Local Crowding Out in China

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Abstract

In China, between 2006 and 2013 local public debt issuance crowded out the investment of private manufacturing firms by tightening their funding constraints, but it did not affect state-owned and foreign firms. The paper, using novel data for local public debt, establishes this result in three ways. First, local public debt is inversely correlated with city-level investment by domestic private manufacturing firms. Second, this finding is stronger for private firms that depend more heavily on external funding. And third, in cities where public debt is high, firms' investment is more sensitive to internal cash flow, even when cash-flow sensitivity is estimated jointly with the probability of being credit-constrained. These results suggest that the enormous increase in local public debt produced by massive debt issuance as part of the post-2008 fiscal stimulus curtailed private investment, thus weakening China's long-term growth prospects.

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1 Introduction

In China, between 2006 and 2013 local government debt almost quadrupled from 5.8% to 22% of GDP. For the most part, this was the product of the fiscal stimulus program carried out after 2008, worth US$590 billion, coupled with much-reduced reliance on central government debt and transfers to local governments. Given China's geographically segmented financial market, this increase in local debt created imbalances in local financial markets: to underwrite it, banks curtailed financing to private domestic firms, forcing them to cut down on investment. This local crowding-out was more pronounced in the cities that issued more public debt. Public firms were shielded from the funding scarcity, thanks to preferential access to bank credit and almost exclusive access to bond financing (Lin and Milhaupt, 2016).[1] So were foreign firms, which could turn to their home countries' capital markets. We document this city-level crowding-out of private investment thanks to a newly constructed dataset of local government debt for prefecture-level Chinese cities in 2006-13. Given that private companies are the most dynamic component of the Chinese economy, our results suggest that the large-scale local public debt issuance in connection with massive fiscal stimulus may have sapped the country's longer-term growth prospects.

Our research strategy and findings thus hinge on the geographical segmentation and regulation of the Chinese financial market. In an integrated, national financial market, there would be no reason to expect local government debt to affect local investment: its issuance would trigger an increase in local interest rates, drawing in capital from the rest of the country and also possibly causing an increase in local saving. Eventually, the greater stock of local public debt would be held by investors throughout the country, and any crowding-out of private investment would occur at national level.[2] But if the financial market is geographically segmented, the imbalance and its impact on investment will be

[1] Chinese corporate debt is issued overwhelmingly by enterprises whose majority (and often sole) shareholder is an organ of the central or local government (Lin and Milhaupt, 2016, p. 16).

[2] The hypothesis of segmentation would not be necessary if external investors had a limited appetite for a certain jurisdiction. In a study of 15 emerging market countries, Ağca and Celasun (2012) show that external public debt can crowd out external borrowing by private corporations.

localized. Since the main financiers of Chinese local governments are state-owned policy and commercial banks (Gao, Ru and Tang, 2016), local public debt issuance ends up being absorbed by local banks. Furthermore, in a financial market with interest rate ceilings, like the Chinese, such issuance does not trigger a rise in local interest rates or any consequent offsetting response of local saving. Thus, unless local saving increases for other reasons (e.g., due to greater public spending), placing additional local public debt with local banks requires a one-for-one tightening of credit to the local private sector.

Hence, in these circumstances increased local public debt issuance – and its placement with local banks, as by underwriting local government financial vehicles – can be expected to translate directly into tighter credit constraints locally. Not all borrowers will be affected equally, however. If banks maximize profits, they will tighten credit more vis-à-vis riskier borrowers, such as those with less collateral to pledge. If instead banks allocate credit preferentially to politically connected clients, such as state-owned firms, then firms with no such political ins will be rationed more strictly. And these two criteria may well coincide, as state-owned firms are generally assisted by government guarantees.[3] Hence, banks will cut their lending to private borrowers that require costly monitoring and information gathering, crowding out their investment – a mechanism modelled by Broner, Erce, Martin and Ventura (2014) in a cross-country setting.

We bring a varied set of complementary evidence to bear on this hypothesis of local crowding-out. First, our regressions for city-level investment show that local government debt is negatively correlated with private manufacturing investment, but not with that of state-owned and foreign-owned manufacturers. We control for the endogeneity of public debt issuance by using an instrumental variable strategy. While these city-level regressions provide prima facie evidence for a causal relationship running from local public debt issuance to local investment, they do not establish that the mechanism consists in differential tightening of credit constraints on private domestic firms. To show that this is the case, we

[3] Dobson and Kayshap (2006, p. 133) quote a Chinese bank manager as follows: "If I lend money to an SOE and it defaults, I will not be blamed. But if I make a loan to a privately-owned shoe factory and it defaults, I will be blamed."

follow empirical strategies based on increasingly disaggregated data.

One such strategy is akin to that adopted by Rajan and Zingales (1998): we test whether local government debt is particularly damaging for industries whose technology requires more external funding. This method allows us to investigate whether government debt affects investment by tightening credit constraints, and it also mitigates problems of endogeneity by permitting the inclusion of city-year and industry-year effects. Again, local government debt turns out to be associated with less investment by domestically-owned private manufacturing firms but not state- and foreign-owned firms. A limitation of this approach is that it measures only the differential effect of government debt on firms in industries with different degrees of dependency on external funding, not the total effect on investment.

Next, we test whether local government debt affects the sensitivity of firms' investment to internally generated funds. By focusing on within-firm and within-city-year variation, this approach overcomes concerns about reverse causality from investment to local government debt. Unlike the Rajan-Zingales approach, this methodology – which is reminiscent of that pioneered by Fazzari, Hubbard and Petersen (1988) and used by Love (2003) to test whether country-level financial depth attenuates credit constraints – needs no assumptions concerning the external financing requirements of firms in different industries. We find that local government debt affects the sensitivity of investment to internally generated funds for domestic private, but not state-owned and foreign-owned, manufacturing firms.

Finally, to take account of the critique of this methodology put forward by Kaplan and Zingales (2000), we use a switching regression model with unknown sample separation, to estimate investment sensitivities jointly with the likelihood of being a credit-constrained firm (as in Hu and Schiantarelli, 1998, and Almeida and Campello, 2007). Again, as in the previous estimates, local government debt affects cash-flow investment sensitivity for credit-constrained but not unconstrained firms.

This paper is related to the vast empirical literature on the impact of government debt on investment and growth. While there is evidence of a negative correlation between public debt and growth (see Reinhart and Rogoff, 2011, Reinhart, Reinhart and Rogoff, 2012, and Cecchetti, Mohanty and Zampolli, 2011, among others), establishing the causal nexus has been more difficult, as international comparisons are plagued by such problems as reverse causality, omitted variables, and limited degrees of freedom (Mankiw, 1995).[4] As noted above, the geographical segmentation and interest rate ceilings of China's financial market enable us to identify a local crowding-out channel whereby government debt may reduce growth. Specifically, we show that higher levels of local government debt crowd out investment by tightening the financing constraints on private manufacturing firms. As such, our work also relates to the vast corporate finance literature turning on the thesis that the investment of credit-constrained firms is more sensitive to internal cash flow than that of unconstrained firms.

We also contribute to the strand of research inquiring into the effects of the Chinese fiscal stimulus in the wake of the global financial crisis (see Deng, Morck, Wu and Yeung, 2015, Ouyang and Peng, 2015, and Wen and Wu 2014, among others). The stimulus plan appears to have exacerbated a long-standing feature of China's economy, namely that high-productivity private firms fund their investment out of internal savings while low-productivity state-owned firms survive thanks to easier access to credit (Song, Storesletten and Zilibotti, 2011): under the stimulus plan, new bank credit went disproportionately to state-owned firms rather than more productive private firms (Cong and Ponticelli, 2016; Ho, Li, Tian, and Zhu, 2016).[5] According to Bai, Hsieh, and Song (2016), funding the stimulus plan via local government financing vehicles induced a credit reallocation in favor of politically well-connected firms, probably with negative effects on long-run productivity growth. Such reallocation is consistent with our finding that public debt issuance constrained the

[4] Panizza and Presbitero (2013, 2014) survey the literature on debt and growth with particular emphasis on issues of causality and measurement.

[5] Papers on capital misallocation in China include Bai, Hsieh, and Qian (2006), Chang, Liao, Yu, and Ni (2014), Chong, Lu, and Ongena (2013), Cull and Xu (2003), and Song and Wu (2015). Moreover, there is a vast literature on the connections between economic growth and finance in China, focusing on the transformation of the state sector (Hsieh and Song, 2016), the role of government credit (Ru, 2017), bank competition (Ru, Townsend, and Yan, 2017), and the side effects of financial interventions (Brunnermeier, Sockin, and Xiong, 2016).

investment of private firms but not that of state-owned enterprises, which are by definition politically connected. Indeed our estimates of the extent of such credit reallocation are necessarily conservative, since the private firms examined include some politically connected ones that may have been spared by the reallocation, and may even have gained from it.[6]

Finally, our paper produces new knowledge about local government debt in China: the previous studies either estimate total local government debt with no geographical breakdown (Zhang and Barnett, 2014, National Audit Office, 2011, 2013, and Wu, 2015), or study only bond issues, which account for a small part of total borrowing by local government financing vehicles (Ang, Bai and Zhou, 2015, Ambrose, Deng and Wu, 2015, Liang, Shi, Wang, and Xu, 2016). Instead, we build detailed data on total borrowing by local government financing vehicles (LGFVs) in 261 prefecture-level cities between 2006 and 2013. The only other recent comprehensive study of China's local government debt is Gao, Ru and Tang (2016), who document that distressed local governments prefer to default on commercial bank loans rather than politically-sensitive policy bank loans.

The paper is organized as follows. Section 2 sets out our data. Section 3 describes the drivers of geographical segmentation in the Chinese financial market. Section 4 uses city-level data to show that local government debt is negatively correlated with investment by private-sector manufacturing firms and applies an instrumental variable strategy to show that the relationship appears to be causal. Section 5 uses industry-level data to show that local government debt is particularly harmful for industries that need more external financial resources; and Section 6 uses firm-level data to show that local government debt increases investment sensitivity to cash flow for credit-constrained firms. Section 7 concludes.

2 The data

This brief data description focuses in particular on our ad hoc dataset on Chinese local government debt. For further information, see Appendix A and Table A5.

[6] Unfortunately, it is impossible to measure political connections for our sample of more than 350,000 private firms.

Our analysis focuses on prefecture-level cities, the second tier of Chinese local government bodies, below provinces. These cities are administrative units that include continuous urban areas and their surrounding rural areas, comprising smaller towns and villages.[7] While we build debt data for all 293 prefecture-level cities for 2006-13, our statistical analysis is limited to 261 cities, as for 32 macroeconomic data are lacking.

Prefecture-level cities (henceforth, just "cities") tend to be large. Populations range from 200,000 to 33 million, and 196 of our sample cities (75 per cent) have at least 2.5 million inhabitants, with a median population of 3.8 million. Our sample also includes 100 cities with over 5 million inhabitants and 25 cities with more than 8 million.

The cities in our sample had a total population of 1.2 billion in 2013, or 91% of China's total population. Total GDP for the 261 cities came to 60.7 trillion yuan, which was actually more than China's estimated GDP that year of 58.8 trillion yuan. The discrepancy depends in part on the incentive for local politicians to overestimate economic growth (Koch-Weser, 2013) but in part also on double-counting due to the difficulty of tracking value added across city borders. According to the head of the Chinese National Statistics Bureau, in 2011 local government GDP numbers were about 10% higher than the corresponding central government figures.[8] Dividing 60.7 trillion by 1.1 yields 55.2 trillion, which suggests that the cities in our sample produce about 93% of China's GDP.

2.1 Local government debt in China

There have been a good many attempts to estimate the total amount of local government debt in China (e.g., Zhang and Barnett, 2014), but no public source offers time series for either city-level or province-level government debt. One contribution of this paper consists precisely in the construction of such series.

Before going into details, it is worth briefly recounting the manner in which Chinese local

[7] Prefecture-level cities are further divided into a third tier, namely counties or county-level cities. Cities in the strict sense of the term (i.e., contiguous urban areas) are called urban areas (shìqû in Chinese).

[8] For an article in the Financial Times documenting this discrepancy, see: http://blogs.ft.com/beyond-brics/2012/02/15/chinese-gdp-doesnt-add-up/. The original Chinese source is available at: http://finance.china.com.cn/news/gnjj/20120215/534298.shtml

governments issue debt. Municipalities cannot borrow from banks or issue bonds directly, but they can set up local government financing vehicles (LGFVs), transfer assets to them (usually land), and instruct them to borrow from banks or issue bonds, possibly posting the transferred assets as collateral (Ambrose, Deng and Wu, 2015). Our measure of local government debt is the volume of loans and bonds issued by these LGFVs.

As LGFVs are not generally required to disclose their financial information, efforts to collect data on local government debt from publicly available sources have generally looked at bond issuance by these entities (Ambrose Deng and Wu, 2015; Ang, Bai and Zhou, 2015). While bond issuance has grown dramatically in recent years (from 6% of total LGFV debt in 2006 to 21% in 2013), the volume of bonds outstanding is far less than the total debt, which actually consists mostly of bank loans (Figure 1).

To estimate the total financial liabilities of LGFVs, we exploit the fact that all entities that request an authorization to issue a bond in a given year are required to disclose their balance sheets for the current and at least the three previous years. So if an entity issues a bond in year t, we have data on its total outstanding debt back to year $t-3$. As the number of LGFVs issuing bonds soared between 2007 and 2014, this method provides a much more accurate and comprehensive lower bound for local government debt than bond issuance alone. Appendix A describes our methodology in detail and shows that our data match the aggregate figures published by the National Audit Office.

Our data show that municipal debt grew rapidly in the wake of the global financial crisis, when local governments were asked to contribute to the central government's massive fiscal stimulus but were not accorded additional fiscal resources with which to do so (Lu and Sun, 2013, and Zhang and Barnett, 2014). Between 2006 and 2010, outstanding local government debt jumped six-fold, from 1.2 trillion to 7.2 trillion yuan (Table 1); in proportion to GDP it trebled from 5.8% to 18.1%. And it continued to grow thereafter, reaching 12.5 trillion yuan or 22% of Chinese GDP in 2013. The share of cities with some debt outstanding rose from less than half in 2007 to nearly 100% in 2011, while their average debt expanded from 7 billion to 28 billion yuan.

2.2 Other city-level and firm-level data

We draw data for other city-level variables from the China City Statistical Yearbook, which provides time series on a vast array of city-level economic variables, including GDP, total bank loans, population, and economic growth. The final dataset produced by merging the two sources covers 261 cities from 2006 to 2013.

Our firm-level data come from the Annual Survey of Industrial Firms (ASIF), also known as the Chinese Industrial Enterprise Database (CIED). This database covers the universe of manufacturing firms with annual sales above 5 million yuan until 2009 (about $750,000 at the 2009 exchange rate) and 20 million yuan thereafter ($3,200,000 at the 2015 exchange rate). ASIF reports firms' location, ownership structure, and balance-sheet variables. This survey has been used, among others, by Bai, Hsieh and Song (2016), Brandt, Van Biesebroeck and Zhang (2012), Hsieh and Song (2015), Song, Storesletten and Zilibotti (2011), and Song and Wu (2015).

