp$	-0.014	-0.013

	(0.009)	(0.009)
$Openness$	-0.014**	-0.015**
	(0.006)	(0.006)
$Investment$	0.024***	0.024***
	(0.003)	(0.003)
$Inflation$	0.468***	0.491***
	(0.117)	(0.117)
$LandTrans$	0.124***	0.122***
	(0.024)	(0.024)
$Education$	0.014	0.013
	(0.021)	(0.021)
$PopGro$	0.021	0.021
	(0.014)	(0.014)
Observations	2724	2724
Adjusted R-squared	0.641	0.639

Note: Robust standard errors in parentheses. *** Significant at the1% level. ** Significant at the 5% level. * Significant at the10% level.

4 Endogeneity issues

A large number of studies show that there can be a two-way causality between financial development and economic growth (see for example, Demetriades and Hussein (1996), Ahmed (1998), Shan, Morris, and Sun (2001)). On the one hand, the supply-leading hypothesis proposes a causal relationship from financial development to economic growth. It argues that financial system is a facilitator to mobilize funds for investment, thus is beneficial for the rest of the economy. On the other hand, the demand-following hypothesis proposed by Patrick (1966) postulates a causal relationship from economic growth to financial development (i.e. financial sector responds passively to economic growth). It maintains that an increasing demand for financial services might induce an expansion in the financial sector as the real economy grows.

The reverse causality may generate biases in the OLS estimates shown in Table 3. That is, if financial deepening reacts to the expectation of growth positively[7], the error term in the growth regression is positively correlated with financial development and thus the estimated OLS coefficients are biased (Favara, 2003; Wait, Ruzive, & le Roux, 2017). To address addressed reverse causality, we will use the GMM approach in Section 4.1, and the instrumental variable approach in Section 4.2.

4.1 GMM

The generalized method of moments have been widely applied in the finance-growth literature (see for example, Beck et al. (2000), H. Chen (2006), Arcand et al. (2015)) to address potential endogeneity by using lagged observations of financial depth as internal instruments. In our growth regression, the use of lagged observations of explanatory variables can address the bias caused by the joint determination of financial development and economic growth, and also alleviate the endogeneity problem for our conditional variables. Thus, we use system GMM estimator proposed by Arellano and Bond (1991) to estimate a dynamic panel model.

Note that our study employs system GMM which makes use of both levels along with the first difference series to handle challenges of weak instruments. The system GMM is more efficient when compared to first difference estimator which only uses the first difference series, as the latter estimator can generate poor results when lagged levels of a persistent series prescribe weak instruments for the successive first difference series (Arellano & Bover, 1995; Blundell & Bond, 1998). Furthermore, to

[7] It is likely that the reverse causality is negative during the period after the global financial crisis. When economic growth slows down or the economy experiences a recession, there is a strong need for stimulus through the banking system and hence loan to GDP increases.

obtain more asymptotic efficient estimates, we deploy two-step system GMM estimator rather than one-step system GMM (See discussion in Roodman (2006), Ganda (2019)).

In Column (1) of Table 4, the GMM estimation reveals a negative $FinDev$ coefficient. This negative finance-growth relationship is consistent with the results estimated by OLS in Table 3. The coefficient of $FinDev$ estimated by GMM is more negative than the one estimated by OLS. We also conduct the second-order serial correlation test and Hansen test to exam the validation of GMM estimates. The null hypothesis of AR(2) is accepted, i.e. the second order error terms are not serially corrected. The Hansen's test confirms the overall validity of our model as its p-values exceed the conventional significance levels.

Table 4 Regressions correcting for endogeneity

Dep. Variable: $GDPGro$	(1) GMM	(2) IV	(3) IV	(4) IV
$FinDev$	-0.033***	-0.049***	-0.063***	-0.045***
	(0.007)	(0.012)	(0.023)	(0.013)
$GovtCredit$	0.037***	0.036***	0.043***	0.034***
	(0.011)	(0.008)	(0.014)	(0.008)
$Initial\ GDP$	0.433	-0.056	-0.097	-0.053
	(0.628)	(0.179)	(0.224)	(0.168)
$GovtExp$	0.019	0.040**	0.048**	0.036**
	(0.043)	(0.017)	(0.023)	(0.018)
$Openness$	-0.039**	0.011**	0.015*	0.010*
	(0.019)	(0.006)	(0.008)	(0.006)
$Investment$	-0.001	0.018***	0.015**	0.019***
	(0.010)	(0.004)	(0.006)	(0.004)
$Inflation$	-0.479	0.607***	0.637***	0.604***
	(0.395)	(0.188)	(0.208)	(0.184)
$LandTrans$	-0.192*	0.182***	0.213***	0.174***
	(0.115)	(0.040)	(0.057)	(0.041)
$Education$	0.164	0.085***	0.096**	0.082***
	(0.151)	(0.028)	(0.040)	(0.026)
$PopGro$	0.441***	0.059***	0.062***	0.058***

	(0.141)	(0.013)	(0.016)	(0.012)
obs	2724	2719	2724	2719
GMM test:				
Hansen test (p-value)	0.118			
AR(1) test (p-value)[a]	0.000			
AR(2) test (p-value)[a]	0.483			
IV Test:				
IV		$Colonization_c$ and $\frac{Branch_{c,2008}}{Population_{c,t-1}}$	$Colonization_c$	$\frac{Branch_{c,2008}}{Population_{c,t-1}}$
Kleibergen-Paap F test		9.930	8.601	12.126
Cragg-Donald F statistic		105.196	60.281	181.052
StockYogo-15%[b]		11.59	8.96	8.96
StockYogo-10%[b]		19.93	16.36	16.36
LM statistic		22.914***	8.090***	17.930***
Sargan-Hansen test (P values)		0.379	-	-

Note: [a] AR(1)-test and AR(2) are the Arellano–Bond test for serial correlation of order one and two, respectively.

[b] StockYogo-15% and StockYogo-10% are Stock, Yogo, Andrews, and Stock (2005) weak identification test with critical values for 10% and 15%, respectively. The instrument assessment reported in Stock et al. (2005) is as follows: Cragg-Donald F statistic >10% maximal IV size: very powerful instrument; 10% <Cragg-Donald F statistic <15% maximal IV size: powerful instrument;15% <Cragg-Donald F statistic <20% maximal IV size: medium instrument; 20% <Cragg-Donald F statistic <25% maximal IV size: weak instrument.

Robust standard errors in parentheses. $***$ Significant at the 1% level. $**$ Significant at the 5% level. $*$ Significant at the 10% level.

4.2 Instrumental Variables Two-Stages Least Squares (IV-2SLS)

GMM with a suitable instrument rank is frequently used in models without perfectly exogenous explanatory variables (Blundell & Bond, 2000). It provides a first step to address the endogeneity in our study. But the GMM estimation is inadequate to fully address endogeneity as it imposes a strong assumption that the internal use of lagged explanatory variable does not have any direct causal effect on the dependent variable or unobserved confounders. In this section, we use an instrumental variable approach with two external instruments, i.e. colonization intensity index and bank density index. We discuss these two instruments as follows.

4.2.1 Instrumental variables for financial development ($FinDev$)

(A) IV: Colonization intensity index

Our first external instrument for financial development is a colonization intensity index. To systematically understand their relationship, it is necessary to look back into the Chinese colonization history. During the late Qing Dynasty (1840–1911), China was defeated in a series of wars against foreign powers, including two Opium Wars with Great Britain, the Sino-Japanese War of 1894–1895, and the Boxer Rebellion. In the wake of military defeats, the Qing government was forced to sign unequal treaties including territorial concessions. The foreign powers effectively established their sovereign authorities and created a decentralised and pluralistic political regime which largely weakened unrestricted government privileges of the Qing government to monopolize domestic business. As a result, the foreign powers reduced the Qing government's arbitrary use of power over private sectors, and established a market-oriented, legalized, and internationalized business environment in the colonised areas, which facilitated their financial liberalization and development in the long run. Particularly, this financially open atmosphere helped the colonization areas to quickly become the financial centre, such as Shanghai and Tianjin. These centres still take a prominent position in their respective local financial markets.

We conjecture that the previously colonized cities in China were more likely to experience higher financial development as they are more likely to have inherited informal institutions and environments that promote financial openness and participation. We do not distinguish the different effect of different foreign powers on financial development as all of them exerted a strong positive impact by protecting the financial sector of colonial domains against the strong interference of Qing government. It is plausible that the duration of local colonial powers is a good measure of such

effect. Thus, we use a colonization intensity index as an external instrument to explain differences in financial development across cities. The colonization intensity index is constructed as follows:

$$Colonization_c = \ln\left(\sum_m C_{c,m}\right)$$

Where $C_{c,m}$ is the duration of colonial power m in the city c. Our colonization intensity index[8] is the logarithm of aggregate colonization durations of all colonial powers in city c. The colonization intensity index is zero for cities without any colonization history. The colonized cities with the information of the duration of their colonization are collected from Wang and Luo (2022) (see details in Appendix 2). The first-stage IV regressions validate our conjecture for the relevance of the instrument: the colonization intensity index is a powerful predictor of financial development in the cross-city dimension. This instrument variable could be considered as exogenous as the concessions and treaty ports are historically set by foreign forces.

(B) IV: Bank branch density

We also use the bank branch density as another instrument variable for financial development. Deliberate creation of financial institutions and markets increases the supply of financial services, and thus promotes financial development (Calderón & Liu, 2003; Guiso, Sapienza, & Zingales, 2004; Yang, Guariglia, Peng, &

[8] We also use the colonization dummy as an external instrument for financial development. It gives a robust result. Our colonization intensity index has some advantages over the colonization dummy variable. This index captures two important factors of the colonization experience which are ignored by the dichotomous setting. Firstly, some cities and provinces had multiple foreign concessions. Secondly, the duration of the occupation is different. Those two factors influence the spread of the foreign financial culture and informal institutions, thus our index provides a better measure of colonial power on financial development. In addition, since most colonized regions in China are located in coastal areas, using the intensity index can relieve of the concern of geographic endogeneity in the dichotomous setup.

Shi, 2022). We use the density rather than the number of bank branches to account for the fact that a large regional financial system is of limited use as it is not accessible to a sufficiently large proportion of the population. Thus, we scale the number of bank branches by population at the city level. The bank branch density is proxied as the ratio of total number of bank branches to total population in city c in year t, denoted as $\frac{Branch_{c,t}}{Population_{c,t}}$.

However, using $\frac{Branch_{c,t}}{Population_{c,t}}$ as an IV may violate the exclusion criteria of IV approach as the establishment of new bank branches in an area can reflect local economic environment and growth opportunities (De Gregorio & Guidotti, 1995; Jayaratne & Strahan, 1996; King & Levine, 1993). While the set-ups of bank branches in China heavily rely on some political factors such as administrivia divisions (Almanac of China's Finance and Banking, 1999), the financial commercialization process since the late 1990s increases banks' independence to establish more branches in areas with better economic expectation on a commercial basis (Jayaratne & Strahan, 1996). Given the possibility that the establishment of new bank branches may reflect local growth expectation in China during recent years, we construct a new IV using a predetermined variable, namely $\frac{Branch_{c,2008}}{Population_{c,t-1}}$. This instrument is strictly exogenous as it is unlikely to be affected by any exogenous economic shock in year t.

(C) IV estimation results

We use both colonization intensity index and bank branch density as external instruments for financial depth index ($FinDev$). The IV approach results are shown in column (2) of Table 4. There is a significant negative effect of financial deepening on economic growth, and this negative effect is larger than those estimated by the OLS

approach in Table 3. The under-identification test (i.e. Kleibergen-Paap rk LM statistic) is rejected, which valid our identification strategy. The result of Kleibergen-Paap F test that examines the joint significance of our IV's coefficients is 9.9, which is almost as high as the rule of thumb value of 10 suggested by Staiger and Stock (1994). The Cragg-Donald F-statistics for the weak IV test is 105.2, which is greater than the critical value of 19.9 under the 10% margin of error suggested by Stock et al. (2005). The Hansen over-identification test is not rejected, which implies that the our external instruments do not have a direct effect on the dependent variable, which valid our external instruments.

The last two columns of Table 4 present the IV estimation results for colonization intensity index and bank branch density (i.e. $\frac{Branch_{c,2008}}{Population_{c,t-1}}$), respectively. They give a robust negative finance-growth nexus. The related IV diagnostic tests indicates that our IV estimates do not suffer from the problem of weak- and under-identification. The related IV diagnostic tests indicates that our IV estimates do not suffer from the problem of weak- and under-identification[9].

As an alternative robustness check, we also use the branches number in a specific year during 2005-2007 to construct several branch density IVs, namely $\frac{Branch_{c,m}}{Population_{c,t-1}}, m\sim(2005,2007)$. Still, the results of those exogenous instruments show a robust negative growth effect of financial development (see Appendix 3).

5 Robustness Checks

[9] Sargen-Hansen test is not reported as it only works under overidentification (i.d. the number of instruments are more than the number of endogenous variables).

5.1 long-term relationship

We examine the finance-growth nexus in the long-run. To do so, the dependent and explanatory variables are all averaged over 2009–2018. The basic cross-sectional regression model is:

Equation 2 $GDPGro_c = \alpha + \beta * FinDev_c + \delta * GovtCredit_c + \gamma * X_c + \varepsilon_c$

Equation 2 is firstly estimated by OLS technique. The OLS estimate gives similar results as the panel analysis (see column (1) of Table 5). It indicates a long-run negative growth effect of financial development. As discussed in the previous section, we also employ the IV approach to alleviate the endogeneity issue, by using the branch density in 2008 [10] and the colonization intensity index as relevant instrument. The IV estimation gives a larger negative coefficient of financial development, which is consistent with the findings in Section 4.

5.2 Nonlinearities

Recent studies propose a nonlinear finance-growth nexus (see for example, C.-H. Shen and Lee (2006), Law and Singh (2014), Samargandi et al. (2015)). These papers claim that financial development only helps economic growth up to a certain point before it start to hinder it. If this is the case, the finance-growth relationship should be non-linear, specifically an inverted U-shaped one (Arcand et al., 2015). To estimate this nonlinear relationship, we use the model as follows:

Equation 3 $\boldsymbol{GDPGro_{c,t} = \alpha + \beta_1 * FinDev_{c,t} + \beta_2 * FinDev^2_{c,t} + \delta * GovtCredit_{c,t} + \gamma * X_{c,t} + \vartheta_t + \mu_c + \varepsilon_{c,t}}$

[10] This IV is slightly different from the one used in Section 4. It is defined as the ratio of bank branches scaled by population in 2008, namely $\frac{Branch_{c,2008}}{Population_{c,2008}}$.

The OLS and GMM estimates in Column (2) of Table 5 shows a negative coefficient of financial depth ($FinDev$) and a positive coefficient of its quadratic term. It indicates the finance-growth relationship in our study is not inverted U-shaped but a U-shaped one[11]. This U-shaped finance-growth relationship has a turning point around 184.8%. Given that less than 3% (i.e. 76/2724) of our $FinDev$ observations exceeds this value, we maintain our finding that at Chinese city level, financial development and economic growth are negatively correlated.