ASIF covered 90% of China's manufacturing output in 2004 (Brandt, Van Biesebroeck and Zhang, 2012) and 70% in 2013. This very broad coverage reflects the fact that it is compulsory for firms larger than the above threshold sizes to file detailed annual reports to their local statistics bureaus. The data are then transmitted to the National Bureau of Statistics (NBS), which aggregates them in the China Statistical Yearbook. Our sample spans the period from 2005 to 2013 and contains the same number of observations as the NBS during these years. Unfortunately, however, the survey is not available for 2010, depriving us of three years' worth of data from this source: besides 2010, we lose observations for 2011 because we need data at time $t-1$ in order to compute investment at time t , and also data for 2012, because our regressions include lagged variables.[9]

To compensate for this loss of information, we merge our ASIF data with the Annual Tax Survey (ATS), conducted by the Ministry of Finance between 2007 and 2011. The ATS gives detailed financial statements for manufacturing firms but also for agriculture, construction,

[9] We compute investment in year t as fixed assets in year t plus depreciation in year t minus fixed assets in year $t-1$. We compute cash flow as net profits (profits minus taxes) plus depreciation.

and services. By exploiting the overlap in coverage between the two databases, we were able to retrieve data for a large number of firms; however, our sample of firms for 2010-12 still remains considerably smaller, on average, than for 2006-9 or 2013 (61,000 as against 387,000 firms per year).

Dropping the observations of firms with negative assets and those in the top and bottom 1% of the revenue distribution, and applying a 5% winsorization for all our firm-level variables, we are left with 1,150,340 observations on 387,781 firms, and 1,281 city-years. Shanghai has the most observations (61,347), Jiayuguan City the fewest (167). The sample includes 30 cities with at least 10,000 observations, and 90% of the sample cities have over 1,700 observations. The median is 1,970 observations, the mean 4,407.

3 Geographical segmentation

As noted, the key to our empirical strategy is the geographical segmentation of China's financial markets. The financial system is heavily bank-based, with three policy banks, one postal bank, five large commercial banks, 12 joint-stock commercial banks, 40 locally incorporated foreign banks, 133 city commercial banks, and more than 2000 rural banks or credit cooperatives. Policy banks hold some 10 percent of total Chinese banking assets, large commercial banks about 40 percent, joint-stock commercial banks 19 percent, and local banks (city-level and rural banks and credit cooperatives) 30 percent. Foreign banks control the remaining 1 percent (China Banking Regulatory Commission, 2015).[10]

Geographical segmentation arises from two characteristics of the banking system. First, city and rural financial institutions rarely operate outside their own city or province. Until 2006, local banks were prohibited from doing business outside their province of origin. And although reforms between 2006 and 2009 allowed them to operate across provincial boundaries, only a very few inter-province licenses have actually been approved. The city commercial banks that have been so authorized typically have branches only in a few of the

[10] For details on the Chinese banking and capital markets see, among others, Allen, Qian, and Qian (2005), Allen, Qian, Zhang, and Zhao (2012), Ayyagari, Demirgüç-Kunt, and Maksimovic (2010), Bailey, Huang, and Yang (2011), and Berger, Hasan, and Zhou (2009).

wealthiest cities (Shanghai, Beijing, Tianjin, Hangzhou, and Ningbo).

Second, even the policy banks and large commercial banks, which are present throughout China and together account for 50 percent of total bank assets, still conduct business on a local basis: Dobson and Kayshap (2006, p. 132) describe the large banks as holding companies with separate legacy organizations for every province, each with its own information and human resource system and power base. The consequence is a fragmented banking system in which local branches have substantial decision-making power and autonomy with respect to headquarters. In such a decision-making process, local politics and the pressure to lend to local governments and local state-owned enterprises play an important role. According to Roach (2006), local Communist Party officials, through their influence on bank branches, often have a bigger say in investment project approval than the credit officers at the head offices of the major banks in Beijing. The impact of local branches dwarfs the role of regulators and central bankers. Local authorities, furthermore, are crucial to bank managers' career advancement, and may thus influence lending decisions.[11]

The geographical segmentation of the Chinese financial system and its distortionary effects on capital allocation are documented by many studies (Boyreau-Debray and Wei, 2004, 2005; Allen, Qian and Qian, 2005; Brandt and Zhu, 2007; Dollar and Wei, 2007; Firth, Lin, Liu and Wong, 2009). And evidence of such segmentation is present in our data as well: we find that the interest rates of LGFV bonds at issue vary significantly and persistently between cities, controlling for default risk (credit rating) and other bond characteristics.[12] Moreover, these municipal bond yield differentials are positively correlated

[11] Ho, Li, Tian and Zhu (2015) quote the following observation by a Chinese bank manager: "When my superior is thinking of promoting someone out of several equally good candidates from sub-branches, he might consult his friends in the local branch of the People's Bank of China, the local branch of the China Bank Regulatory Commission and the local government. Therefore, we have to manage the relationships with these government departments very carefully and skillfully. Otherwise, it will ruin our career since the senior will not promote a bank manager who is unwelcomed by his friends in the related fields, which in turn might endanger his career" (p.10).

[12] With data for nearly 9,000 such bonds, we first regress the interest rate at issue on credit rating, face value (in log), maturity (in years), the Chinese interbank rate (Shibor) on the issue date, and year fixed effects: this regression accounts for 50 percent of the variance of the interest rate. Including city fixed effects, the regression's adjusted R^2 rises to 60 percent. We also estimate separate regressions for each year in our dataset. The adjusted R^2 of the regressions that do not control for city fixed effects ranges between 29 percent (for 2013) and 65 percent (for 2010); for those that do, the range is from 38 percent (for 2013) and 74 percent (for 2010). Always the adjusted R^2 of the regressions that control for city fixed effects is at least

with local government debt, when our measure of local government debt is included as a further explanatory variable in interest rate regressions: the point estimate of the relevant coefficient implies that a 10 percent increase in local government debt is associated with an 80-basis-point increase in the local interest rate. While this finding is not evidence of a causal effect running from local government debt to interest rates, it is consistent with city-level financial markets being not only segmented, but also forced to absorb a disproportionate amount of local public debt (see also Chen, He, and Liu, 2016).

Another characteristic of the Chinese financial market is interest rate ceilings on both deposits and loans. Such regulation was a factor in the rapid growth of a shadow banking sector, whose assets increased from 4.5 trillion yuan (14 percent of GDP) in 2008 to 11 trillion (27 percent) in 2010 (Elliot, Kroeber, and Qiao, 2015), partly as a result of the 2009 stimulus package itself (Chen, He, and Liu, 2016). The doubling in size of the sector coincided with the jump in the spread between the shadow lending rate and the official lending rate following the post-crisis fiscal stimulus (Figure A3). Whereas in the US shadow banking is channeled mostly through money market and hedge funds, in China it operates via a wide array of (often opaque) financial instruments: for instance, informal lending accounts for 17 percent of it and entrusted loans (i.e., loans from a non-financial corporation to another via a bank as servicing agent) constitute almost a third (Allen, Qian, Tu and Yu, 2016).[13] In such transactions, informational asymmetries are paramount, and most shadow banking transactions have a limited geographical scope. For instance, Allen, Qian, Tu and Yu (2016) show that, other things being equal, entrusted loans between firms located in the same city carry a significantly lower interest rate (by more than 1 percentage point) than transactions between firms in different cities. So the growing shadow banking sector presumably contributes further to the fragmentation of the Chinese financial market and amplifies the distortions generated by the pre-existing geographical segmentation.

10 percentage points higher than of those that do not.

[13] On the Chinese shadow banking sector see also: Acharya , Qian, and Yang (2016), Chen, Ren, and Zha (2015), Chen, He and Liu (2016), Hachem and Song (2016), and Wang, Wang, Wang, and Zhou (2016).

4 Local government debt and city-level investment

We start the empirical analysis with evidence of the correlation between aggregate city-level investment and local government debt: the firm-level data set forth in subsequent sections will pin causality and transmission channels down more firmly, but these city-level regressions already provide illustrative evidence consistent with the hypothesis of local crowding-out. Hence, after aggregating data at the city-year level, we estimate the following specification:

$$I_{c,t} = \beta LGD_{c,t} + X_{c,t}\Gamma + \alpha_c + \tau_t + \varepsilon_{c,t}, \tag{1}$$

where $I_{c,t}$ is the ratio of investment to assets for manufacturing firms in city c and year t, $LGD_{c,t}$ is the ratio of local government debt to local GDP, $X_{c,t}$ are a set of city-level controls (bank loans over GDP, local government balance over GDP, GDP growth, log of GDP per capita, log of population, and average price of land), and α_c and τ_t are city and year fixed effects. Variants of this specification are estimated, first taking as dependent variable $I_{c,t}$ for the entire manufacturing sector of city c in year t (as the weighted average of the investment-to-asset ratios for all the manufacturing firms), and then separately for private-sector, state-owned, and foreign-owned manufacturing firms.

Table 2 presents estimates of specification (1) without macro controls (i.e., setting $\Gamma = 0$): the correlation between total manufacturing investment and local government debt is negative and statistically significant. The point estimate in column 1 indicates that a 1-standard-deviation increase in the debt-GDP ratio (13 percentage points) is associated with a 1-percentage-point decrease in the investment ratio (which averages 8% in our sample). The correlation between government debt and investment is slightly higher (in absolute value) for private-sector manufacturing firms (column 2) and is not statistically significant for state-owned and foreign-owned firms (columns 3 and 4). When the investment ratios of all three types of manufacturers are pooled (column 5), the correlation is statistically significant only for private sector firms, as in columns 2-4.[14] The tests at the bottom of the

[14] In column 5 of Table 2 and Table 3 we estimate the following model: $I_{c,t,o} = LGD_{c,t}\left(\beta_1 PRI + \beta_3 SOE + \beta_3 FOR\right) + X_{c,t}\Gamma + \alpha_c + \tau_t + \varepsilon_{c,t}$, where $I_{c,t,o}$ is the average investment ra-

table show that the private sector coefficient is always significantly different from those for state-owned and foreign-owned firms.

Table 3 expands the specification of Table 2 by including additional city-level controls: total bank loans scaled by GDP (BL, which includes loans to local governments), local government budget balance scaled by GDP (GB, i.e. the unconsolidated budget balance of the city, excluding LGFVs), local GDP growth (GR), log of per capita GDP ($ln(GDP\,PC)$), log of population ($ln(POP)$), and log of average land price (LP). Controlling for these variables does not affect the baseline results of Table 2: local government debt remains negatively correlated with the investment ratio of private sector manufacturing firms and is not significantly correlated with those of state- and foreign-owned firms.[15]

While the results of Tables 2 and 3 are consistent with the thesis that local government debt has a negative effect on private manufacturing investment, these are simple correlations, likely to suffer from endogeneity bias. The direction of the bias, however, is not clear. On the one hand, local politicians may respond to negative shocks to private investment by instructing LGFV managers to borrow and invest more: that is, the negative correlation could actually be due to reverse causality – from investment to local public debt. Or else common shocks – say, spending on public infrastructures, which increases both the profitability of private firms and public debt issuance – could be driving both variables, biasing the estimates in the opposite direction.

We will be better equipped to address the endogeneity problem when we use more granular industry and firm-level data in Sections 5 and 6 below. In any case, we begin here by estimating a set of instrumental variable regressions. Though not constituting ironclad evidence for a causal interpretation, these regressions do give some sense of causality.[16]

tio of firms with ownership o (private, state-owned, and foreign-owned) in city c , year t (we thus have 3 observations for each city-year) and PRI, SOE, and FOR are dummy variables set equal to 1 for private, state-owned, and foreign-owned firms, respectively.

[15] Most of the additional controls are not significantly correlated with the investment ratios of private and public domestic firms (the exceptions being GDP growth, which has a positive and statistically significant coefficient in columns 1, 2, 3, and 5). Instead, government balance, GDP per capita and population are statistically significant in the regression for foreign-owned manufacturing firms.

[16] For a detailed description of the endogeneity problem and of our instrumental variable estimations, see Huang, Pagano, and Panizza (2016). That paper also shows that our results are robust to identifying the causal effect of local government debt using the heteroskedasticity approach of Rigobon (2003) and Lewbel

Our instrumental variable strategy is based on an argument from political economy: that is, cities with stronger political connections with the national government may have more leeway to issue debt and initiate investment projects (Shih, Adolph and Liu, 2012, and Zhu, 2014); and they may also be deemed to be less risky borrowers, more likely to be bailed out if they should fail to meet their obligations (Ambrose, Deng and Wu, 2015). This is the basis for instrumenting local government debt with the number of top national policy-makers (at ministerial level or above) who were born in the city.[17]

A problem with this instrument is that national leaders with close links to a city may have other means of favoring it besides allowing it to borrow more. One obvious way is increasing central government transfers. Accordingly, we control directly for transfers, a method that solves one endogeneity problem but may create another, in that transfers are driven partly by local economic conditions. Other things being equal, underperforming cities tend to receive larger transfers. Hence, transfers are endogenous with respect to private investment. We address this problem by constructing a simulated instrument for transfers in the spirit of Moffitt and Wilhelm (2000), Gruber and Saez (2002), and Dahl and Lochner (2012).[18]

The top panel of Table 4 shows instrumental variable estimates, which confirm our previous findings of a negative effect of local government debt on private investment but no effect on investment by state-owned or foreign-owned manufacturing firms. The bottom

(2012).

[17] We construct this instrument on the basis of biographical information originally collected by Zhou (2014) on members of the Central Committee of the Chinese Communist Party from 2006 to 2013. We exclude the military and members who work in local governments and tally up the total number of members at the ministerial level or above who were born in a given city. Zhou collects information on the members of the 16^{th} ,17^{th} and 18^{th} Central Committee from official websites including the Chinese Bureaucracies and Leaders Database (http://politics.people.com.cn/GB/8198/351134/index.html), Chinese Government Public Information Online (http://202.106.125.57/guotu/PeopleLook.aspx), and the Chinese Political Elites Database constructed and maintained by the National Chengchi University (http://ics.nccu.edu.tw/chinaleaders/index.htm and http://faculty.washington.edu/cadolph/index.php?page=61).

[18] Specifically, our instrument is equal to $STR_{c,t} = \frac{TR_{c,2005}}{TT_{2005}} TT_t$, where $TR_{c,2005}$ measures total transfer income received by city c in 2005 and TT_t is the total amount of transfers from China's central government to all cities in year t. $STR_{c,t}$ is exogenous with respect to time-varying local conditions because its within-city variance is driven by changes in total transfers at the national level. For the few cities on which the transfer data begin after 2005, we replace 2005 with the first available year. For a study using simulated instruments to study the fiscal incentives of Chinese local governments, see Li and Kai-Sing Kung (2015).

panel reports the first stage estimates, showing that the instruments are correlated with the endogenous variables, and that the correlations are not weak.

Another possible concern is that national politicians may favor their native city in still other ways, beyond additional borrowing capacity and direct transfers. For instance, powerful politicians could steer government contracts towards cities where they have close connections (see Cohen, Coval and Malloy, 2011, for evidence to this effect in the US). Insofar as this generates a positive correlation between our instrument and private investment, it should induce a positive bias in the estimate (i.e., it may bias our point estimate, which is negative, towards zero). We address this issue by restricting the estimate to the investment of firms with limited exposure to government spending.[19] We calculate total city-level investment of the industries in the bottom 25% of the government exposure index and then re-estimate the regressions of Tables 2-4 for investment of the low-exposure industries only (Table 5). For this subset of industries our results are stronger, which is consistent with the existence of a positive bias in the previous results.