[11] This result confirms that there is no downward bias concern (see Arcand, Berkes et al. (2015))

Table 5 Robustness checks

	(1) Long-run		(2) nonlinear		(3) $FD_{c,t}^{Loan\&Deposit}$			(4) $FD_{c,t}^{savings}$			(5) $\boldsymbol{Year}_{y,y+1} * FinDev$
	OLS	IV	OLS	GMM	OLS	GMM	IV	OLS	GMM	IV	OLS
$FinDev$	-0.016***	-0.049***	-0.104***	-0.114***							-0.024***
	(0.003)	(0.014)	(0.010)	(0.036)							(0.004)
$FinDev^2$			0.000***	0.000***							
			(0.000)	(0.000)							
$FD_{c,t}^{Loan\&Deposit}$					-0.012***	-0.012***	-0.018***				
					(0.001)	(0.003)	(0.004)				
$FD_{c,t}^{savings}$								-0.068***	-0.034***	-0.112***	
								(0.005)	(0.008)	(0.030)	
$\boldsymbol{Year}_{2009,2010} * FinDev$											-0.032***
											(0.004)
$\boldsymbol{Year}_{2011,2012} * FinDev$											-0.028***
											(0.004)
$\boldsymbol{Year}_{2013,2014} * FinDev$											-0.022***
											(0.004)
$\boldsymbol{Year}_{2015,2016} * FinDev$											-0.011***
											(0.003)
$GovtCredit$	0.018***	0.037***	-0.012*	-0.009	0.029***	0.042***	0.063***	0.020***	0.018**	0.031***	-0.015**
	(0.005)	(0.009)	(0.007)	(0.013)	(0.007)	(0.014)	(0.013)	(0.006)	(0.008)	(0.007)	(0.007)
$Initial\ GDP$	0.150***	0.030	-2.563***	-0.083	-1.779***	0.601	0.061	-3.638***	0.856	-0.729**	-1.698***
	(0.047)	(0.213)	(0.489)	(1.110)	(0.489)	(0.578)	(0.143)	(0.524)	(0.542)	(0.290)	(0.478)
$GovtExp$	0.018*	0.055**	-0.007	-0.017	-0.011	0.097**	0.061***	0.003	0.127**	0.083**	-0.003
	(0.011)	(0.028)	(0.009)	(0.036)	(0.009)	(0.041)	(0.020)	(0.010)	(0.050)	(0.038)	(0.009)
$Openness$	0.001	0.008	-0.010	-0.069*	-0.012*	-0.007	0.008*	0.005	0.019	-0.005	-0.006
	(0.004)	(0.005)	(0.006)	(0.037)	(0.006)	(0.015)	(0.004)	(0.007)	(0.014)	(0.004)	(0.006)
$Investment$	0.026***	0.012*	0.025***	0.029***	0.025***	0.019**	0.019***	0.023***	0.019***	0.010*	0.029***
	(0.005)	(0.007)	(0.003)	(0.010)	(0.003)	(0.008)	(0.004)	(0.003)	(0.006)	(0.006)	(0.003)
$Inflation$	1.633***	3.079***	0.427***	0.848	0.524***	-0.405	0.628***	0.464***	0.179	0.238	0.458***
	(0.590)	(1.188)	(0.116)	(1.099)	(0.117)	(0.335)	(0.179)	(0.116)	(0.243)	(0.234)	(0.116)
$LandTrans$	0.082**	0.187***	0.133***	0.273**	0.126***	-0.005	0.162***	0.105***	-0.173*	0.165***	0.115***
	(0.038)	(0.062)	(0.024)	(0.126)	(0.024)	(0.115)	(0.033)	(0.024)	(0.102)	(0.045)	(0.024)
$Education$	0.062	0.094*	0.009	-0.361*	0.014	0.230*	0.093***	0.003	-0.135	0.059*	0.003
	(0.039)	(0.055)	(0.021)	(0.216)	(0.021)	(0.131)	(0.026)	(0.021)	(0.096)	(0.030)	(0.021)

$PopGro$	0.190**	0.292**	0.022	0.128	0.020	0.678***	0.056***	0.014	0.036	0.021	0.015
	(0.093)	(0.146)	(0.014)	(0.142)	(0.014)	(0.142)	(0.011)	(0.014)	(0.076)	(0.014)	(0.014)
obs	275	273	2724	2724	2703	2703	2698	2699	2699	2694	2724
Adjusted R-squared	0.981		0.649		0.639			0.651			0.650
GMM test:											
Hansen test (p-value)				0.314		0.218			0.220		
AR(1) test (p-value)				0.000		0.000			0.000		
AR(2) test (p-value)				0.763		0.049			0.003		
AR(3) test (p-value)[a]						0.135			0.423		
IV Test:											
IV		$\frac{Branch_{c,2008}}{Population_{c,2008}}$ and $Colonization_c$					$Colonization_c$ and $\frac{Branch_{c,2008}}{Population_{c,t-1}}$			$Colonization_c$ and $\frac{Branch_{c,2008}}{Population_{c,t-1}}$	
Cragg-Donald F statistic		13.155					122.728			42.040	
Kleibergen-Paap F test		8.682					14.325			6.538	
LM statistic		19.761***					31.134***			13.265***	
Sargan-Hansen test (P values)		0.404					0.498			0.534	

Note: [a] if there is an evidence of serial correlation of order two in the differenced residuals, we restricted the instrument set to lags three and deeper (Roodman, 2006).
Robust standard errors in parentheses. *** Significant at the 1% level. ** Significant at the 5%level. * Significant at the10% level.

5.3 Additional robustness tests

Two alternative financial development indicators at city level are used as a robustness check. Firstly, we use the ratio of total loans and deposits in the financial system to GDP, namely $FD_{c,t}^{Loan\&Deposit}$. This indicator gauges the overall size of the financial institutions and approximates the financial interrelation ratio (Goldsmith, 1969). The second indicator is the ratio of total household savings to local GDP, namely $FD_{c,t}^{savings}$, which measures China's financial development with regard to mobilizing household savings (Guariglia & Poncet, 2008; C. Zhang et al., 2015; J. Zhang et al., 2012). Both GMM and IV estimates, as well as OLS estimates in Columns (3)-(4) of Table 5, show that the correlation between the two alternative financial development indicators and economic growth are consistently negative.

We also check whether the negative finance and growth relationship is consistent in all the years during our sample period. We divide our sample period into five periods, and then create four period dummies, i.e. $Year_{2009,2010}$, $Year_{2011,2012}$, $Year_{2013,2014}$, $Year_{2015,2016}$. For example, $Year_{2009-2010}$ is dummy variable: one for year 2009-2010, and zero for other years. The regression model is:

Equation 4

$$\boldsymbol{GDPGro_{c,t} = \alpha + \beta_1 * FinDev_{c,t} + \beta_2 * \sum_{y=2009,2011,2013,2015} Year_{y,y+1} * FinDev_{c,t} * + \delta * X_{c,t} + \vartheta_t + \mu_c + \varepsilon_{c,t}}$$

Equation 4 is estimated by OLS technique[12] including fixed effects. Column (5) of Table 5 shows that the finance-growth relationship is consistently negative for all five two-years periods. The size of the negative relationship is very large during 2009-

[12] The interaction term $\boldsymbol{Year_{20017,2018}} * FinDev$ is dropped due to collinearity.

2010 and 2011-2012, and it decreases significantly afterwards. A possible reason for the decreasing trend is that, the massive 2008-2009 stimulus program exacerbated the problem of financial inefficiency in China's financial system (see discussion in section 6), but the distortions have been gradually mitigated by a series of macroprudential and monetary policies in the following years.

Another robustness check is conducted to examine whether the negative finance-growth nexus is robust across different regions. We divide our sample data into three different geographic regions, i.e. eastern, central and western areas. All of the results show a robust negative finance-growth nexus across different regions (see Appendix 4).

6 Discussion

While it is without any doubt that a well-functioning banking sector is imperative to economic growth, the China's story in this study provides a counterexample to this common insight. We find that cities with higher financial development tend to grow slower during 2009-2018 by using the traditional financial development index (i.e. the ratio of total loan to GDP). This negative relationship is not unique in our study. Early finance-growth studies also find that financial development was not a determinant for the China's economic miracle during 1990s (see for example, Allen et al. (2005), H. Chen (2006) , Hasan et al. (2009)), and mainly attribute the negative nexus to the low efficiency of credit distribution in the banking sector. In this sector, we explore the specific reasons for the negative finance-growth nexus during the post-GFC.

We consider that this negative relationship between finance and growth in China reflects two major problems concerning the role of bank in promoting local

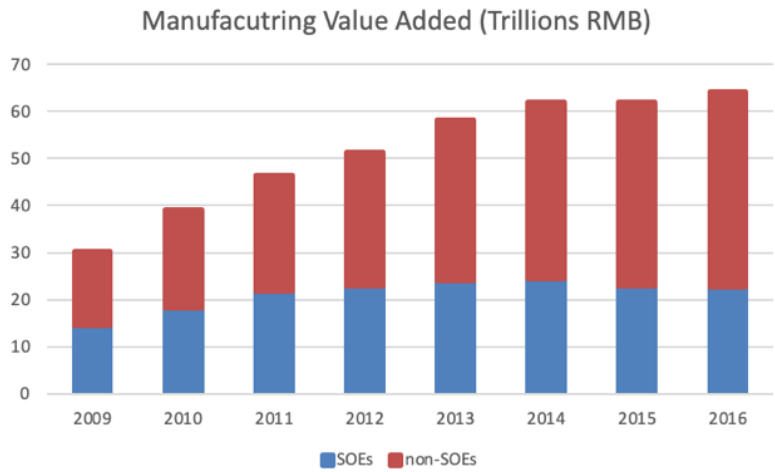
growth. Firstly, China's bank-dominated financial sector is recognized for the strong political intervention from local and central government. This may constrain the ability of Chinese banks to make their independent commercial lending decisions to support productive private sectors and households. For example, while small and medium enterprises (SMEs) are the engine of China's rapid economic growth (Cunningham, 2011; Tsai, 2015), they are discriminated against in loan financing and have to pay a higher interest rate than SOEs (Bai, Hsieh, & Song, 2016; Deng, Jiang, Li, & Liao, 2020; Huang et al., 2020). This has been a long-term problem for China as recognized by the existing literature. A direct impact of this problem is that private firms may invest less relative to SOE firms. We will investigate this issue in section 6.1.

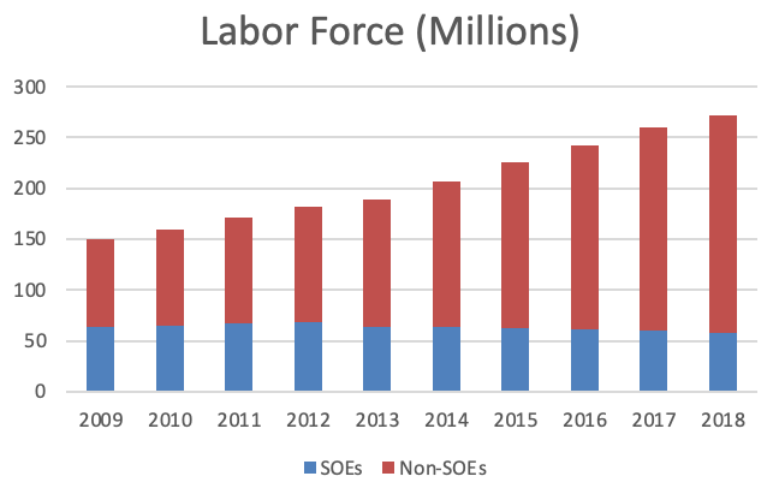
Secondly, the expansionary policies backed by the 2008-09 four trillion stimulus programs through the financial system may have aggravated the problem of capital misallocation at the local level leading to asset bubbles during the post-crisis period. We provide two pieces of evidence on this issue. Firstly, the booming real estate sector overwhelmingly attracted a large volume of financial resources, which led to soaring housing prices. We will discuss this issue in sections 6.2. Secondly, in the wake of the stimulus program, the rapid credit expansion was not effectively channelled into productive real sectors (Song & Xiong, 2018). In section 6.3, we provide some evidence on the increasing financial inefficiency by examining whether credit expansion caused faster growth of financial relative to the growth of real sector. All this suggests that financial distortions and risks in China have increased substantially since 2008.

6.1 Bank discrimination against non-SOEs

The bank-dominated financial system in China is characterized by strong government intervention. Under the political pressure, banks are guided to expand preferential loans to state sector, even into loss-making SOEs (see for example, Biggeri (2003), H. Chen (2006), Hasan et al. (2009)). The lending preference causes a serious problem of credit misallocation between SOEs and private firms. It negatively contributes to the traditional finance-growth nexus through two possible ways. Firstly, bank discrimination against private firms leads to credit constraints for these firms (Bai et al., 2016; Deng et al., 2020; Huang et al., 2020), and thus preventing them from reaching efficient levels of investment. As an important growth engine of China's economic growth, private firms rely heavily on informal financial channels and self-financing, and only account for one third of all corporate debt in China (CADTM, 2022). The share is disproportionately small considering non-state-owned enterprises (non-SOEs) account for a significant share of output and employment (see Figure 1). As a result, financing discrimination hinders the growth of non-SOEs, and hence hinders economic growth.

Figure 1 Labour force and manufacturing value added for non-SOEs and SOEs





Data source: National Bureau of Statistics of China (NBS) (http://www.stats.gov.cn/english/)

Secondly, banks in China, especially large sized state-owned commercial banks continuously support loss-making SOEs in slow-growing sectors due to political considerations. In China, there are a large number of zombie SOEs which rely on blood transfusions from state banks (Lam, Schipke, Tan, & Tan, 2017). These zombie SOEs, particularly those in heavy industries, are unable to make profits, to invest in research and development, or to create new products, and ultimately, they face overcapacity problems and become progressively obsolete. In connection to this, some SOEs which can obtain cheap loans easily are often found to make bad investment, leading to problems of overinvestment and excessive economic capacity (Boyreau-Debray, 2003a; Cull & Xu, 2003, 2005; Q. Liu, Pan, & Tian, 2018; Zhao & Gong, 2021), It has also been found that part of the cheap loans were often used by SOEs for speculative purposes through high interest rate lending to other entities (HANDLEY, 2017). These activities exerted high financing cost on the economy in particular on non-SOE sectors. As a result, it leads to inefficiency and low economic growth.

We examine whether China's banking sector tends to favour SOEs against non-SOEs in our sample period. This may affect the investment level of non-SOEs and

SOEs differently. A direct way to test this view is to analyze the relationship between aggregate investment at local level and local financial development. We use the aggregate investment data for SOEs and non-SOEs at provincial level during the same period of 2009-2018[13]. The provincial aggregate investment data is collected from National Bureau of Statistics of China (NBS). The OLS and GMM results in columns (1)-(2) of Table 6 show that there is a significantly negative correlation between non-SOEs' total fixed capital investment-GDP ratio and the provincial financial development level while there is also a significantly positive relationship between SOEs' total fixed capital investment-GDP ratio and the financial development indicator. These results are consistent with the view that the banking and other financial sectors in China are inclined to lend excessively to SOEs, and as a result fail to support non-SOEs investments.

[13] Note, the investment data for SOEs and non-SOEs are only available at province level. In our regression, our city-level variables, such as financial depth index, are averaged at the province level. We also provide a robustness check by aggregating these city-level variables within the same province.