5 Industry-level evidence

The previous section shows a strong and robust inverse correlation between local government debt and city-level private manufacturing investment, and the IV regressions of Tables 4 and 5 suggest that this relationship can be interpreted as causal, and that it is higher local government debt that leads to lower investment rather than the reverse. While these city-level regressions do not show the channel through which the causal relationship operates, the granularity of our data allows us to probe further. We begin to do so here by lowering the level of aggregation of the analysis from city to industry-city. In Section 6 we lower it further, to firm level. Considering the institutional features of China's financial market,

[19] Since most LGFVs manage public infrastructure projects, the exposure index takes as sectors directly affected by LGFV expenditure: (i) electricity production and distribution; (ii) heat production and distribution; (iii) gas distribution; (iv) water supply and sewage treatment; (v) construction; (vi) environmental management; and (vii) public facilities management. We match these sectors with the input-output table constructed by the National Statistics Bureau and construct indexes of exposure to these seven sectors for the 135 sectors covered in the input-output tables (following Tang et al. (2014), we use the input-output table for 2007). Finally, we match these exposure indexes with the manufacturing firms in our survey.

we hypothesize, as is explained in the introduction, that the channel is a local credit-rationing mechanism. In the cities that issue more debt, more funds are allocated to the public sector, so the credit constraints on private manufacturing firms tighten, while public firms are spared the crunch. One way of testing whether the data are consistent with this thesis is to aggregate at industry-city-year level and apply a methodology analogous to that developed by Rajan and Zingales (1998) to determine whether government debt has a stronger negative impact on investment in industries that for technological reasons need more external funds. Formally, we estimate the following model:

$$I_{j,c,t} = \beta I_{j,c,t-1} + \delta \left(EF_j \times LGD_{c,t} \right) + \alpha_{j,t} + \theta_{c,t} + \varepsilon_{j,c,t}, \tag{2}$$

where $I_{j,c,t}$ is the investment-asset ratio in industry j, city c and year t, EF_j is a time-invariant measure of the external-finance dependency of industry j, $LGD_{c,t}$ is local government debt scaled by GDP in city c and year t, and $\alpha_{j,t}$ and $\theta_{c,t}$ are industry-year and city-year fixed effects. The parameter δ measures the incremental impact of local government debt in industries that depend more heavily on external finance. Due to the inclusion of industry-year and city-year fixed effects, the specification (2) controls for any industry- or city-level time-varying factor, and therefore does not suffer from any obvious problem of reverse causality. The estimate of δ could be biased only if specification (2) omitted some source of credit constraint that is itself correlated with local government debt. We address this potential problem by expanding specification (2) and controlling for variables that might be jointly correlated with local government debt and credit constraints.

Rajan and Zingales (1998) create their index of external financial dependency by calculating the industry median ratio of capital expenditures less operating cash flow to total capital expenditure for a sample of US firms in the 1980s. They use data for US firms, as these are least likely to be credit-constrained, thanks to the high degree of US financial development. Hence, the amount of external funds used by US firms is likely to be a good measure of their unconstrained demand for external financing.

To adapt the Rajan-Zingales measure to our sample, one must consider that the technological parameters of Chinese firms are likely to be very different from those of the large US firms upon which Rajan and Zingales base their indicator of external financial dependency (Furstenberg and Kalckreuth, 2006, 2007). Hence, we construct an industry-level measure of external financial dependency in China using data from the four cities with the most highly developed financial markets (Beijing, Shanghai, Hangzhou, and Wenzhou)[20] and then use this measure to estimate equation (2) for the remaining 257 cities in our sample.

The estimates, shown in Table 6, indicate that the coefficient δ of the interaction between external financial dependency and local government debt is negative and statistically significant both for total manufacturing investment (column 1) and for investment by domestic private manufacturing firms (column 2); it is not significant for investment by state-owned and foreign-owned firms (columns 3 and 4). These results are robust to controlling for other city-level variables (bank loans, log of GDP per capita, GDP growth, and log of average land price) that could be jointly correlated with local government debt and credit constraints (Table 7).

To gauge the economic significance of the magnitude of δ, we use the point estimates of column 2 of Table 7 to evaluate its effect for the industries at the 25^{th} percentile (paper) and the 75^{th} percentile (battery production) of the distribution of the index of external financial dependency.[21] The left panel of Figure 2 shows the relationship between local government debt and the investment ratio for the industry at the 25^{th} percentile of the distribution of the external financial dependency index. It also shows the average investment ratio in this industry (8% of total assets, corresponding to the solid horizontal line). As the public debt-GDP ratio increases from its 10% nationwide average, the investment ratio in this industry featuring low financial dependency rises slightly (since its index of external financial dependency is negative), but is never significantly different from the average. Conversely, the right panel of Figure 2 shows the relationship at the 75^{th} percentile of the distribution,

[20] Among the large Chines cities, these are the cities with the ratios of highest bank loans to GDP.

[21] Industries with indexes of external financial dependency close to the paper industry include cigarette manufacturing and glass manufacturing. Those with indexes similar to batteries include transmission, distribution and control equipment and communication equipment.

comparing it with the average investment ratio for this industry (the horizontal line at 10.5%). As local government debt rises, in this more financially dependent industry the investment ratio decreases sharply: when local public debt exceeds 15% of GDP the ratio falls significantly below its 10.5% industry average, and when the debt climbs to 50% the investment ratio drops to about 9%.

6 Firm-level evidence

The Rajan-Zingales approach enables us to specify credit rationing as the economic channel through which local crowding-out operates. However, this methodology depends on strong assumptions concerning the technological determinants of firms' external funding needs. For instance, it assumes that the external financing requirement of a paper-producing firm in Beijing is comparable to that of a paper producer in a small, isolated city. But manufacturers in the same industry may well adapt their production technologies to local conditions, so as to save on external funding. This would lead us to underestimate the impact of local government debt on manufacturing investment.[22]

To overcome this limitation, we adopt an empirical strategy that relies on firm-level estimates of cash flow sensitivity to test whether government debt tightens the financing constraints on private manufacturing firms. Fazzari, Hubbard and Petersen (1988) were the first to make empirical use of the idea that investment sensitivity to internally generated funds should be greater among credit-constrained firms (they proxied credit constraints by average dividend payouts).[23] Love (2003) extended this approach to an international data set and showed that deeper financial markets can attenuate financing constraints by reducing the sensitivity of investment to internal funds, especially for firms more likely to

[22] The impact of local government debt on investment could also be underestimated inasmuch as the Rajan-Zingales methodology measures only the differential impact of government debt on firms that belong to industries characterized by different degrees of dependency, not the total effect of local government debt on investment.

[23] Bond and Meghir (1994) used the same proxy of credit constraints. Papers with a similar methodology but based on other measures of financing constraints include Hoshi et al. (1991), Oliner and Rudebusch (1992), Whited (1992), Gertler and Gilchrist (1994), and Harris et al. (1994).

be constrained. Applying a variant of this approach to our sample of 261 Chinese cities, we not only confirm Love's finding that financial depth reduces the sensitivity of investment to firms' cash flow but further demonstrate that local government debt tightens the financing constraints on private-sector manufacturing firms.

The sensitivity of investment to cash flow has been criticized as a measure of financing constraints (Kaplan and Zingales, 2000), in that cash flow may proxy for investment opportunities and the sensitivity could be driven by influential outliers or by firm distress.[24] We address this criticism in two ways.

First, we take the suggestion of Fazzari, Hubbard and Petersen (2000) that credit constraints can be inferred from large differences in investment sensitivity to cash flow between subsamples of constrained and unconstrained firms, obtained using a priori criteria. Our baseline firm-level regressions show that local government debt does not affect this sensitivity for state- and foreign-owned firms but does for private domestic firms. Since state-owned firms are not credit-constrained, enjoying preferential treatment by banks, while foreign firms can presumably tap their national (or international) financial market, our findings are consistent with the thesis that high local government debt is especially problematic for firms subject to financing constraints.

Second, we follow Hu and Schiantarelli (1998) and Almeida and Campello (2007) and use a switching regression model of investment in which the probability of a firm's facing investment constraints is determined endogenously. This approach addresses the critique of Kaplan and Zingales (2000), because it does not simply compare predetermined samples of constrained and unconstrained firms but jointly estimates investment sensitivities and the probability of credit constraint.

[24] Fazzari et al. (2000) rebut Kaplan and Zingales (2000). Hadlock and Pierce (2010) criticize the Kaplan-Zingales index of financial constraints and suggest that firm size and age are the variables most closely correlated with the presence of such constraints.

6.1 Baseline regressions

The literature has adopted two different approaches to studying financing constraints (Schiantarelli, 1996, and Hubbard, 1998). One is based on Tobin (1969) and the Q-theory of investment in Hayashi (1982). The second estimates an Euler equation in which investment is optimally determined by setting the marginal cost of investing in one period equal to the cost of waiting one extra period to invest (see, for instance, Whited, 1992, Hubbard and Kashyap, 1992, Calomiris and Hubbard, 1995, and Gilchrist and Himmelberg, 1998).

As our sample includes unlisted firms for which share price data are lacking, we cannot use Q-theory. Accordingly we follow Love (2003), who derives the Euler equation for a firm that maximizes the present value of future dividends subject to adjustment costs and external financial constraints.[25] Linearizing the Euler equation, Love creates an empirical model in which investment (scaled by total assets) depends on lagged investment, sales, cash flow, the interaction between cash flow and a measure of (freedom from) financial constraints (credit to the private sector), and a set of fixed effects. We use a similar model, but with city-level government debt as our measure of financial constraint:

$$I_{i,c,t} = \beta I_{i,c,t-1} + \delta REV_{i,c,t-1} + (\gamma_1 + \gamma_2 LGD_{c,t})\, CF_{i,c,t-1} + \alpha_i + \theta_{ct} + \varepsilon_{i,c,t}, \qquad (3)$$

where I, REV and CF are fixed capital investment, revenue growth and cash flow of firm i, in city c and year t (all scaled by beginning-of-year total assets), and LGD is local government debt scaled by GDP in city c and year t. The specification also includes firm-level fixed effects (α_i) and city-year effects (θ_{ct}). The latter control for the direct effect of local government debt on firm-level investment (as well as for any other city-level macroeconomic variables).

Given financing constraints, investment will be positively correlated with internally generated funds (proxied by cash flow), yielding a positive value for γ_1. A positive value for

[25] The model in Love (2003) does not provide for borrowing, and the external financial constraint consists in the condition that the firm cannot pay negative dividends. Allowing for borrowing complicates the model but does not alter the first-order conditions for investment.

γ_2, instead, would be consistent with the hypothesis that government borrowing crowds out private investment by tightening financing constraints. This is the main hypothesis that we test here.

As equation (3) exploits only within-firm and within-city-year variation in investment, cash flow, and in the interaction between local public debt and cash flow, it does not suffer from any obvious problem of reverse causality. However, there could be an omitted variable bias if the equation failed to control for sources of credit constraint correlated with local government debt. We discuss this danger in the robustness analysis.

When equation (3) is estimated on the full sample of firms, the coefficient of γ_1 is positive and significant (column 1 in Table 8). The point estimate suggests that a 1-standard-deviation increase in cash flow is associated with a 1.4-percentage-point increase in the investment ratio. This is consistent with the presence of financing constraints for the average firm in a city with no public debt, but it could also result from cash flow serving as a proxy for investment opportunities not captured by other control variables (Kaplan and Zingales, 2000).[26] More important for our purposes, in our estimate γ_2 is positive and statistically significant. This finding bears out the hypothesis that local government debt crowds out investment by tightening financial constraints; moreover, it is immune to the Kaplan-Zingales critique. The point estimate implies that a 1-standard-deviation increase in local government debt is associated with a 6% increase in the elasticity of investment to cash flow. The top-left panel of Figure 3 plots the sensitivity of investment to cash flow at different levels of local government debt: the elasticity rises from 6.7 with zero government debt to 8.1 with a 50% debt ratio.

If local government debt crowds out private investment by tightening local financial markets, this effect should be less substantial for state-owned enterprises, which presumably have access to privileged credit channels or the national financial market. The same reasoning applies to foreign-owned firms. Hence, we divide firms into three groups: (i)

[26] Kaplan and Zingales (2000) also suggest that the positive correlation between investment and cash flow could be driven by influential outliers or by a few firms in debt distress. However, such outliers are unlikely to be relevant in a sample like ours, with over 380,000 firms.

private-sector domestically-owned (henceforth, private) firms; (ii) state-owned firms, and (iii) foreign firms.

When equation (3) is estimated for the group of private firms (column 2 of Table 8), the results are essentially the same as for the whole sample but with tighter confidence intervals (see the top right panel if Figure 3). For the other two groups of firms, the results are dramatically different. State firms are less credit-constrained than the average (γ_1 decreases from 6.7 to 4.3, column 3 of Table 8), and the severity of the constraint is inversely correlated with local government debt, so that they become essentially unconstrained when local public debt reaches 20 per cent of GDP; above that threshold, the correlation between cash flow and investment is no longer statistically significant (bottom-left panel of Figure 3). This suggests that at least a part of the funds raised by Chinese cities via public debt issuance is actually channeled to local state-owned firms, mitigating or eliminating any credit constraints that they would otherwise face. For foreign firms, the correlation between cash flow and investment is always negative and never statistically significant (column 4 of Table 8 and bottom-right panel of Figure 3).

The last column of Table 8 uses all observations but with separate coefficients for state-owned and foreign firms. The coefficients of the interaction between cash flow and local government debt are significantly lower than for private firms and the total effects for the other two types of firms (reported in the bottom panel) are always negative but not significant (as found also in columns 3 and 4).

These specifications may omit an important variable, however, namely the interaction between cash flow and total bank loans as a ratio to GDP. Bank loans are likely to belong in equation (3) because they are correlated both with local government debt (see Tables A2 and A3) and with credit to the private sector, a variable that other studies have found to relax credit constraints (Love, 2003). As bank loans are correlated directly with local government debt and inversely with credit constraints, their exclusion from the model should generate a downward bias in the estimate of γ_2.[27] And this is exactly what we find when

[27] Suppose that the true model is

specification (3) is expanded by including the interaction between cash flow and bank loans as an explanatory variable. The point estimate of γ_2 almost trebles (from 0.03 in column 1 of Table 8 to 0.08 in column 1 of Table 9); a 1-standard-deviation rise in local government debt is thus associated with an increase of 13 percentage points in the elasticity of investment to cash flow. As expected, we also find that more bank lending reduces the sensitivity of investment to cash flow, consistent with the thesis that bank loans can proxy for local financial depth and with the finding, in Love (2003), that financial depth relaxes credit constraints.

Column 2 of Table 9 shows that these results are robust to restricting the sample to private firms, while columns 3 and 4 show that government debt and bank loans have no statistically significant effect on the correlation between cash flow and investment in state-owned and foreign firms. In all subsequent regressions we continue to control for the interaction between cash flow and bank loans, but all our results are robust to dropping it.

6.2 Robustness

We now check to see whether our baseline results are robust to additional controls, alternative sub-samples, and different estimation techniques.

First, we consider whether our results may not be driven by the omission of potentially relevant variables that are also correlated with local government debt. Let us premise the detailed discussion of these variables with the observation that none of the robustness tests alter our main finding, namely that higher local government debt increases the sensitivity of private investment to cash flow. The coefficient of the interaction between local government

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$$y = \alpha + \beta LGD + \gamma BL + \epsilon,$$

where BL denotes bank loans, with $\gamma < 0$ and $\sigma_{LGD,BL} > 0$. If instead one estimates $y = a + bLGD + e$, the expected value of b is:

$$E(b) = \beta + \gamma \frac{\sigma_{LGD,BL}}{\sigma^2_{LGD}},$$

and the bias is

$$E(b) - \beta = \gamma \frac{\sigma_{LGD,BL}}{\sigma^2_{LGD}} < 0.$$

debt and cash flow is always positive, statistically significant and almost equal to that in our baseline estimates.

We start with the local government budget balance in proportion to GDP. This variable is not correlated mechanically with our measure of local government debt, because the balance reflects the direct income and expenditure of the local government, while our measure of debt refers to LGFVs, which are extra-budgetary entities. However, it is possible that more profligate local governments have over-indebted LGFVs, or else that LGFVs that are backed by financially sound governments are able to borrow more. In fact, Tables A2 and A3 show that there is a positive and statistically significant correlation between debt and the municipal budget balance. However, when our baseline model is expanded to include this variable, its interaction with cash flow is never statistically significant and the baseline results are robust to including the interaction (column 1, Table 10).

Next, we add the interaction between cash flow and the log of the city's per capita GDP. Again the additional variable is not significant and its inclusion does not alter our baseline result (column 2, Table 10).

When instead we control for GDP growth (which in Table A3 is positively correlated with local government debt), the financing constraint appears to be tighter in city-years characterized by slow growth, but again the baseline results are robust.

We also explore the role of land prices. Land is the main collateral for LGFVs' debt, and land sales constitute local governments' main source of income (Cai, Henderson and Zhang, 2009). In fact, both local government debt and the municipal budget balance are positively correlated with land prices (the correlations range between 0.3 and 0.4 and are always statistically significant at the 1 percent confidence level). A priori, the effect of the price of land on financing constraints is ambiguous. On the one hand, high prices may ease the collateral constraints of land-owning firms (Chaney, Sraer and Thesmar, 2012). On the other hand, high prices may induce banks to lend to collateral-rich land developers rather than to manufacturing firms that require intensive screening (Manove, Padilla and Pagano, 2001; Chakraborty, Goldstein and MacKinlay, 2016). Our results are consistent with the latter interpretation (column 4, Table 10).

Finally, we estimate a specification that includes all the control variables described above jointly, finding some evidence that faster economic growth and higher per capita GDP relax financing constraints, while a larger municipal budget tightens them. More important for our purposes, including these variables has no effect on the baseline result that local government debt tightens financing constraints.

We also check whether our results are robust to firms' exposure to projects funded by LGFVs. Firms may self-select into cities with large infrastructure projects, and being a supplier for these projects may ease credit constraints, as the firm may discount invoices or borrow directly from the LGFVs they supply.[28] Indeed, the estimates in Table 11 show that private firms that are more exposed to LGFV-funded projects are less constrained than those that are not so exposed, the coefficient of the interaction between exposure and cash flow being negative and statistically significant. However, all our baseline results are robust to controlling for exposure to LGFV-funded projects, and exposure to government funded projects has no separate impact on the crowding-out effect of local government debt: the coefficient of the triple interaction is not statistically significant.

When the model is augmented with this exposure index, we lose nearly 200,000 observations, but the estimates of column 2 in Table 11 demonstrate that our baseline results persist. Our results are also robust to restricting the estimate to private firms (column 3), but private firms with greater exposure to government-funded projects are less constrained by local government debt (the triple interaction being negative and significant in this case). As before, there is no evidence that local government debt affects financing constraints on state-owned and foreign firms (columns 4 and 5). As a final experiment, we convert our continuous variable of exposure to government-funded projects into a discrete variable ($HEXP$), equal to 1 for industries with above-median exposure and 0 for the others: this discrete measure of exposure does not alter our baseline results (Column 6, Table 11).

[28] Inasmuch as large infrastructure projects are positively correlated with local government debt, not controlling for exposure to them would produce a downward bias in the estimate of the correlation between local government debt and the sensitivity of investment to cash flow. The construction of the index of exposure to LGVF-funded projects is described in Section 4.

One possible source of concern with the regressions shown in Tables 8-11 is that lagged investment is correlated negatively with current investment. This sign reversal is likely to be due to the downward bias generated by firm-level fixed effects (Nickell, 1981). A standard solution to this problem is to apply the difference and system estimators used in Arellano and Bond (1991), Arellano and Bover (1995), and Blundell and Bond (1998).[29] The top panel of Table 12 reports the results obtained using the system estimator of Arellano and Bover (1995) and Blundell and Bond (1998): the coefficient of the lagged dependent variable becomes positive (although not statistically significant), and the point estimates for the variables of interest (cash flow and the interactions between cash flow and, respectively, local government debt and bank loans) are essentially identically to the baseline estimates of Tables 8 and 9. The bottom panel of Table 12 reports standard fixed effect estimations (i.e., the same models as in Tables 8 and 9) based on the sample of the top panel. Although the lagged dependent variable in these fixed effects estimations is always negative and significant, the results for our variables of interest are essentially identical. Another way of addressing the same problem is to exclude the lagged dependent variable (investment).[30] Table A6 in the appendix shows that our results are robust to this estimation method.

Next, we explore whether our results are driven by firms located in the provinces for which our debt measure exceeds the official debt as published by the National Audit Office (see Appendix A for details). In the first column of Table 13 we drop Beijing, Tianjin, and fourteen other cities located in Jiangsu and Zhejiang provinces. In column 2 we restrict the sample to 212 medium-sized cities (population of 1-10 million). The results are similar to the baseline estimates in Table 9.

We also check whether our results are robust to the IV strategy described in Section 4 (see Table 4). While we cannot instrument local government debt (or any other city-level

[29] We do not use these estimation methods in our baseline specification for two reasons. First, they require at least three consecutive years of observations for each firm – a requirement that would greatly reduce the size of our sample, due to its unbalanced nature. Second, while system GMM estimations of equation (MOD) generally satisfy the specification tests developed by Arellano and Bond (1991), they do so only just barely, and small changes in the lag structure often lead to different values of these tests (the point estimates, instead, tend to be stable).

[30] This is a common approach in the finance literature (e.g., Cohen et al., 2011); however, it often serves to control for Tobin's Q, a variable that does not exist for our sample of unlisted firms.

variable), because its main impact is fully absorbed by the city-year fixed effects, we can augment our model with the interaction between cash flow and transfers and instrument this interaction term and the interaction between cash flow and local government debt with the interaction between cash flow and the share of top political leaders, as well as with the simulated transfer. Table 14 shows that the instruments are strong (the bottom panel reports the Cragg-Donald F tests) and that our baseline results are robust to the IV strategy.

Finally, our results are also robust to restricting the data to the period after 2007, when local government borrowing began to soar, and to using data only from the Annual Survey of Industrial Firms (Tables A7 and A8 in the Appendix).

6.3 Switching regressions

In the regressions conducted so far, firms' financing status – credit-constrained or not – is identified by exogenously partitioning the sample on the basis of ownership. There are two problems with this approach (Hu and Schiantarelli, 1998): first, it cannot jointly control for the various factors that affect the ways in which firms can substitute external for internal funds; second, it does not allow for firms to change status from credit-constrained to unconstrained or viceversa, as their ownership status never changes.

We address these issues by estimating an endogenous switching regression model with unknown sample separation. Following Hu and Schiantarelli (1998) and Almeida and Campello (2007), we assume that at each point in time a firm operates in one of two regimes: credit-constrained, where investment is very sensitive to internal funds; or unconstrained, where it is not. The probability of being in one or the other is determined by a switching function that depends on firm characteristics capturing the severity of the agency problems faced by the firm at a given point in time.

Formally, we jointly estimate the following three equations:

$$W^*_{i,c,t} = M_{i,c.t}\psi + u_{i,c,t}, \tag{4}$$

$$I_{1,i,c,t} = X_{i,c,t}\alpha_1 + \epsilon_{1,i,c,t}, \tag{5}$$

$$I_{2,i,c,t} = X_{i,c,t}\alpha_2 + \epsilon_{2,i,c,t}, \tag{6}$$

where W^* is a latent variable capturing the probability that firm i in period t will be in one of the two regimes and equation (4) is the selection equation that estimates the likelihood that the firm will be in regime regime 1 ($I_{i,c,t} = I_{1,i,c,t}$ if $W^*_{i,c,t} < 0$) or regime 2 ($I_{i,c,t} = I_{2,i,c,t}$ if $W^*_{i,c,t} \geq 0$) as a function of a set of variables M that proxy for financial strength and other factors that may amplify agency problems and therefore tighten financing constraints. Following the literature, we model selection into the two regimes as a function of the log of firm age, the log of total assets, distance to default (Altman Z-score), a time-invariant measure of industry-level asset intangibility, a dummy variable for firm type (1 for private domestic firms, 0 otherwise), and local government debt.[31] A firm's likelihood of being credit-constrained is expected to decrease with age, size, distance to default, and asset tangibility, and to increase with private ownership and local government debt.

Equations (5) and (6) are the investment equations, which are identical to our baseline model of Equation (3) but allow for different coefficients for firms in the two financing regimes.[32] The regimes are not observable but are determined endogenously by the system of equations (4)-(6).

As in Hu and Schiantarelli (1998), the parameters ψ, α_1, and α_2 are jointly estimated by maximum likelihood, under the assumption that the error terms of the switching and investment equations are jointly normally distributed with zero mean and a covariance

[31] Almeida and Campello (2007) also consider dividend payments, bond ratings, short-term and long-term debt, and financial slack. Unfortunately, our dataset does not give us these variables. In building the Z-score we use emerging market-specific weights as suggested by Altman (2005). Specifically, Specifically, we set $Z = 3.25 + 6.56X_1 + 3.26X_2 + 6.72X_3 + 1.05X_4$, where $X_1 = \frac{(Current\ Assets - Current\ Liabilities)}{Total\ Assets}$; $X_2 = \frac{Retained\ Earnings}{Total\ Assets}$; $X_3 = \frac{EBIDTA}{Total\ Assets}$; and $X_4 = \frac{Book\ Value\ of\ Equity}{Total\ Liabilities}$. It is worth noting that there is an ongoing discussion in the literature on whether the standard measures of financial constraints actually do measure the constraints (Farre-Mensa and Ljungqvist, 2016).

[32] The switching regression model does not converge when we include firm fixed effects.

matrix that allows for non-zero correlation between shocks to investment and shocks to the firm characteristics that determine the regime.

Column 1 of Table 15 reports the results for a specification that includes city and year fixed effects. As expected, the selection equation (panel A) shows that the likelihood of being credit-constrained is decreasing in firm age, size, distance to default, and asset tangibility; and it is higher for private-sector firms and in city-years with high local government debt.

The investment equations (panel B) show that for unconstrained firms the correlation between cash flow and investment is decreasing in local government debt (column 1.1): local public debt issuance allows these firms to decouple their investment even more from internal resources, probably because unconstrained firms are mostly state-owned and so enjoy more generous funding from local governments that issue large amounts of debt. For credit-constrained firms, however (column 1.2), the correlation between investment and cash flow is positive and increasing in the level of government debt, confirming the results obtained in the previous sections. Again, this reflects the fact that credit-constrained firms are disproportionately private and domestic.

Column 2 of Table 15 reports the results for a model that includes city-year fixed effects, which absorb the effect of local government debt on a firm's probability of being credit-constrained. The probability of being credit-constrained is again estimated to be higher for private-sector firms and decreasing in firm age, size, distance to default, and asset tangibility. Moreover, in unconstrained firms the sensitivity of investment to cash flow is again decreasing in local government debt. The point estimates in column 2.1 show that for unconstrained firms the sensitivity of investment to cash flow is positive in city-years with no local government debt but drops to zero when local government debt reaches 5% of GDP. For credit-constrained firms, the opposite holds: the sensitivity of investment to cash flow is much greater and is again increasing in local government debt (column 2.2).

Finally, we estimate a model that controls for city-year fixed effects and industry-year fixed effects, which absorb the effect of asset tangibility (defined at the industry-level). The results are essentially identical to those of column 2.

7 Conclusions

China reacted to the global financial crisis with massive fiscal stimulus. In November 2008 the government announced a package worth 4 trillion yuan (approximately $590 billion). The plan was implemented immediately, the funds being channeled primarily through local governments. In 2009 city-level debt increased by 1.7 trillion yuan (based on our estimates, see Table 1), while central government debt increased by 700 billion yuan (from 5.3 trillion to 6 trillion yuan, based on CICC).

The stimulus package focused on investment. In 2009 the growth rate of fixed capital formation was nearly twice its pre-crisis rate, and fixed investment's contribution to Chinese GDP growth came to almost 90% (Wen and Wu, 2014). This surge in investment was achieved by injecting enormous financial resources into state-owned firms. The leverage ratio of state-owned manufacturing firms rose from 57.5% in 2008Q1 (pre-crisis) to 61.5% in 2010Q1. Meanwhile, for private-sector manufacturing firms the ratio slipped from 59% to 57% (Wen and Wu, 2014).

At first glance, the stimulus was a resounding success. China escaped the Great Recession and became one of the main drivers of world economic growth (Wen and Wu, 2014). Our estimates suggest, however, that this policy suffered from a major drawback: the massive increase in local government debt had a powerful adverse impact on investment by private manufacturing firms. As these have much higher productivity than their state-owned counterparts (Song, Storesletten and Zilibotti, 2011), this reallocation of investment from the private to the public sector is likely to undercut China's long-run growth potential, especially in the areas where local governments have issued the largest amount of debt. Moreover, by increasing the share of public debt in banks' asset portfolios, this policy has further strengthened the bank-sovereign nexus in China, which threatens in the future to generate serious risks to systemic stability, as the euro-area sovereign debt crisis has so forcefully demonstrated (Acharya, Drechsler and Schnabl, 2014; Acharya and Steffen, 2015; Altavilla, Pagano and Simonelli, 2015; Popov and van Horen, 2013).

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Table 1: **Local Government Debt in China**

This table summarizes our data for local government debt. Columns 2-5 are based on city-level variables. Columns 6 and 7 report year totals in RMB and as a percent of China's GDP.

Year	μ	σ	Min.	Max.	Total China		N. Cities	
		Bill. RMB			Bill. RMB	(% GDP)	All	D>0
2006	4.3	18.1	0.0	173	1,255	5.8	293	92
2007	7.1	27.6	0.0	268	2,087	7.9	293	144
2008	10.4	38.4	0.0	383	3,036	9.7	293	189
2009	18.9	62.8	0.0	589	5,535	16.2	293	248
2010	24.7	80.5	0.0	789	7,249	18.1	293	281
2011	28.5	93.7	0.0	951	8,336	17.6	293	291
2012	35.6	113.0	0.0	1,145	10,425	20.1	293	292
2013	42.9	132.1	0.0	1,303	12,556	22.1	293	292

Table 2: **Local Government Debt and Investment: City-Level Regressions**

This table reports the results of a set of regressions where the dependent variable is the city-level investment ratio of the manufacturing sector (computed as the weighted average of investment over total assets of all manufacturing firms in city c year t) and the dependent variable is local government debt over GDP (LGD). Column 1 includes all manufacturing firms, column 2 only private sector manufacturing firms, column 3 state-owned manufacturing firms, column 4 foreign-owned manufacturing firms, and column 5 all types of firm but estimating separate effects by interacting local government debt with private sector (PRI), state-owned (SOE), and foreign-owned (FOR) dummies. The regressions cover 261 cities for the period 2006-2013.