Table 6 Possible channels for the negative finance-growth nexus

	(1) SOEs'fixed capital investment/GDP		(2) Non-SOEs' fixed capital investment/GDP		(3) housing price			(4) $g_{c,t}^{financial\ sector} - g_{c,t}^{real\ sector}$		
	OLS	GMM	OLS	GMM	OLS	GMM	IV	OLS	GMM	IV
$FinDev$	0.067***	0.177***	-0.059***	-0.083*	0.024***	0.030**	0.041*	0.719***	0.430***	0.348***
	(0.023)	(0.036)	(0.019)	(0.045)	(0.003)	(0.014)	(0.022)	(0.052)	(0.056)	(0.093)
$GovtCredit$	0.031	0.011	-0.125**	0.044	-0.001	0.119**	-0.007	0.212*	-0.309***	-0.282***
	(0.059)	(0.110)	(0.050)	(0.071)	(0.004)	(0.049)	(0.012)	(0.112)	(0.073)	(0.071)
$ln\ GDP$	5.878	0.698	3.204	0.743	2.047***	1.184	1.833***	55.533***	-0.964	2.523
	(4.468)	(8.723)	(3.773)	(3.058)	(0.175)	(1.967)	(0.514)	(7.752)	(4.319)	(2.276)
$GovtExp$	-0.194***	-0.170***	0.036	0.068*	0.047***	0.008	-0.013	0.760***	1.316***	0.217
	(0.029)	(0.027)	(0.024)	(0.035)	(0.014)	(0.055)	(0.033)	(0.127)	(0.255)	(0.278)
$Openness$	-0.163***	-0.155**	0.015	0.173	0.024***	-0.109	0.040***	0.152*	-0.035	-0.062
	(0.054)	(0.070)	(0.045)	(0.136)	(0.004)	(0.082)	(0.015)	(0.086)	(0.081)	(0.049)
$Investment$	0.234***	0.422***	0.213***	0.136*	0.002	0.013	0.014	-0.101**	-0.254***	-0.063
	(0.029)	(0.088)	(0.024)	(0.076)	(0.004)	(0.022)	(0.009)	(0.050)	(0.076)	(0.043)
$Inflation$	-1.634***	-1.161	-1.115**	1.933	-0.245	0.762	0.326	3.416*	6.745*	0.044
	(0.611)	(0.915)	(0.516)	(1.855)	(0.316)	(0.908)	(0.616)	(2.034)	(3.839)	(2.184)
$LandTrans$	-0.301	0.064	-0.040	0.154	0.255***	0.237	0.288***	0.219	0.823	-0.481**
	(0.274)	(0.356)	(0.232)	(0.708)	(0.030)	(0.159)	(0.101)	(0.346)	(0.750)	(0.239)
$Education$	1.394***	0.993*	-0.000	-0.384	-0.056	0.058	-0.077	-0.018	0.006	-0.531***
	(0.267)	(0.508)	(0.226)	(0.488)	(0.039)	(0.281)	(0.072)	(0.251)	(0.805)	(0.206)
$PopGro$	-0.019	-0.011	0.028	0.102	0.044	0.213	0.055*	0.061	-1.086*	-0.252***
	(0.124)	(0.080)	(0.105)	(0.120)	(0.029)	(0.251)	(0.033)	(0.157)	(0.627)	(0.096)
obs	242	242	242	242	1178	1179	1178	1916	1916	1915
Adjusted R-squared	0.937		0.874		0.591			0.222		

GMM test:				
Hansen test (p-value)	0.353	0.893	0.343	0.246
AR(1) test (p-value)	0.044	0.436	0.779	0.135
AR(2) test (p-value)	0.643	0.449	0.608	0.159
IV Test:				
IV			$Colonization_c$ and $\frac{Branch_{c,2008}}{Population_{c,t-1}}$	$Colonization_c$ and $\frac{Branch_{c,2008}}{Population_{c,t-1}}$
Kleibergen-Paap F test			10.734	7.631
Cragg-Donald F statistic			66.277	59.075
LM statistic			22.888***	17.735***
Sargan-Hansen test (P values)			0.193	0.299

Note: [a] The dependent variable is only available at the provincial level. Other variables are averaged at the province-level.
Robust standard errors in parentheses. *** Significant at the1%level. ** Significant at the5% level. * Significant at the10% level.

6.2 Housing market booms

The real estate booms may contribute to the negative finance-growth nexus in China, despite a fast increase in the loan to GDP ratio. During the decade following global financial crisis, the average housing prices roughly tripled, while China's government made efforts to dampen the property price increases through many regulation policies[14]. The steep increase in housing price-to-income ratio in urban China has pushed that ratio above the average level observed in developed economies in recent years (L. Shen, 2012; Sun, 2020). Although the fixed investment in the housing market is an important contributor to the post-crisis economic momentum in China, booms in the real estate sector give rise to the misallocation of resources and capital, and thus deteriorates the traditional finance-growth nexus (T. Chen, Liu, Xiong, & Zhou, 2017).

The booms exacerbate capital misallocation via three channels. Firstly, there is the crowding out effect. Bank credit in China was allocated disproportionately to financing investment in real estate (K. Chen, Ren, & Zha, 2016; Song & Xiong, 2018), which crowded out the access to bank financing for many non-land-holding firms. Secondly, there is the speculation effect. The rising land prices in China increased firms' speculative motivation to finance and acquire more land and thus to reduce their non-land investment. For example, during 2000–2015, roughly one fifth of capital investment of publicly listed corporations (excluding financial, real estate, and construction firms) was invested in purchasing industrial, commercial and residential land (T. Chen et al., 2017). Thirdly, there is the collateral effect. The soaring land prices

[14] Such as increasing downpayments for second house purchase, and forbidding selling apartments to non-residents of the cities.

in China can help land-holding firms to obtain more bank loans by using the land use rights as collaterals, which strengthens the speculation and crowding-out mechanisms.

We examine whether financial development in China has fuelled house price bubbles in China during the period after GFC. We regress average local housing price on the financial depth indicator (i.e. $FinDev$). The average housing price at prefectural level is obtained from a major real estate website in China (Anjuke.com)[15]. The OLS, GMM and IV results in Column(3) of Table 6 show that financial development in the form of higher loan to GDP ratio positively contributes to the housing price booms at city level in China. This finding provides some evidence that by expanding loans banks play an important role in fuelling speculative asset bubbles in the real estate sector.

6.3 Unbalanced growth of financial and real sectors

In the wake of the 2008-2009 four trillion stimulus program, the rapid credit expansion did not effectively support the growth of productive real sectors (Huang & Ge, 2019; Song & Xiong, 2018). Empirical evidence has shown that lending decisions of state-ruled banks in China demonstrate serious moral hazard issue (see D. Zhang, Cai, Dickinson, and Kutan (2016) and Jiang and Yuan (2022)). Specifically state-owned commercial banks and under-capitalized banks tend to undertake more risk which may cause fast credit growth and a problem of non-performing loans in the financial system.

The runaway credit growth has led to unbalanced growth of the financial and the real sectors, and thus may have reduced economic growth. According to Ductor

15 This website was chosen as it is one of the most commonly used online platforms in China for buying, selling, and renting real estate and serves most cities in China.

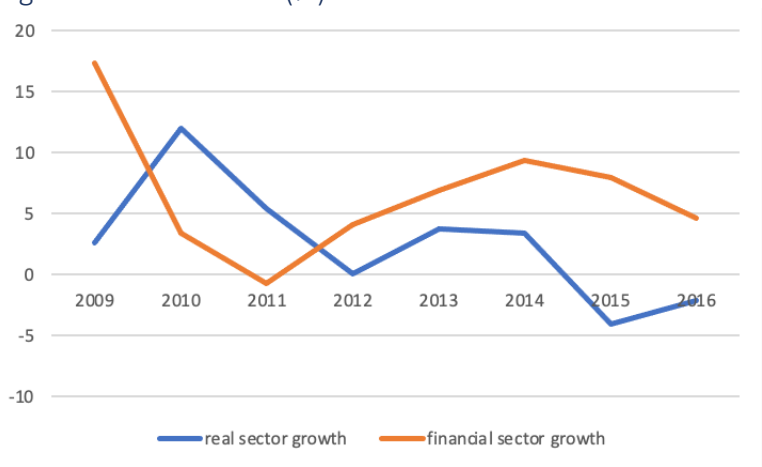
and Grechyna (2015), the balanced growth of financial and real sectors is crucial to sustain economic growth rates. A sufficiently fast-growing real sector can maintain a high demand for financial funds and can sustain relatively high prices of financial funds. The latter makes less efficient projects unprofitable. Thus, it reduces the possibility for inefficient capital allocation to less productive projects and avoids the build-up of financial instability. As a result, it can sustain long-run economic growth (see also, Cheng and Degryse (2010), Beck, Degryse, and Kneer (2014)). However, a disproportionally fast-growing financial sector can produce high rents and can draw resources (e.g. skilled workforce) from non-financial sectors (for example, Santomero and Seater (2000), Ductor and Grechyna (2015), Bolton, Santos, and Scheinkman (2016)). The inefficient resource allocation raises a threat to achieve optimal growth potential.