	(1)	(2)	(3)	(4)	(5)
LGD	-0.083***	-0.089***	-0.017	0.017	
	(0.026)	(0.0289)	(0.029)	(0.052)	
$LGD \times PRI$					-0.090***
					(0.031)
$LGD \times SOE$					-0.029
					(0.028)
$LGD \times FOR$					0.0154
					(0.033)
N. Obs.	1,861	1,859	1,658	1,146	4580
N. Cities	261	261	261	245	261
Year FE	YES	YES	YES	YES	YES
City FE	YES	YES	YES	YES	YES
Sample	All	Private	State	Foreign	All
$LGD \times PRI - LGD \times SOE$					-0.060*
p-value					(0.06)
$LGD \times PRI - LGD \times FOR$					-0.105***
p-value					(0.01)
$LGD \times SOE - LGD \times FOR$					-0.045
p-value					(0.13)

Robust s.e. clustered at the city level in parenthesis

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

Table 3: **Local Government Debt and Investment: City-Level Regressions**

This table reports the results of a set of regressions where the dependent variable is the city-level investment ratio of the manufacturing sector (computed as the weighted average of investment over total assets of all manufacturing firms in city c year t) and the dependent variables are local government debt over GDP (LGD), bank loans over GDP (BL), local government balance over GDP (GB), GDP growth (GR), the log of GDP per capita ($GDP\ PC$), the log of population (POP), and the log of the price of land (LP). Column 1 includes all manufacturing firms, column 2 only private sector manufacturing firms, column 3 only state-owned manufacturing firms, column 4 only foreign-owned manufacturing firms, and column 5 all types of firm but estimating separate effects by interacting local government debt with private sector (PRI), state-owned (SOE), and foreign-owned (FOR) dummies. The regressions cover 261 cities for the period 2006-2013.

	(1)	(2)	(3)	(4)	(5)
LGD	-0.093***	-0.104***	-0.029	0.032	
	(0.028)	(0.030)	(0.040)	(0.053)	
$LGD \times PRI$					-0.095***
					(0.031)
$LGD \times SOE$					-0.024
					(0.028)
$LGD \times FOR$					0.019
					(0.033)
BL	-0.012	-0.002	-0.027	0.012	-0.004
	(0.014)	(0.014)	(0.024)	(0.033)	(0.015)
GB	0.020	0.028	-0.139	-0.484*	-0.169
	(0.153)	(0.168)	(0.209)	(0.252)	(0.137)
GR	0.409***	0.332**	0.632***	-0.206	0.288***
	(0.127)	(0.135)	(0.164)	(0.190)	(0.104)
$ln(GDP\ PC)$	4.506	6.394*	-5.851	14.93**	4.544
	(3.283)	(3.752)	(4.408)	(5.875)	(2.893)
$ln(POP)$	7.506*	9.374**	-5.674	15.32**	6.026*
	(3.821)	(4.295)	(5.511)	(6.371)	(3.308)
$ln(LP)$	0.598	0.505	-0.411	2.005*	0.537
	(0.629)	(0.694)	(0.979)	(1.124)	(0.612)
N. Obs.	1,805	1,803	1,658	1,109	4,420
N. Cities	261	261	261	242	261
Firms	All	Private	State	Foreign	All
Year FE	YES	YES	YES	YES	YES
City FE	YES	YES	YES	YES	YES
$LGD \times PRI - LGD \times SOE$					-0.071**
p-value					(0.04)
$LGD \times PRI - LGD \times FOR$					-0.114***
p-value					(0.01)
$LGD \times SOE - LGD \times FOR$					-0.043
p-value					(0.15)

Robust s.e. clustered at the city level in parenthesis

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

Table 4: **Local Government Debt and Investment: City-Level IV Regressions**

This table reports the results of a set of instrumental variable regressions where the dependent variable is the city-level investment ratio of the manufacturing sector (computed as the weighted average of investment over total assets of all manufacturing firms in city c year t) and the endogenous explanatory variables are local government debt over GDP (LGD) and transfers over GDP (TR). The top panel reports the reduced form regressions and the bottom panel the first stage regressions in which LGD and TR are instrumented with number of national politicians who originate from city c and simulated transfers STR. Column 1 includes all manufacturing firms, column 2 only private sector manufacturing firms, column 3 only state-owned manufacturing firms, and column 4 only foreign-owned manufacturing firms. The regressions cover up to 261 cities for the period 2006-2013.

	Second Stage							
	(1)		(2)		(3)		(4)	
LGD	-0.789**		-0.779**		-0.446		-0.210	
	(0.368)		(0.383)		(0.310)		(0.277)	
TRI	0.454*		0.467*		0.0883		-0.131	
	(0.258)		(0.272)		(0.258)		(0.244)	
	First Stage							
	(1.1)	(1.2)	(2.1)	(2.2)	(3.1)	(3.2)	(4.1)	(4.2)
	LGD	TRI	LGD	TRI	LGD	TRI	LGD	TRI
TOP	0.13	2.48***	0.12	2.49***	0.03	2.75***	-0.23	3.11***
	(0.41)	(0.81)	(0.4)	(0.82)	(0.44)	(0.89)	(0.43)	(1.02)
STRI	0.39***	0.27	0.39***	0.28	0.40***	0.27	0.40***	0.23
	(0.07)	(0.25)	(0.07)	(0.24)	(0.08)	(0.26)	(0.08)	(0.27)
N. Obs.	1,861		1,859		1,575		1,127	
N. Cities	261		261		261		226	
CD F test	11.44		11.93		11.92		12.66	
City FE	YES		YES		YES		YES	
Year FE	YES		YES		YES		YES	
Sample	All		Private		State		Foreign	

Robust s.e. clustered at the city level in parenthesis
*** p<0.01, ** p<0.05, * p<0.1

Table 5: **Local Government Debt and Private Investment: Only Firms with Low Exposure to Government Expenditure**

This table reproduces the results of columns 1 of Tables 2 and 3, and column 1 of Table 4 but only referring to investment by firms with low exposure (below the 25th percentile of the distrbution) to government expenditure. The regressions cover 261 cities for the period 2006-2013.

	(1)	(2)	(3)
LGD	-0.089***	-0.103***	-0.938*
	(0.034)	(0.0378)	(0.502)
BL		-0.011	
		(0.018)	
GB		0.048	
		(0.205)	
GR		0.292*	
		(0.154)	
ln(GDP PC)		7.857*	
		(4.645)	
ln(POP)		7.571*	
		(4.381)	
LP		1.712*	
		(0.929)	
TR			0.700**
			(0.342)
N. Obs.	1,820	1,764	1,820
N. Cities	261	261	261
F test			11.4
Est.	LSDV	LSDV	IV
City FE	YES	YES	YES
Year FE	YES	YES	YES

Robust s.e. clustered at the city level in parenthesis
*** p<0.01, ** p<0.05, * p<0.1

Table 6: **Industry-Level Regressions**

This table reports the results of a set of regressions where the dependent variable is the investment ratio (computed as investment over total assets at the beginning of the period) aggregated at the city-industry-year level. The regressions control for initial investment (I_{t-1}) and the interaction between local government debt over GDP (LGD) and the Rajan-Zingales index of external financial dependence(EF) computed on firms in Beijing, Shanghai, Hangzhou, and Wenzhou. The first column includes all manufacturing firms, column 2 only private sector manufacturing firms, column 3 only state-owned manufacturing firms, and column 4 only foreign-owned manufacturing firms. The regressions cover 257 cities for the period 2006-2013.

	(1)	(2)	(3)	(4)
I_{t-1}	-0.273***	-0.271***	-0.426***	-0.396**
	(0.006)	(0.006)	(0.034)	(0.16)
$EF \times LGD$	-0.015***	-0.019***	0.016	0.007
	(0.005)	(0.006)	(0.017)	(0.042)
N. Obs	57,054	53,262	6,249	2,550
N. Cities	15,768	14,906	3,252	1,121
City-Year FE	YES	YES	YES	YES
Ind.-Year FE	YES	YES	YES	YES
Sample	All	Private	State	Foreign

Robust s.e. clustered at the firm level in parenthesis
*** p<0.01, ** p<0.05, * p<0.1

Table 7: **Industry-Level Regressions: Additional Interactions**

This table reports the results of a set of regressions where the dependent variable is the investment ratio (computed as investment over total assets at the beginning of the period) aggregated at the city-industry-year level. The regressions control for initial investment (I_{t-1}) and the interaction between the Rajan-Zingales index of external financial dependence (EF) computed on firms in Beijing, Shanghai, Hangzhou, and Wenzhou and each of the following variables: local government debt over GDP (LGD), bank loans over GDP (BL), the log of GDP per capita ($GDP\ PC$), GDP growth (GR), and the log of average land price (LP). The first column uses all manufacturing firms, column 2 only private sector manufacturing firms, column 3 only state-owned manufacturing firms, and column 4 only foreign-owned manufacturing firms. The regressions cover 257 cities for the period 2006-2013.

	(1)	(2)	(3)	(4)
I(t-1)	-0.272***	-0.271***	-0.427***	-0.398***
	(0.006)	(0.006)	(0.03)	(0.164)
$EF \times LGD$	-0.018***	-0.023***	0.018	0.008
	(0.005)	(0.006)	(0.011)	(0.04)
$EF \times BL$	0.001	0.001	-0.003	-0.003
	(0.001)	(0.001)	(0.003)	(0.016)
$EF \times ln(GDP\ PC)$	0.227	0.186	0.679	-0.382
	(0.19)	(0.196)	(0.942)	(3.08)
$EF \times GR$	0.0286*	0.0338	0.0646	0.0191
	(0.016)	(0.019)	(0.09)	(0.312)
$EF \times LP$	-0.129	-0.131	-0.230	0.018
	(0.107)	(0.114)	(0.528)	(1.443)
N. Obs	56,209	52,503	6,065	2,520
N. Cities	15,693	14,839	3,194	1,115
City-Year FE	YES	YES	YES	YES
Ind.-Year FE	YES	YES	YES	YES
Sample	All	Private	State	Foreign

Robust s.e. clustered at the city-indutry level in parenthesis
*** p<0.01, ** p<0.05, * p<0.1

Table 8: **Firm-Level Regressions: Firm and City-Year FE**

This table reports the results of a set of regressions where the dependent variable is the firm-level investment ratio (computed as investment over total assets at the beginning of the period), and the explanatory variables are lagged investment (I_{t-1}), revenue growth over total assets (REV_{t-1}), lagged cash flow (CF_{t-1}), and the interaction between CF_{t-1} and local government debt over GDP (LGD). The first column includes all manufacturing firms, column 2 only private sector domestically owned manufacturing firms, column 3 only state-owned manufacturing firms, column 4 only foreign-owned manufacturing firms; column 5 includes all observations and allows state-owned and foreign-owned firms to have different coefficients for the interaction between local government debt and cash flow. The regressions cover 261 cities for the period 2006-2013.

	(1)	(2)	(3)	(4)	(5)
I_{t-1}	-0.273***	-0.280***	-0.371***	-0.282***	-0.273***
	(0.002)	(0.002)	(0.008)	(0.011)	(0.002)
REV_{t-1}	3.773***	3.799***	2.398***	2.942***	3.77***
	(0.031)	(0.034)	(0.167)	(0.220)	(0.031)
CF_{t-1}	6.725***	7.334***	4.328***	-0.253	6.70***
	(0.231)	(0.256)	(1.190)	(1.534)	(0.231)
$CF_{t-1} \times LGD$	0.028**	0.029**	-0.097	-0.07	0.038***
	(0.011)	(0.013)	(0.055)	(0.05)	(0.012)
$CF_{t-1} \times LGD \times State$					-0.080**
					(0.036)
$CF_{t-1} \times LGD \times Foreign$					-0.091***
					(0.024)
N. Obs.	1,150,340	975,454	61,755	33,784	1,150,340
N. Firms	387,781	353,434	32,103	15,950	387,781
N. Cities	261	261	261	261	261
Firm FE	YES	YES	YES	YES	YES
City-Year FE	YES	YES	YES	YES	YES
Sample	All	Private	State	Foreign	All
$CF_{t-1} \times LGD + CF_{t-1} \times LGD \times State$					-0.042
p-value					0.26
$CF_{t-1} \times LGD + CF_{t-1} \times LGD \times Foreign$					-0.053
p-value					0.11

Robust s.e. clustered at the firm level in parenthesis
*** p<0.01, ** p<0.05, * p<0.1

Table 9: **Firm-Level Regressions: Controlling for Bank Loans**

This table reports the results of a set of regressions where the dependent variable is the firm-level investment ratio (computed as investment over total assets at the beginning of the period), and the explanatory variables are lagged investment (I_{t-1}), revenue growth over total assets (REV_{t-1}), lagged cash flow (CF_{t-1}), and the interaction between CF_{t-1} and each of the following variables: local government debt over GDP (LGD) and bank loans over GDP (BL). The first column includes all manufacturing firms, column 2 only private sector domestically owned manufacturing firms, column 3 only state-owned manufacturing firms, and column 4 only foreign-owned manufacturing firms. The regressions cover 261 cities for the period 2006-2013.

	(1)	(2)	(3)	(4)
I_{t-1}	-0.274***	-0.281***	-0.371***	-0.281***
	(0.002)	(0.002)	(0.008)	(0.011)
REV_{t-1}	3.770***	3.796***	2.393***	2.933***
	(0.031)	(0.033)	(0.168)	(0.220)
CF_{t-1}	8.343***	9.141***	6.020***	-2.973
	(0.374)	(0.411)	(1.893)	(2.665)
$CF_{t-1} \times LGD$	0.075***	0.083***	-0.045	-0.110*
	(0.014)	(0.016)	(0.068)	(0.058)
$CF_{t-1} \times BL$	-0.022***	-0.025***	-0.023	0.028
	(0.004)	(0.004)	(0.019)	(0.019)
N. Obs.	1,150,340	975,454	61,755	33,784
N. Firms	387,781	353,434	32,103	15,950
N. Cities	261	261	261	261
Firm FE	YES	YES	YES	YES
City-Year FE	YES	YES	YES	YES
Sample	All	Private	State	Foreign

Robust s.e. clustered at the firm level in parenthesis
*** p<0.01, ** p<0.05, * p<0.1

Table 10: **Firm-Level Regressions: Additional Controls**

This table reports the results of a set of regressions where the dependent variable is the firm-level investment ratio (computed as investment over total assets at the beginning of the period), and the explanatory variables are lagged investment (I_{t-1}), revenue growth over total assets (REV_{t-1}), lagged cash flow (CF_{t-1}), and the interaction between CF_{t-1} and each of the following variables: local government debt over GDP (LGD), bank loans over GDP(BL), local government budget balance over GDP(GB), city-level log of GDP per capita ($GDP\ PC$), GDP growth (GR), and the log of average land prices (LP). The regressions cover 261 cities for the period 2006-2013.

	(1)	(2)	(3)	(4)	(5)
I_{t-1}	-0.274***	-0.274***	-0.274***	-0.273***	-0.274***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
REV_{t-1}	3.771***	3.771***	3.796***	3.763***	3.787***
	(0.031)	(0.031)	(0.032)	(0.032)	(0.032)
CF_{t-1}	8.137***	9.150***	18.60***	2.039	19.15***
	(0.426)	(0.492)	(0.799)	(1.482)	(2.399)
$CF_{t-1} \times LGD$	0.075***	0.072***	0.052***	0.055***	0.051***
	(0.014)	(0.014)	(0.014)	(0.014)	(0.015)
$CF_{t-1} \times BL$	-0.021***	-0.024***	-0.026***	-0.025***	-0.021***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
$CF_{t-1} \times GB$	-0.038				0.093*
	(0.042)				(0.052)
$CF_{t-1} \times ln(GDP\ PC)$		0.539**			-0.794**
		(0.237)			(0.332)
$CF_{t-1} \times GR$			-0.739***		-0.802***
			(0.051)		(0.056)
$CF_{t-1} \times LP$				1.047***	-0.105
				(0.247)	(0.316)
N. Obs.	1,150,340	1,150,340	1,123,318	1,142,536	1,115,514
N. Firms	387,781	387,781	385,540	387,037	384,720
N. Cities	261	261	261	261	261
Firm FE	YES	YES	YES	YES	YES
City-Year FE	YES	YES	YES	YES	YES
Sample	All	All	All	All	All

Robust s.e. clustered at the firm level in parenthesis
*** p<0.01, ** p<0.05, * p<0.1

Table 11: **Firm-Level Regressions: Exposure to Government Expenditure**

This table reports the results of a set of regressions where the dependent variable is the firm-level investment ratio (computed as investment over total assets at the beginning of the period), and the explanatory variables are lagged investment (I_{t-1}), revenue growth over total assets (REV_{t-1}), lagged cash flow (CF_{t-1}), the interaction between CF_{t-1} and bank loans over GDP (LGD), and the interaction between CF_{t-1} and local government debt over GDP (LGD) further interacted with exposure to government expenditure (EXP). The first two columns include all manufacturing firms, column 3 only private sector domestically owned manufacturing firms, column 4 only state-owned manufacturing firms, and column 5 only foreign-owned manufacturing firms. Column 6 uses a discrete measure of exposure to government expenditure. The regressions cover 261 cities for the period 2006-2013.

	(1)	(2)	(3)	(4)	(5)	(6)
I_{t-1}	-0.277***	-0.278***	-0.283***	-0.375***	-0.304***	-0.278***
	(0.002)	(0.002)	(0.002)	(0.009)	(0.01)	(0.002)
REV_{t-1}	3.757***	3.756***	3.786***	2.368***	2.738***	3.756***
	(0.035)	(0.035)	(0.038)	(0.192)	(0.259)	(0.035)
CF_{t-1}	9.049***	8.455***	9.515***	7.913***	2.994	8.553***
	(0.442)	(0.421)	(0.487)	(2.360)	(3.410)	(0.477)
$CF_{t-1} \times LGD$	0.0895***	0.0785***	0.106***	0.029	-0.109	0.083***
	(0.0172)	(0.0156)	(0.020)	(0.079)	(0.086)	(0.020)
$CF_{t-1} \times BL$	-0.021***	-0.021***	-0.024***	-0.031	0.006	-0.021***
	(0.004)	(0.004)	(0.005)	(0.022)	(0.024)	(0.004)
$CF_{t-1} \times EXP$	-4.632***		-2.065*	-6.877***	-16.94	
	(1.009)		(1.236)	(2.128)	(11.24)	
$CF_{t-1} \times EXP \times LGD$	-0.064		-0.125**	-0.111	0.166	
	(0.046)		(0.052)	(0.105)	(0.481)	
$HEXP \times LGD$	-0.034**		-0.039**	-0.056	-0.071	
	(0.0136)		(0.0159)	(0.0384)	(0.0680)	
$CF_{t-1} \times HEXP$						-0.197
						(0.451)
$CF_{t-1} \times HEXP \times LGD$						-0.009
						(0.024)
$HEXP \times LGD$						0.003
						(0.004)
N. Obs.	935,255	935,255	796,947	50,192	24,087	935,255
N. Firms	323,914	323,914	295,448	26,065	11,790	323,914
N. Cities	261	261	261	261	261	261
Firm FE	YES	YES	YES	YES	YES	YES
City-Year FE	YES	YES	YES	YES	YES	YES
Sample	All	All	Private	State	Foreign	All

Robust s.e. clustered at the firm level in parenthesis
*** p<0.01, ** p<0.05, * p<0.1

Table 12: **System GMM Regressions**

The top panel of this table estimates the models of Table 9 using the system GMM estimator of Arellano and Bover (1995) and Blundell and Bond (1998). The set of instruments includes all available lags. The bottom panel reports standard fixed effects estimations that use the same sample as the top panel. The first column includes all manufacturing firms, column 2 only private sector domestically owned manufacturing firms, column 3 only state-owned manufacturing firms, and column 4 only foreign-owned manufacturing firms. The regressions cover 261 cities for the period 2006-2013.

	(1)	(2)	(3)	(4)
	SYS GMM			
I_{t-1}	0.018	0.002	0.372	-0.404*
	(0.024)	(0.026)	(0.216)	(0.244)
REV_{t-1}	9.709***	9.756***	3.977	-0.607
	(0.365)	(0.407)	(3.882)	(3.494)
CF_{t-1}	9.69***	11.04***	36.15**	46.93*
	(2.41)	(2.69)	(17.48)	(22.80)
$CF_{t-1} \times LGD$	0.052***	0.037***	-0.044	0.056
	(0.011)	(0.012)	(0.046)	(0.123)
$CF_{t-1} \times BL$	-0.065***	-0.035	-0.066	-0.187*
	(0.020)	(0.023)	(0.106)	(0.170)
AR1 (p-value)	0.00	0.00	0.03	0.04
AR2 (p-value)	0.07	0.03	0.15	0.30
Sargan (p-value)	0.15	0.07	0.00	0.00
	Standard FE on same sample			
I_{t-1}	-0.242***	-0.251***	-0.339***	-0.206***
	(0.002)	(0.003)	(0.015)	(0.018)
REV_{t-1}	4.18***	4.24***	2.82***	1.07***
	(0.04)	(0.04)	(0.31)	(0.33)
CF_{t-1}	12.93***	12.87***	7.55**	15.32***
	(0.49)	(0.56)	(3.11)	(3.56)
$CF_{t-1} \times LGD$	0.018***	0.018***	0.005	0.021
	(0.002)	(0.002)	(0.013)	(0.013)
$CF_{t-1} \times BL$	-0.066***	-0.063***	-0.085***	-0.110***
	(0.005)	(0.006)	(0.030)	(0.027)
N. Obs.	797,314	623,837	53,657	18,848
N. Firms	261,525	190,451	19,136	6,028
N. Cities	261	261	261	261
Firm FE	YES	YES	YES	YES
City-Year FE	YES	YES	YES	YES
Sample	All	Private	State	Foreign

Robust (Windmeijer) s.e. clustered at the firm level in parenthesis
*** p<0.01, ** p<0.05, * p<0.1

Table 13: **Firm-Level Regressions: Different Samples**

This table reports the results of a set of regressions where the dependent variable is the firm-level investment ratio (computed as investment over total assets at the beginning of the period), and the explanatory variables are lagged investment (I_{t-1}), revenue growth over total assets (REV_{t-1}), lagged cash flow (CF_{t-1}), and the interaction between CF_{t-1} and each of the following variables: local government debt over GDP (LGD) and bank loans over GDP (BL). Column 1 excludes Beijing, Tianjin and all cities in the provinces of Jiangsu and Zhejiang. Column 2 only includes firms located in cities with population of 1-10 million. The regressions cover up to 235 cities for the period 2006-2013.

	(1)	(2)
I_{t-1}	-0.282***	-0.278***
	(0.0018)	(0.0016)
REV_{t-1}	3.955***	3.793***
	(0.037)	(0.033)
CF_{t-1}	7.928***	8.352***
	(0.416)	(0.420)
$CF_{t-1} \times LGD$	0.057***	0.076***
	(0.019)	(0.017)
$CF_{t-1} \times BL$	-0.015***	-0.020***
	(0.004)	(0.004)
N. Obs.	781,670	1,003,337
N. Firms	264,914	340,510
N. Cities	235	212
Firm FE	YES	YES
City-Year FE	YES	YES
Sample	Excluding 4 provinces where HPP>Off.	1m<POP<10m

Robust s.e. clustered at the firm level in parenthesis
*** p<0.01, ** p<0.05, * p<0.1

Table 14: **Local Government Debt and Investment: Firm-Level IV Regressions**

This table reports the results of a set of instumental variable regressions where the dependent variable is the firm-level investment ratio (computed as investment over total assets at the beginning of the period), and the explanatory variables are lagged investment (I_{t-1}), revenue growth over total assets (REV_{t-1}), lagged cash flow (CF_{t-1}), and the interaction between CF_{t-1} and each of the following variables: local government debt over GDP (LGD), central government transfers over GDP (TR), and bank loans over GDP (BL). The interactive terms $CF_{t-1} \times LGD$ and $CF_{t-1} \times TR$ are treated as endogenous and are instrumented with the interaction between cash flow and the number of national politicians who originate from city c and simulated transfers STR (this is the same IV strategy as in Table 4). Column 1 includes all manufacturing firms, column 2 only private sector manufacturing firms, column 3 only state-owned manufacturing firms, and column 4 only foreign-owned manufacturing firms.

	(1)	(2)	(3)	(4)
I_{t-1}	-0.291***	-0.296***	-0.370***	-0.291***
	(0.002)	(0.002)	(0.009)	(0.024)
REV_{t-1}	3.659***	3.682***	2.358***	3.073***
	(0.032)	(0.035)	(0.180)	(0.464)
CF_{t-1}	23.65***	28.07***	20.08	2.736
	(1.647)	(2.314)	(14.09)	(5.895)
$CF_{t-1} \times LGD$	2.638***	3.188***	2.176	1.829
	(0.286)	(0.392)	(2.232)	(1.310)
$CF_{t-1} \times BL$	-0.342***	-0.427***	-0.310	-0.154
	(0.035)	(0.050)	(0.289)	(0.115)
$CF_{t-1} \times TR$	-0.637***	-0.720***	-0.594	-0.824
	(0.076)	(0.097)	(0.614)	(0.619)
N. Obs.	928,772	775,250	43,617	19,130
N. Cities	261	261	256	2243
N. of firms	258,338	223,566	15,739	6,807
CD F test	415.1	242.2	22.2	29.1
City FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
Sample	All	Private	State	Foreign

Robust s.e. clustered at the city level in parenthesis
*** p<0.01, ** p<0.05, * p<0.1

Table 15: **Firm-Level Regressions: Switching Regression Model**

This table reports the switching regression model described in Equations (4)-(6). The selection equation (Panel A) controls for the log of firm age ($ln(Age)$), the log assets ($ln(Assets)$), distance to default ($Zscore$), a time-invariant industry-level measure of the share of tangible assets over total assets ($Tangible$), a dummy that takes a value of 1 if the firm is neither foreign-owned or state-owned ($Private$), and time-variant measures of city-level local government debt (LGD). The investment equation (Panel B) controls for lagged cash flow (CF), the interaction between lagged cash flow and local government debt (LGD), lagged investment (not reported), and revenue growth (not reported). Model 1 includes city and year fixed effects, Model 2 includes city-year fixed effects, and Model 3 includes city-year and industry-year city-year fixed effects. For each model we report separate investment equations for firms that are not credit-constrained (regime 1) and credit-constrained firms (regime 2). The regressions cover 261 cities for the period 2006-2013.

	(1)		(2)		(3)	
A. Selection Equation						
$ln(Age)$	10.93***		7.236***		8.532***	
	(0.077)		(0.721)		(0.066)	
$ln(Assets)$	0.077**		0.725***		1.706***	
	(0.034)		(0.030)		(0.026)	
$Zscore$	0.110***		0.049***		0.033***	
	(0.008)		(0.008)		(0.007)	
$Private$	-9.340***		-5.09***		-4.339***	
	(0.142)		(0.013)		(0.012)	
$Tangible$	7.898***		4.62***			
	(0.279)		(0.026)			
LGD	-0.012*					
	(0.008)					
N. Obs	1,060,404		1,060,404		1,060,404	
B. Investment Equation						
	(1.1)	(1.2)	(2.1)	(2.2)	(3.1)	(3.2)
	Not Constr.	Constr.	Not Constr.	Constr.	Not Constr.	Constr.
CF_{t-1}	1.62***	0.40***	0.31***	0.81***	0.14***	0.71***
	(0.03)	(0.02)	(0.03)	(0.02)	(0.03)	(0.02)
$CF_{t-1} \times LGD$	-0.042***	0.014***	-0.063***	0.052***	-0.033***	0.011***
	(0.005)	(0.003)	(0.01)	(0.01)	(0.01)	(0.004)
LGD	-0.012***	-0.041***				
	(0.001)	(0.004)				
N. Obs.	306,175	754,229	274,822	785,222	231,925	828,479
City FE	YES		NO		NO	
Year FE	YES		NO		NO	
City-Year FE	NO		YES		YES	
Ind-Year FE	NO		NO		YES	

Robust s.e. clustered at the firm level in parenthesis

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

Figure 1: **Local Government Debt in China: Bonds and Loans.** This figure plots the composition of total local government debt in China divided between oustanding bonds and other financial liabilities.

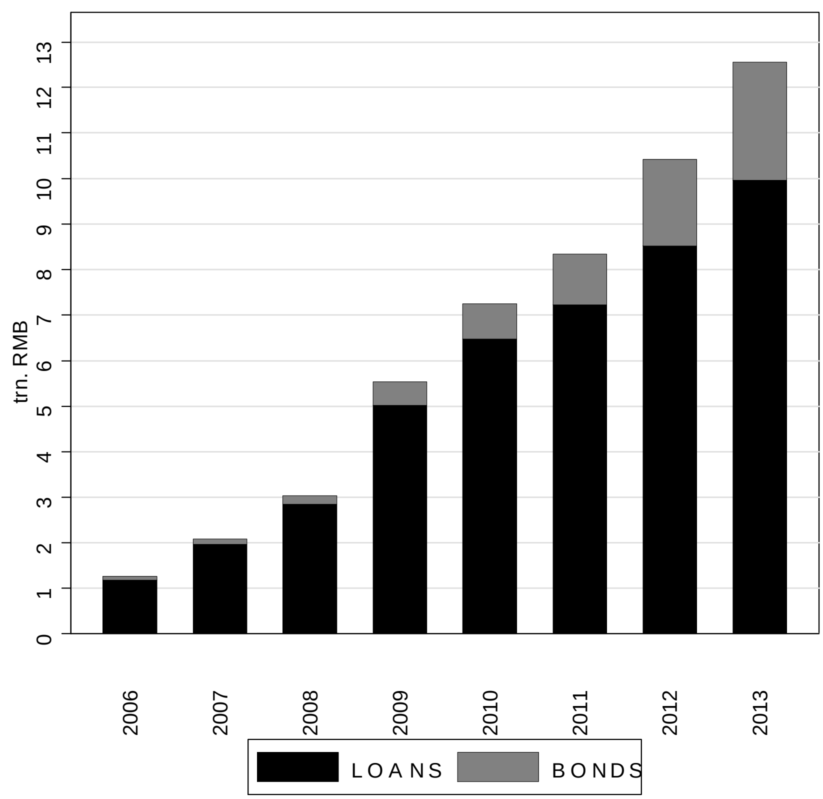


Figure 2: **Local Government Debt and Investment Ratios in Different Industries**. This figure plots how investment ratios vary with the level of government debt for private sector manufacturing firms in the paper industry (25th percentile of the distribution of the index of external financial dependence) and the battery industry (75th percentile of the distribution of the index of external financial dependence). The graphs are based on the the estimations of column 2, Table 6. The dashed lines are 95% confidence intervals and the horizontal lines are the average investment ratios in the two industries (8.3% for paper and 10.6% for batteries).