To investigate this issue, we examine whether China's financial development resulted in an incommensurate growth of financial and real sector. The speed of financial development is measured as the growth rate of $FinDev$ (namely, $\boldsymbol{g}_{c,t}^{financial\ sector}$). We use the growth rate of industrial value added (namely, $\boldsymbol{g}_{c,t}^{real\ sector}$) as an indicator of the growth of the real sector development. The data of industrial value added at city level is collected from China City Statistical Yearbook.

Figure 2 provides some preliminary evidence on the unbalanced growth of finance and growth sector by using the average value of $\boldsymbol{g}_{c,t}^{real\ sector}$ **and** $\boldsymbol{g}_{c,t}^{financial\ sector}$**.** It shows a decreasing trend of the real sector growth in China during 2009-2018, while an increasing trend for the financial sector growth. After 2011, the growth rate of financial sector exceeded the growth rate of real sector. Then, the difference of the two growth rates (i.e. $\boldsymbol{g}_{c,t}^{financial\ sector} - \boldsymbol{g}_{c,t}^{real\ sector}$) is regressed on

our financial depth index ($FinDev$) and a set of control variables. The OLS, GMM and IV results in the column (4) of Table 6 confirm a significantly positive coefficient of $FinDev$. Our findings support that, the financial deepening in the form of higher loan to GDP ratio has led to disproportionately fast-growing financial sector relatively to real sector.

Figure 2 Growth rates (%) of real sector and financial sector over 2009-2016



7 Conclusion

This study explores the role of China's financial development on its regional economic growth using a sample of 275 cities. We construct a new financial development index which better measures the loans extended by banks and other financial institutions to local enterprises and households. To address the endogeneity problem in our empirical estimation, GMM and IV estimates are employed to capture the exogenous component of financial development. Our results suggest a negative growth role of financial development in China during 2009-2018. Various robustness tests confirm this negative impact of financial development on local economic growth.

Our finding is consistent with the existing studies which find a negative finance-growth nexus prior to 2000 as a result of capital misallocation due to the distorting nature of the China's state-ruled banking sector. We find evidence based on most recent data to support this view that banks discriminate against non-SOEs and favouring SOEs in their lending activities. We find that the total fixed capital investment GDP ratio of non-SOEs is negatively associated with the provincial bank loan GDP ratio while for SOEs, this association is positive. Thus, bank lending tended to be channelled towards the low-productivity sector away from sectors with high productivity.

We also find that the negative impact of finance on growth appeared to be strongest right after the announcement of the four trillion stimulus government program in 2008-09 and it was reduced gradually. There are indications that China's misallocation of capital may have been worsened by the massive stimulus program which was channelled through the financial system. We provide two new pieces of evidence to support this view. One is related to the speculative bubbles in the real estate sector and suggests that this massive program stimulated these bubbles; the other is that the stimulus program aggravated the unbalanced growth of the financial sector relative to the growth of the real sector. These findings are very much related to the recent literature on the negative role of excessive finance and financial instability. Excessive financial deepening could exacerbate the problem of capital misallocation in financial markets without necessary judicial or regulatory framework (Rousseau & Wachtel, 2011). Our findings raise alarm on the increasing financial risks in China after the 2008 global financial crisis. The rapid expansion of China's banking system triggered speculative behaviour by banks and reduced financial efficiency. The results

of this paper calls attention for more government regulation and supervision of the banking system.

Echoing S. Cecchetti et al. (2015), we urge caution in the use of loan-to-GDP ratio, more broadly private credit-to-GDP ratio, as an indicator of financial development. This ratio mainly measures the size and activity of financial intermediaries. As a measurement of financial development, it is based on an assumption that it is strongly correlated with financial efficiency. However, the efficiency of Chinese financial system seems not to have been improved despite the rapid credit expansion in China over 2009-2018, as indicated by several empirical measures of banks' distortive behaviour. Thus, the private credit-to-GDP is a crude ratio to measure financial development. For future studies, one may wish to map the different functions of financial development into very specific empirical measures.

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9 Appendix

Appendix 1 The construction of government debt

Local government financing vehicles (LGFVs) provide off-balance-sheet quasi-fiscal support for local governments and become increasing important in promoting China's infrastructure and economic development. They raise capital mainly through bank loans and corporate bonds which are secured by local government endorsements and assets (e.g. land use rights). LGFVs have a long history which can be traced back to the tax-sharing reform in 1994, and experienced a surge following the 2007-2008 global financial crisis.

There have been many attempts to estimate the amount of off-balance-sheet regional government debt (e.g., M. Y. S. Zhang and Barnett (2014)), but no public source offers the debt data for provincial or city governments in China. LGFVs provides large quasi-fiscal supports for regional governments, and account for most of off-balance-sheet local government debt (Huang, Pagano, & Panizza, 2016). Following Huang et al. (2016), we proxy local government credit in a city by the sum of bank loans of all LGFVs located in this city.

A common way to collect LGFVs' loan data is to retrieve the publicly available financial sheets for those with new bond issuances (Ambrose, Deng, & Wu, 2015; Ang, Bai, & Zhou, 2015). Similarly, we take the advantage of the requirement that all organizations seeking approval to issue bonds in a particular year t should disclose their most recent and historical financial statement to the public (at least for the

previous three years). In other word, if a company decides to issue a bond in year t, we can retrieve its debt-related information dating back to year $t-3$. We manually collect the bank loan obligations of LGFVs from their financial sheets listed in China Bond and the Wind Information Co. (WIND) database[16]. The bank loan liability of each LGFVs includes short-term debt, long-term debt, and noncurrent liabilities due within a year[17]. Then, the local government-related bank loans ($GovtCredit_{c,t}$) in city c is measured by aggregating bank loans of all LGFVs headquartered in city c.

Our data for regional government bank loans is available for 306 prefectural-level cities. Our data show that China's radical response to the 2007–08 GFC resulted in a quick proliferation of LGFV debts (see Figure A1). Particularly, a major proliferation of local government debt was triggered by China's fiscal stimulus package of RMB 4 trillion during 2008-2009. Between 2005 and 2009, total outstanding regional government debt grew more than five-fold, going from RMB 1.35 to RMB 7.43 trillions, and nearly trebled relative to GDP, from 7.2% to 21.3%. After 2009, it continued to grow, and accounts for 46.47% of GDP by the end of 2018. Particularly, bank loans accounts for the majority of total LGFVs' debt (see Figure 1). The aggregated LGFVs data listed in Figure A1 is much similar to that of Huang et al. (2020) listed in Figure A2. However, our LGFVs debt data is larger than the official data by the National Audit Office (NAO). The 2013 NAO[18] report indicates that total LGFV debt as contingent liability of the government stood at 13.1 percent of 2012 GDP by the end-June 2013,

[16] WIND (https://www.wind.com.cn/en/about.html) categorizes urban investment bond issuance (UIBs), namely LGFV bond issuance, in line with the ChinaBond (https://www.chinabond.com.cn/d2s/cbData.html). The UIB classification of ChinaBond is different from that of NAO. We choose ChinaBond (and thus WIND) due to: (1) market participants frequently use ChinaBond's classifications; (2) The data listed on NAO does not contain any prefectural-level information. In addition, the data for LGFV's liability reported by NAO is only available for June 2013.

[17] Short-term debt (Unit: RMB) refers to loans that have not been returned for one year or less. Long-term debt (Unit: RMB) refers to loans that the company borrows from banks or other financial institutions for a period of more than one year. Noncurrent liabilities due within a year (Unit: RMB) are the company's noncurrent liabilities that will mature within one year.

[18] The data on the Audit Office only covers "official" debt of the LGFVs, which the Audit Office defines as "the debt that government has responsibility to repay or the debt to which the government would fulfil the responsibility of guarantee or for bailout when the debtor encounters difficulty in repayment." (National Audit Office, 2011)

and it is around 30% in our dataset. The “official" debt by audit office is only a subset of total debt of the LGFVs. This is because, the collateral loans secured by the transferred “high-quality” assets are not accounted in the Audit Office’ report. According to Jin and Rial (2016), regional governments mainly transfer some of its “high-quality assets” to the LGFV to improve its creditworthiness, such as public land.