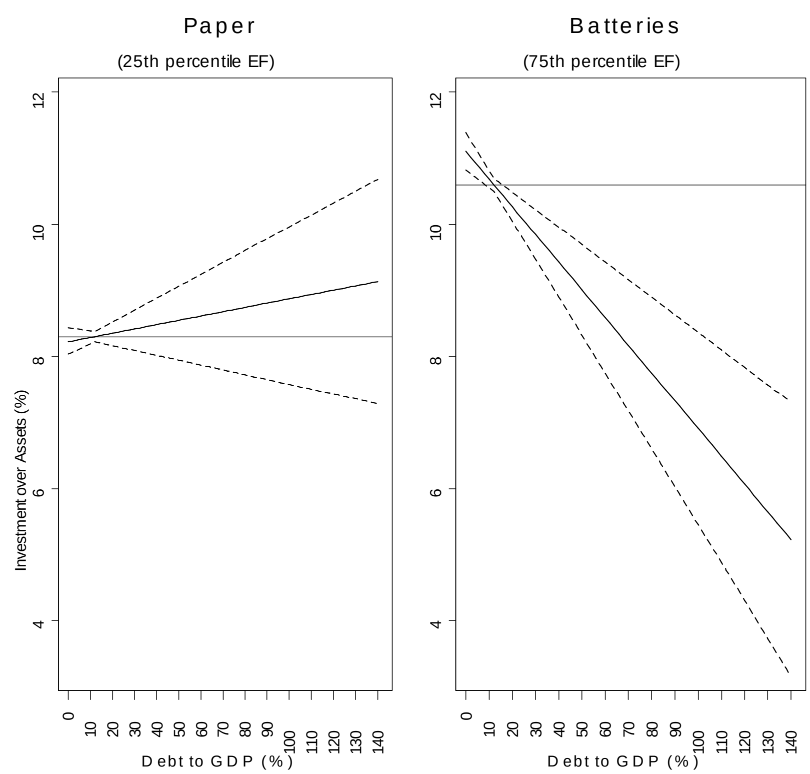
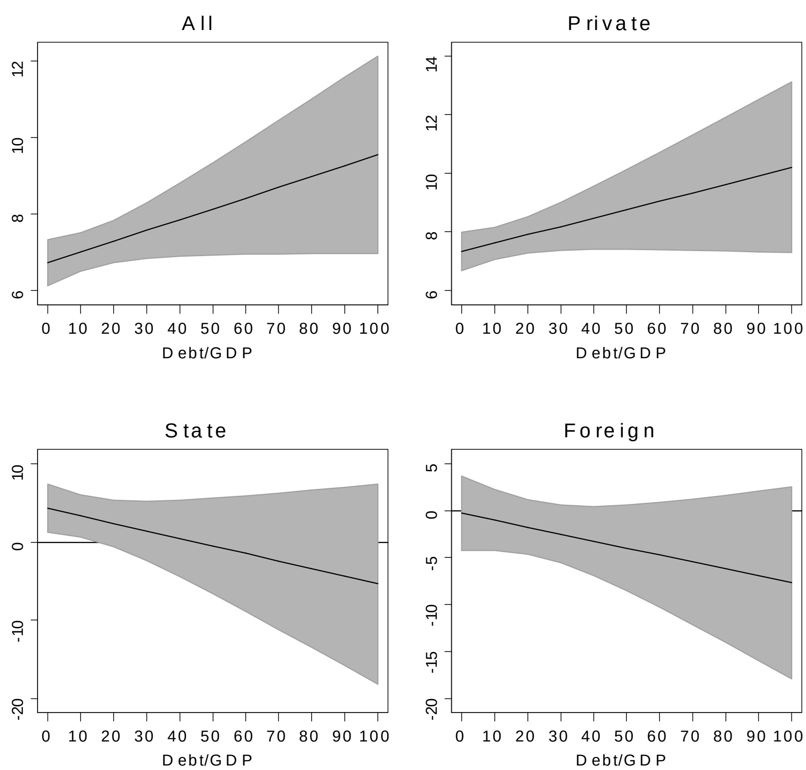


Figure 3: **Sensitivity of Investment to Cash Flow**.

The figures plot how the sensitivity of investment to cash flow changes with the level of local government debt. These marginal effects are based on the estimates reported in columns 1-4 of Table 8.



Appendix

A Construction of the data set

A.1 Local public debt data

To estimate the total financial liabilities of LGFVs, we use the balance-sheet data disclosed by all entities that requested an authorization to issue bonds, proceeding as follows. First, we obtain from the China Banking Regulatory Commission (CBRC) the list of all authorized LGFVs. At the end of 2013, the CBRC database had data on LGFVs in 293 cities across all provinces of China.

Next, we use the Wind Information Co. (WIND) database to retrieve balance-sheet data for the entities listed by CBRC. When an entity listed by CBRC is not available in the WIND database, we get the needed balance-sheet data manually. We estimate total debt of each LGFV by adding up its short-term and long-term debt.[33]Finally, we add up total debt (and its subcomponents) of all LGFVs located in a given city to obtain our measure of city-level local government debt. This measure also includes the (rare) cases in which the central government issued special bonds for the local government.

In constructing our aggregate measure of debt, we avoid double counting by excluding issues of LGFVs that belong to a holding group (in which case we factor in only the total debt of the group), and do not duplicate information for LGFVs with multiple issues in a given year.

The data show that local government debt started growing rapidly after the global financial crisis, when local governments were asked to take part in the massive fiscal stimulus package but not given additional fiscal resources (Lu and Sun, 2013, and Zhang and Barnett, 2014).

Between 2006 and 2010, local government debt grew six-fold, from 1.2 trillion to 7.2 trillion yuan (Table 1), and trebled relative to GDP, from 5.8% to 18.1%. It continued to grow thereafter, reaching 12.5 trillion yuan in 2013, or 22% of Chinese GDP. Over the same period, average city-level debt increased from 7 billion to 28 billion yuan.

Figure A1 plots the evolution of total local government debt on the basis of our data and the official data (from the National Audit Office, NAO, and China International Capital Corporation Limited, CICC). While our estimates are slightly lower than the official figures (as explained above, we can only set a lower bound for total government debt, not local debt), we match the trend in the official data. In 2012 and 2013 our totals are close to the official figures, within 5%.

We were also able to obtain province-level official data from the NAO surveys in 2012 and 2013. Accordingly, we aggregated our 293 cities into the 30 Chinese provinces for comparison with the NAO's figures. The NAO breaks local government debt down into three components: (i) direct debt (NAO 1 in Table A1); (ii) debt guaranteed by local governments (NAO 2 is equal to NAO 1 plus this second component); and (iii) debt that is not guaranteed by the local government but may create contingent liabilities (NAO 3 is

[33]Short-term debt, in turn, is short-term borrowing plus notes payable, non-current liabilities due within one year, other current liabilities and short-term bonds payable. Long-term debt equals long-term borrowing plus bonds payable.

equal to NAO 2 plus this third component).[34] Summing the first two components (NAO 2 in Table A1), one gets a stock of total outstanding government debt that is close to the figure generated by our own data (the column labeled HPP). The correlation between our data aggregated at province level and the NAO figures is always above 65% (often above 70%) and statistically significant at the 1 percent confidence level.

Figure A2 illustrates the close correlation between our province-level aggregates and the official data for NAO 2. It also shows that our measure can effectively serve as a lower bound for total local government debt, with most points lying below the 45-degree line. There are four exceptions: Beijing, Tianjin, Jiangsu and Zhejiang. Beijing and Tianjin, which are both cities and provinces, are two of the four Chinese municipalities under the direct control of the central government; Jiangsu, located just north of Shanghai, is the province with the largest stock of outstanding local government debt; and Zhejiang, in the Pearl River delta, is also close to Shanghai. For Beijing and Tianjin, our data on outstanding local government debt are far higher than those of the NAO, possibly because of the two cities' special status: as they are under direct control of the central government, some issuance that we assign to them could actually be central government liabilities. For Jiangsu and Zhejiang, our estimates are slightly higher than those of the NAO, but the difference is moderate, ranging from 5% to 15%. Our results are robust to dropping the observations for these cities.

A.2 City-level correlates of local government debt

Table A2 reports the overall correlations (between and within cities) between local government debt and a set of city-level variables: debt is positively correlated with per capita income ($\ln(GDP\,PC)$), population ($\ln(POP)$), total income ($\ln(GDP)$), the local government budget balance (GB, i.e. the unconsolidated budget balance of the city itself, thus excluding the LGFVs that issued the debt, scaled by city GDP), bank loans (BL, i.e. total bank loans, including credit to local governments, scaled by city GDP), and two measures of the average price of land ($LP1$, the log of an average of auction prices and administered prices set by the local government, and $LP2$, the log of the auction price).[35] However, the correlation between local government debt and economic growth (GR) is negative if one does not control for other city-level variables (column 4 of Table A2), but becomes positive and statistically significant if one controls jointly for the latter (column 9 of Table A2).

As most of our analysis consists in within-city regressions, Table A3 shows the within-city correlation of the variables described above (i.e., we control for city-fixed effects). In this case, local government debt has no correlation with per capita income, total income, or population, but it has a positive and statistically significant correlation with growth, with budget balance, with bank loans, and with land prices.

The positive correlation between local government debt and growth suggests that, rather than conducting counter-cyclical city fiscal policy, LGFVs are more likely to issue debt to finance infrastructure projects when the local economy is booming and tax revenues are

[34] The NAO observes that analysts and researchers should be careful in adding up these three components.

[35] Data on land prices are from the Chinese Yearbook of Land and Resources published by the Ministry of Land and Resources. For details on China's property market see Cai et al. (2009).

high. This finding also explains the positive correlation between local government debt and the city budget balance.

The positive correlation of local government debt with bank loans and land prices is instead likely to reflect the fact that lending to local governments is part of total bank lending and that land is commonly posted as collateral by LGFVs.

Table A1: **Local Government Debt in China, Comparison with the Official Data**
This table compares our data (HPP) with data from the National Auditing Office (NAO). NAO 1 refers to debt that NAO classifies as direct obbligations of local governments, NAO 2 is equal to NAO 1 plus debt guaranteed by local governments, and NAO 3 is equal to NAO 2 plus debt that may create contingent liabilities ("some responsibility of assistance" to use NAO's language). The table also reports the correlation between HPP data aggregated at the provice level and the NAO's three different defintions of local goverment debt.

Year	NAO 1	NAO 2	NAO 3	HPP
		2012		
Total China (Billion RMB)	8,835	11,025	14,563	10,425
Province-level correlation with HPP data				
Correlation	0.76	0.71	0.79	
p-value	0.00	0.00	0.00	
		2013		
Total China (Billion RMB)	10,591	13,186	17,432	12,556
Province-level correlation with HPP data				
Correlation	0.66	0.65	0.73	
p-value	0.00	0.00	0.00	

Table A2: **The Correlates of Local Government Debt in China**

This table reports the overall city-level correlations between local government debt and each of the following variables: log of GDP per capita ($ln(GDP\ PC)$), the log of population size ($ln(POP)$), the log of total GDP (GDP), GDP growth (GR), unconsolidated budget balance over GDP (GB, this is the budget of the city government and does not include the activities of the local government financing vehicles that issue the debt), total bank loans over GDP (BL these are local bank loans and include lending to local government financing vehicles), and two measures of land prices ($LP1$ is an average of auction prices and administered prices fixed by the local government; $LP2$ is the auction price). All regressions include data for 261 cities for the period 2006-2013.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
$ln(GDP\ PC)$	5.78***								2.71***
	(0.37)								(0.50)
$ln(POP)$		3.52***							2.23***
		(0.42)							(0.44)
$Ln(GDP)$			5.62***						
			(0.29)						
GR				-0.21**					0.21***
				(0.09)					(0.08)
GB					0.48***				0.04
					(0.05)				(0.05)
BL						0.15***			0.13***
						(0.005)			(0.005)
$LP1$							7.46***		1.81***
							(0.35)		(0.45)
$LP2$								7.09***	
								(0.36)	
Constant	15.48***	-13.00***	-17.76***	10.43***	11.62***	-6.151***	-38.18***	-37.76	-26.96***
	(0.57)	(2.50)	(2.50)	(1.33)	(1.25)	(0.49)	(2.12)	(2.33)	(3.04)
Observations	2,080	2,080	2,093	2,064	2,093	2,089	2,063	2,063	2,022
R-squared	0.11	0.03	0.16	0.002	0.04	0.37	0.18	0.16	0.39
City FE	NO	NO	NO	NO	NO	NO	NO	NO	NO
Year FE	NO	NO	NO	NO	NO	NO	NO	NO	NO

Robust standard errors clustered at the city-level in parenthesis. *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Table A3: **Within-city Correlates of Local Government Debt in China**

This table reports the within-city correlations between local government debt and each of the following variables: log of GDP per capita ($ln(GDP\ PC)$), the log of population size ($ln(POP)$), the log of total GDP (GDP), GDP growth (GR), unconsolidated budget balance over GDP (GB, this is the budget of the city government and does not include the activities of the local government financing vehicles that issue the debt), total bank loans over GDP (BL these are local bank loans and include lending to local government financing vehicles), and two measures of land prices ($LP1$ is an average of auction prices and administered prices fixed by the local government; $LP2$ is the auction price). All regressions include data for 261 cities for the period 2006-2013.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
$ln(GDP\ PC)$	-0.578								0.44
	(0.84)								(1.85)
$ln(POP)$		0.73							0.69
		(0.96)							(2.05)
$Ln(GDP)$			0.04						
			(1.64)						
GR				0.15***					0.19***
				(0.05)					(0.06)
GB					0.30***				0.35***
					(0.08)				(0.08)
BL						0.05***			0.06***
						(0.008)			(0.008)
$LP1$							1.15***		1.01***
							(0.37)		(0.37)
$LP2$								0.50	
								(0.34)	
Observations	2,080	2,080	2,093	2,064	2,093	2,089	2,063	2,063	2,022
N. Cities	261	261	261	261	261	261	261	261	261
City FE	YES	YES	YES	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES	YES	YES	YES

Robust standard errors clustered at the city-level in parenthesis. *** p<0.01, ** p<0.05, * p<0.1

Figure A1: **Evolution of Local Government Debt in China: Comparison with the Official Data**.

This figure plots total local government debt in China. The solid line plots our data and the dashed line plots data from China International Capital Corporation Limited (CICC).