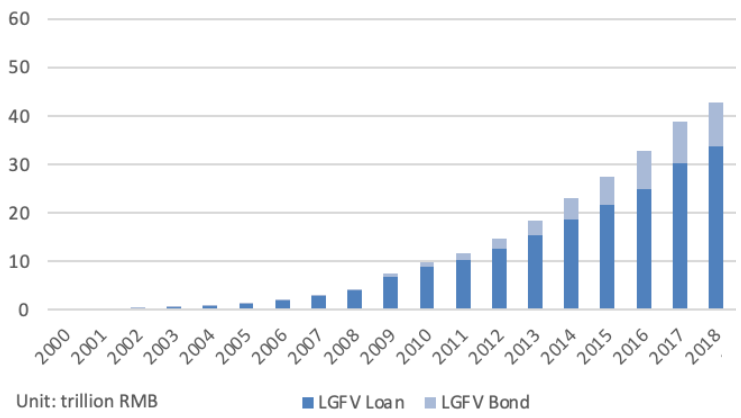

Figure A1: the trend of LGFV debt over 2000-2020

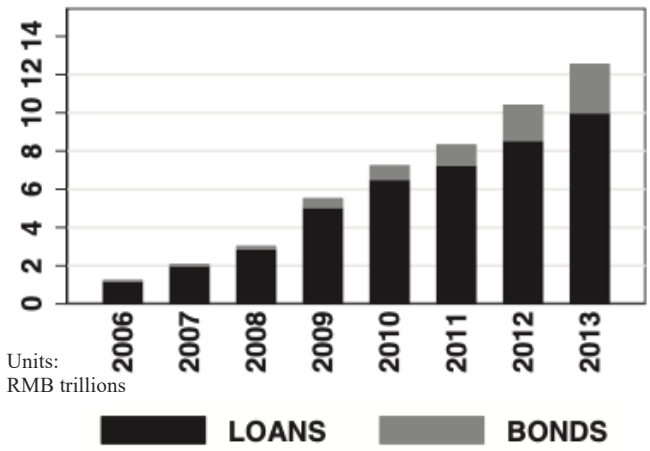

Figure A2: the trend of LGFV debt over 2000-2020 (data source: Huang et al. (2020))

Our measurement has some limitation. The methodology cannot account for debt liability of LGFVs which did not issue bonds. Thus, our measurement is conservative as the loan obligations of hidden LGFVs (i.e. LGFVs that never issued bonds) is not included in our data. Thus, our method only provides a lower bound for the government loans at the prefectural level. It could create reporting bias for cities with a large number of LGFVs which never or seldomly issued any bonds. But the reporting bias could be largely mitigated by our city dummies in terms of the cross-cities variances.

Appendix 2 Colonization history

colonization	Foreign enclave	Location (modern name)	Established	Dissolved	Duration
Austria-Hungary	Beijing legation quarter	Beijing	1861	1945	85
Austria-Hungary	Austro-Hungarian concession in Tianjin	Tianjin	1902	1917	16
Belgium	Beijing legation quarter	Beijing	1861	1945	85
Belgium	Belgian concession in Tianjin	Tianjin	1902	1931	30
France	French concession in Shanghai	Shanghai	1849	1946	98
France	Beijing legation quarter	Beijing	1861	1945	85
France	Gulangyu island	Xiamen	1903	1945	43
France	French concession in Tianjin	Tianjin	1861	1946	86
France	French concession in Shamian island, Guangzhou	Guangzhou	1861	1946	86
France	French railway, Kunming	Kunming	1904	1940	37
France	French concession in Hankou	Hankou/Wuhan	1896	1946	51
France	French concession in Kouang- Tcheou-Wan	Port of Zhanjiang/ Zhanjiang	1889	1946	58
Germany	Frechn concession in Shanghai	Shanghai	1849	1946	98
Germany	Beijing legation quarter	Beijing	1861	1945	85
Germany	Gulangyu island	Xiamen	1903	1945	43
Germany	German concession in Tianjin	Tianjin	1895	1917	23
Germany	German concession in Hankou	Hankou/Wuhan	1895	1917	23
Germany	Kiautschou bay leased territory	Qingdao	1898	1914	17
International	Shanghai international settlement	Shanghai	1863	1945	83

International	Beijing legation quarter	Beijing	1861	1945	85
International	Gulangyu island	Xiamen	1903	1945	43
Italy	Shanghai international settlement	Shanghai	1863	1945	83
Italy	Beijing legation quarter	Beijing	1861	1945	85
Italy	Gulangyu island	Xiamen	1903	1945	43
Italy	Italian concession in Tianjin	Tianjin	1901	1947	47
Japan	Japanese Manchukuo	Qitaihe	1931	1945	15
Japan	Japanese occupation of Shanghai	Shanghai (full control in later stage of 2nd Sino-Japanese War)	1937	1945	9
Japan	Japanese Manchukuo	Dandong	1931	1945	15
Japan	Partially-controlled in 2nd Sino-Japanese War	Jiujiang	1940	1945	6
Japan	Japanese Manchukuo	Yichun	1931	1945	15
Japan	Japanese Manchukuo	Jiamusi	1931	1945	15
Japan	Japanese Manchukuo	Xinganmeng	1931	1945	15
Japan	Beijing legation quarter	Beijing	1861	1945	85
Japan	Partially-controlled in 2nd Sino-Japanese War	Xiamen	1937	1945	9
Japan	Japanese Manchukuo	Shuangyashan	1931	1945	15
Japan	Japanese Manchukuo	Hulunbeier	1931	1945	15
Japan	Japanese Manchukuo	Harbin	1931	1945	15
Japan	Japanese Manchukuo	Siping	1931	1945	15
Japan	Kwantung Leased Territory/ South Manchuria Railway Zone	Dalian	1905	1945	41
Japan	Liaodong Peninsula	Dalian	1894	1895	2
Japan	Japanese concession in Tianjin	Tianjin	1898	1943	46
Japan	Japanese concession in Weihai	Weihai	1895	1898	4
Japan	Japanese Manchukuo	Chengde	1931	1945	15
Japan	Japanese Manchukuo	Fushun	1931	1945	15
Japan	Japanese Manchukuo	Chaoyang	1931	1945	15
Japan	Japanese Manchukuo	Benxi	1931	1945	15
Japan	Japanese concession in Hangzhou	Hangzhou	1897	1943	47
Japan	Japanese Manchukuo	Songyuan	1931	1945	15
Japan	Japanese concession in Hankou	Hankou/Wuhan	1898	1943	46
Japan	Japanese Manchukuo	Shenyang	1931	1945	15
Japan	Japanese Manchukuo	Mudanjiang	1931	1945	15
Japan	Japanese Manchukuo	Baicheng	1931	1945	15
Japan	Japanese Manchukuo	Baishan	1931	1945	15
Japan	Japanese Manchukuo	Panjin	1931	1945	15
Japan	Japanese Manchukuo	Suihua	1931	1945	15
Japan	Japanese concession in Suzhou	Suzhou	1897	1943	47
Japan	Japanese concession in Shashi	Shashi/Jingzhou	1898	1943	46
Japan	Japanese Manchukuo	Yingkou	1931	1945	15

Japan	Japanese Manchukuo	Huludao	1931	1945	15
Japan	Japanese Manchukuo	Chifeng	1931	1945	15
Japan	Japanese Manchukuo	Liaoyuan	1931	1945	15
Japan	Japanese Manchukuo	Tonghua	1931	1945	15
Japan	Japanese Manchukuo	Tongliao	1931	1945	15
Japan	Japanese concession in Chongqing	Chongqing	1897	1943	47
Japan	Japanese Manchukuo	Tieling	1931	1945	15
Japan	Japanese Manchukuo	Xilinguolemeng	1931	1945	15
Japan	Japanese Manchukuo	Jinzhou	1931	1945	15
Japan	Japanese Manchukuo	Changchun	1931	1945	15
Japan	Japanese Manchukuo	Fuxin	1931	1945	15
Japan	Kiautschou Bay leased territory	Qingdao	1914	1922	9
Japan	Japanese Manchukuo	Anshan	1931	1945	15
Japan	Japanese Manchukuo	Jixi	1931	1945	15
Japan	Japanese Manchukuo	Hegang	1931	1945	15
Japan	Japanese Manchukuo	Heihe	1931	1945	15
Japan	Japanese Manchukuo	Qiqihaer	1931	1945	15
Russia	Shanghai international settlement	Shanghai	1863	1945	83
Russia	Beijing legation quarter	Beijing	1861	1945	85
Russia	Gulangyu island	Xiamen	1903	1945	43
Russia	Chinese eastern railway, Harbin	Harbin	1896	1952	57
Russia	Russian Dalian	Dalian	1889	1905	17
Russia	Soviet concession in Dalian	Dalian	1945	1955	11
Russia	Russian concession in Tianjin	Tianjin	1900	1924	25
Russia	Russian concession in Hankou	Hankou/Wuhan	1896	1924	29
UnitedKingdom	British concession in Shanghai	Shanghai	1846	1863	18
UnitedKingdom	British concession in Jiujiang	Jiujiang	1861	1927	67
UnitedKingdom	British concession in Amoy	Xiamen	1852	1930	79
UnitedKingdom	British concession in Dalian	Dalian	1858	1860	3
UnitedKingdom	British concession in Tianjin	Tianjin	1860	1943	84
UnitedKingdom	Weihaiwei leased territory	Weihai	1898	1930	33
UnitedKingdom	Liugong island	Weihai	1930	1940	11
UnitedKingdom	British concession in Shamian island, Guangzhou	Guangzhou	1861	1945	85
UnitedKingdom	British concession in Hankou	Hankou/Wuhan	1861	1927	67
UnitedKingdom	British concession in Zhanjiang	Zhanjiang	1861	1929	69
UnitedStates	Shanghai international settlement	Shanghai	1863	1945	83
UnitedStates	Beijing legation quarter	Beijing	1861	1945	85
UnitedStates	Gulangyu island	Xiamen	1903	1945	43

UnitedStates	American concession in Tianjin	Tianjin	1860	1902	43

Appendix 3 the robustness check of IV-2SLS estimates: bank branch density

Dep. Variable: $GDPGro$	(1)	(2)	(3)
$FinDev$	-0.039**	-0.036**	-0.045***
	(0.016)	(0.014)	(0.014)
$GovtCredit$	0.031***	0.029***	0.033***
	(0.009)	(0.008)	(0.008)
$Initial\ GDP$	-0.050	-0.048	-0.053
	(0.154)	(0.147)	(0.167)
$GovtExp$	0.029	0.026	0.035*
	(0.019)	(0.018)	(0.019)
$Openness$	0.008	0.008	0.010*
	(0.006)	(0.005)	(0.006)
$Investment$	0.020***	0.021***	0.019***
	(0.005)	(0.004)	(0.004)
$Inflation$	0.599***	0.597***	0.604***
	(0.177)	(0.174)	(0.182)
$LandTrans$	0.161***	0.155***	0.173***
	(0.044)	(0.041)	(0.043)
$Education$	0.077***	0.075***	0.081***
	(0.026)	(0.026)	(0.027)
$PopGro$	0.056***	0.055***	0.058***
	(0.012)	(0.012)	(0.012)
obs	2719	2719	2719
IV	$\frac{Branch_{c,2005}}{Population_{c,t-1}}$	$\frac{Branch_{c,2006}}{Population_{c,t-1}}$	$\frac{Branch_{c,2007}}{Population_{c,t-1}}$
Kleibergen-Paap F test	8.104	10.122	11.526
Cragg-Donald F statistic	107.093	119.833	137.879
StockYogo-15%	8.96	8.96	8.96
StockYogo-10%	16.38	16.38	16.38
LM statistic	12.697***	14.835***	17.428***

Note: Robust standard errors in parentheses. *** Significant at the 1% level. ** Significant at the 5%level. * Significant at the10% level.

Appendix 4 The robustness check – across regions

Dep. Variable: ***GDPGro***	(1) Eastern regions			(2) Central regions			(3) Western regions		
	OLS	GMM	IV	OLS	GMM	IV	OLS	GMM	IV
FinDev	-0.036***	-0.032***	-0.088**	-0.024***	-0.025***	-0.052***	-0.015***	-0.013***	-0.005
	(0.005)	(0.010)	(0.043)	(0.008)	(0.002)	(0.013)	(0.006)	(0.002)	(0.014)
GovtCredit	-0.009	-0.004	0.022	0.013	0.013***	0.035**	0.007	0.011***	0.007
	(0.010)	(0.010)	(0.029)	(0.015)	(0.005)	(0.017)	(0.010)	(0.002)	(0.012)
Initial GDP	-4.402***	1.746*	0.302	-1.885**	-0.470***	0.552**	-3.436***	0.283*	-0.089
	(0.828)	(1.026)	(0.494)	(0.828)	(0.097)	(0.236)	(0.969)	(0.149)	(0.283)
GovtExp	0.008	0.146*	0.114	-0.084**	-0.140***	0.008	-0.015	0.053***	0.004
	(0.017)	(0.083)	(0.091)	(0.035)	(0.008)	(0.034)	(0.011)	(0.002)	(0.013)
Openness	-0.044***	-0.011	0.020	0.011	0.049***	0.033**	0.012	0.001	0.006
	(0.010)	(0.022)	(0.015)	(0.014)	(0.004)	(0.013)	(0.011)	(0.003)	(0.005)
Investment	0.068***	0.031***	0.016	0.004	0.010***	0.010	0.015***	0.003**	0.014***
	(0.006)	(0.011)	(0.015)	(0.006)	(0.002)	(0.008)	(0.004)	(0.002)	(0.004)
Inflation	1.278***	3.736***	1.207***	2.122***	1.380***	1.469**	-0.666***	-2.298***	-0.749***
	(0.179)	(1.298)	(0.421)	(0.357)	(0.152)	(0.638)	(0.185)	(0.091)	(0.209)
LandTrans	0.109***	0.321***	0.333**	0.091**	0.258***	0.216***	0.090*	0.349***	0.207***
	(0.031)	(0.125)	(0.144)	(0.046)	(0.017)	(0.047)	(0.050)	(0.030)	(0.069)
Education	0.078**	0.127*	0.150**	-0.059*	-0.256***	-0.083***	0.136**	-0.097***	0.072
	(0.032)	(0.070)	(0.070)	(0.031)	(0.025)	(0.025)	(0.065)	(0.026)	(0.069)
PopGro	0.048**	0.266**	0.098***	-0.015	-0.011**	-0.016	0.056	0.170***	0.072***
	(0.021)	(0.120)	(0.031)	(0.021)	(0.006)	(0.011)	(0.035)	(0.008)	(0.026)
obs	950	950	948	959	959	959	815	815	812
Adjusted R-squared	0.722			0.626			0.641		
GMM test:									
Hansen test (p-value)		0.227			0.234			0.295	
AR(1) test (p-value)		0.002			0.000			0.000	
AR(2) test (p-value)		0.259			0.138			0.257	
IV Test[a]									

Kleibergen-Paap F test	2.002	7.756	5.960
Cragg-Donald F statistic	16.446	50.139	78.754
StockYogo-15%	11.59	11.59	11.59
StockYogo-10%	19.93	19.93	19.93
LM statistic	4.842*	13.566***	9.181***
Sargan-Hansen test (P values)	0.483	0.530	0.586

Note: [a] Instrument variables include $Colonization_c$ and $\frac{Branch_{c,2008}}{Population_{c,t-1}}$.

Robust standard errors in parentheses. $***$ Significant at the 1% level. $**$ Significant at the 5% level. $*$ Significant at the 10% level.