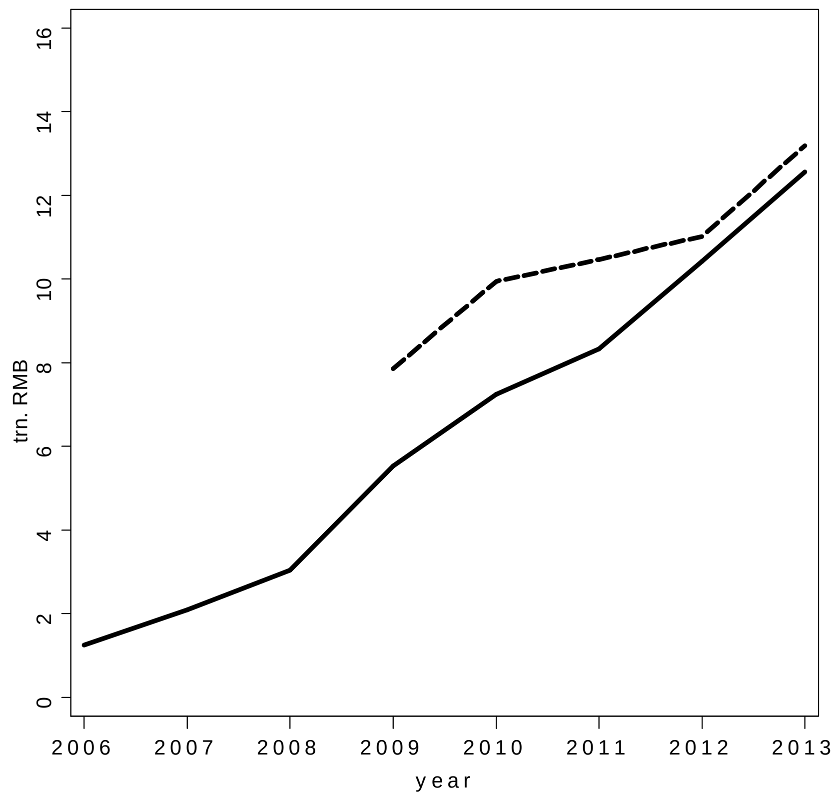


Figure A2: **Local Government Debt in Chinese Provinces**.
These figures compare our local government debt data (HPP) aggregated at the province level with official data from the National Audit Office (NAO) for the years 2012 and 2013.

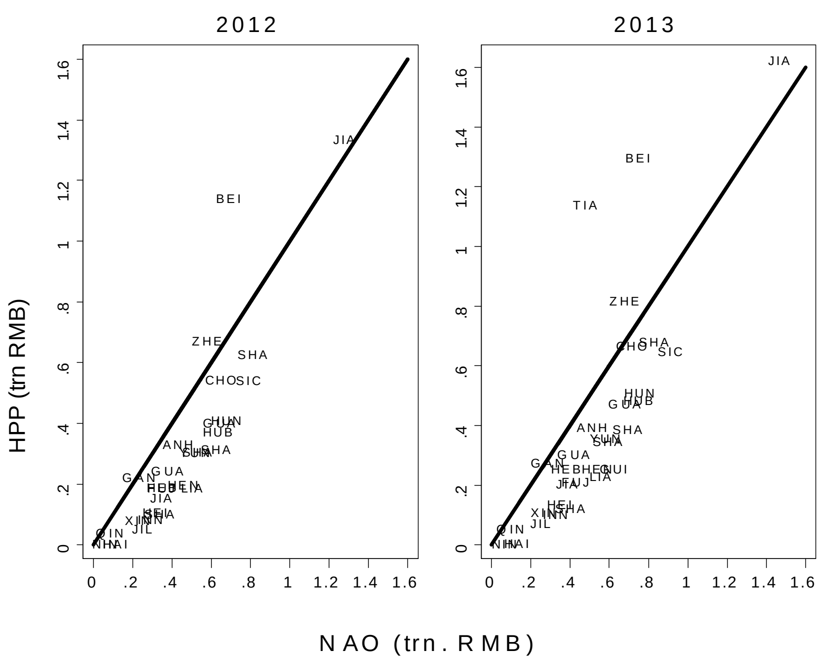
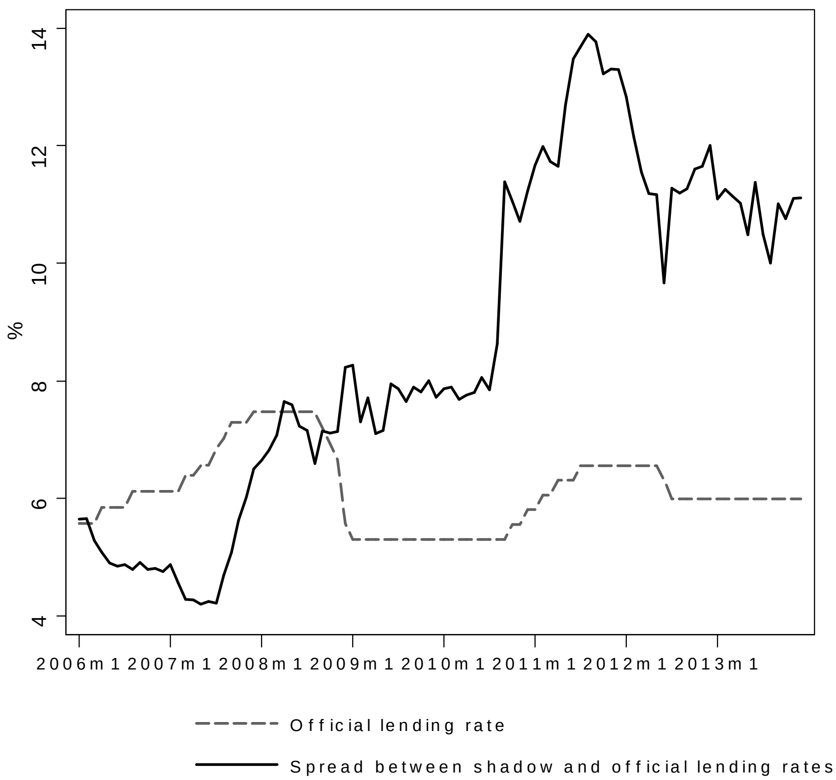


Figure A3: **Official and Shadow Lending Rates**.

This figure compares the official lending rate for 12-month loans and the spead between the average shadow lending rate and the official lending rate.



B Additional tables

Table A4: **Summary Statistics**

	Mean	Median	Std. Dev.	P25	P75	Min	Max	N. Obs
				Firm-level variables				
I	8.63	1.77	19.87	0.10	9.53	-1.86	74.68	1,150,340
REV	0.47	0.14	1.16	0.09	0.64	0..00	4.33	1,150,340
LCF	0.14	0.07	0.21	0.02	0.18	0.00	0.81	1,150,340
AGE	9.1	8	4.99	5	12	1	20	1,150,340
$Assets$	144,916	28,488	674,096	11,369	83,282	0	1.4e+08	1,150,340
$Z-score$	6.81	5.57	5.73	3.35	8.89	0	23	1,078,981
				City-year variables				
LGD	8.12	3.56	14.38	1.28	7.67	0	147.81	2,093
BL	92.40	79.31	52.10	55.36	112.98	7.53	381.31	2,093
GB	-8.30	-6.85	6.07	-11.89	-3.59	-22.00	5.00	2,089
GR	13.02	13.24	3.36	11.19	15.10	5.00	24.00	2,064
$GDP\ PC$	3.8	2.6	4.3	1.6	4.4	0.5	51.0	2,080
GDP	1,653	926	2,247	529	1766	85	21,602	2,093
POP	4.498	3,775	3,249	2,427	8,061	154	33,829	2,080
$LP1$	617.7	438.8	562.1	274.4	746.3	50	3300	2,063
$LP2$	777.3	539.6	775.6	353.0	881.6	75	4899.9	2,063
TOP	0.38	0	0.80	0	1	0	6	2,063
TR	7.53	5.71	9.24	3.16	9.63	1.16	181.8	2,063
EXT	7.00	6.97	0.57	6.61	7.38	5.65	9.08	2,090

LGD, BL, BB, GR are percent of GDP; $GDP\ PC$, GDP and POP are in thousands units.

Table A5: **Data Description and Sources**

Variable	**Description and Sources**
I	Fixed investment over beginning of the year total assets. Fixed investment is computed as total fixed assets at historical price in year t minus total fixed assets at historical price in year $t-1$. Data are from ASIF and ATS.
REV	Change in operating revenues over total assets at the beginning of the period. Data are from ASIF and ATS.
CF	Cash flow over total assets at the beginning of the period. Cash flow is computed as profits minus taxes plus depreciation. Data are from ASIF and ATS.
Age	Firm Age. Data are from ASIF and ATS.
Assets	Firm total assets. Data are from ASIF and ATS.
Z-score	Firm distance to default computed as: $Z = 3.25 + 6.56X_1 + 3.26X_2 + 6.72X_3 + 1.05X_4$, where $X_1 = \frac{(Current\ Assets - Current\ Liabilities)}{Total\ Assets}$; $X_2 = \frac{Retained\ Earnings}{Total\ Assets}$; $X_3 = \frac{EBIDTA}{Total\ Assets}$; and $X_4 = \frac{Book\ Value\ of\ Equity}{Total\ Liabilities}$. Data are from ASIF and ATS.
Private	Dummy variable that takes a value of 1 if the firm belongs to the private sector and is not foreign-owend. Firms in which the public sector or foreigners own less than 30 percent of total shares are classified as private.
State	Dummy variable that takes a value of 1 if the firm is government owned. Firms in which the public sector owns more than 30 percent of total shares and foreigners own less than 30 percent of total shares are classified as state-owned.
Foreign	Dummy variable that takes a value of 1 if the firm is foreign-owned. Firms in which foreigners own more than 30 percent of total shares are classified as foreign-owned.
LGD	City-level local government debt over city-level GDP. The construction of the local government debt variable is described in Section 2.
BL	City-level bank loans over city-level GDP. Both variables are from the from the *China City Statistical Yearbook*.
GDP PC	City-level GDP per capita. Source: *China City Statistical Yearbook*.
GR	City-level GDP growth. Source: *China City Statistical Yearbook*.
GB	City-level budget balance over GDP. Source: *China City Statistical Yearbook*.
LP1	City-level land prices computed as average of auction prices and administered prices fixed by the local government. Source: *Chinese Yearbook of Land and Resources*, published annually by the Ministry of Land and Resources.
LP2	City-level land prices computed as average of auction prices. Source: *Chinese Yearbook of Land and Resources*, published annually by the Ministry of Land and Resources.
TR	City-level measure of transfers computed by adding up national general transfers and special purpose transfers. Sources: *Fiscal Statistics for Prefectures, Municipalities and Counties* and *Statistical Yearbook of China*.
TOP	City-level measure of links to national policymakers. TOP is the number of members of the Central Committee of the Chinese Communist Party born in a given city who are at the ministerial level or above. The total does not include the military and members who work in local governments. We complement data originally collected by Zhou (2014) and based on *Chinese Bureaucracies and Leaders Database*, *Chinese Government Public Information Online* with the *Chinese Political Elites Database* constructed and maintained by the National Chengchi University.
EXT	City-level external shock computed as $EXT_{c,t} = \sum_j \frac{I_{j,c,t-1}}{\sum_j I_{j,c,t-1}} \sum_{v \neq c} I_{j,v,t}$. Source: own elaboration based on ASIF and ATS data.
EXP	Industry-level exposure to government expenditure computed by matching firms in seven sectors (electricity production and distribution; heat production and distribution; gas distribution; water distribution and sewage treatment; construction; environmental management; and public facilities management) with the input-output table constructed by China's National Statistics Bureau.
EF	Industry-level index of external finance requirements computed as the industry median of the ratio between capital expenditures minus cash flow from operations and capital expenditures for all firms based in Beijing, Shanghai, Hangzhou, and Wenzhou. Source: own elaboration based on ASIF and ATS data.

Table A6: **Firm-Level Regressions: Without Lagged Investment**

This table reports the results of a set of regressions where the dependent variable is the firm-level investment ratio (computed as investment over total assets at the beginning of the period), and the explanatory variables are revenue growth over total assets (REV_{t-1}), lagged cash flow (CF_{t-1}), and the interaction between CF_{t-1} and each of the following variables: local government debt over GDP (LGD) and bank loans over GDP(BL). The first includes uses all manufacturing firms, column 2 only private sector domestically owned manufacturing firms, column 3 only state-owned manufacturing firms, and column 4 only foreign-owned manufacturing firms. The regressions cover 261 cities for the period 2006-2013.

	(1)	(2)	(3)	(4)
REV_{t-1}	3.901***	3.936***	2.634***	2.910***
	(0.032)	(0.035)	(0.179)	(0.233)
CF_{t-1}	-9.433***	-9.196***	-17.35***	-20.72***
	(0.378)	(0.416)	(1.981)	(2.762)
$CF_{t-1} \times LGD$	0.106***	0.116***	-0.045	-0.077
	(0.014)	(0.016)	(0.071)	(0.060)
$CF_{t-1} \times BL$	-0.004	-0.008*	-0.014	0.069***
	(0.004)	(0.004)	(0.021)	(0.020)
N. Obs	1,161,298	985,432	62,386	33,888
N. Firms	392,157	357,642	32,403	16,005
N. Cities	261	261	261	261
Firm FE	YES	YES	YES	YES
City-Year FE	YES	YES	YES	YES
Sample	All	Private	State	Foreign

Robust s.e. clustered at the firm level in parenthesis
*** p<0.01, ** p<0.05, * p<0.1

Table A7: **Firm-Level Regressions: Post 2007**

This table reports the results of a set of regressions where the dependent variable is the firm-level investment ratio (computed as investment over total assets at the beginning of the period), and the explanatory variables are lagged investment (I_{t-1}), revenue growth over total assets (REV_{t-1}), lagged cash flow (CF_{t-1}), and the interaction between CF_{t-1} and each of the following variables: local government debt over GDP (LGD) and bank loans over GDP (BL). The regressions cover 261 cities for the period 2008-2013.

	(1)	(2)	(3)	(4)
I_{t-1}	-0.312***	-0.319***	-0.496***	-0.380***
	(0.002)	(0.002)	(0.013)	(0.015)
REV_{t-1}	4.409***	4.395***	2.753***	2.531***
	(0.0434)	(0.0465)	(0.260)	(0.289)
CF_{t-1}	11.18***	11.61***	10.73***	-2.722
	(0.499)	(0.544)	(2.815)	(3.267)
$CF_{t-1} \times LGD$	0.164***	0.167***	0.123	-0.115**
	(0.016)	(0.018)	(0.092)	(0.057)
$CF_{t-1} \times BL$	-0.074***	-0.074***	-0.114***	0.020
	(0.004)	(0.005)	(0.026)	(0.022)
N. Obs.	742,976	647,711	25,998	23,922
N. Firms	349,597	317,265	16,427	13,404
N. Cities	261	261	261	261
Firm FE	YES	YES	YES	YES
City-Year FE	YES	YES	YES	YES
Sample	All	Private	State	Foreign

Robust s.e. clustered at the firm level in parenthesis
*** p<0.01, ** p<0.05, * p<0.1

Table A8: **Firm-Level Regressions: Only Data from ASIF**

This table estimates the models of Table 9 restricting the sample to the observations available in the ASIF survey.

	(1)	(2)	(3)	(4)
I_{t-1}	-0.207***	-0.218***	-0.293***	-0.206***
	(0.003)	(0.003)	(0.013)	(0.015)
REV	0.973***	1.052***	0.497**	1.178***
	(0.040)	(0.0458)	(0.231)	(0.272)
CF_{t-1}	9.719***	9.894***	7.180***	3.539
	(0.406)	(0.476)	(1.981)	(2.211)
$CF_{t-1} \times LGD$	0.440***	0.469***	0.149	-0.0565
	(0.034)	(0.040)	(0.145)	(0.142)
$CF_{t-1} \times BL$	-0.263***	-0.275***	-0.222***	-0.0952***
	(0.007)	(0.009)	(0.036)	(0.032)
N. Obs.	572,075	455,958	36,619	20,055
N. Firms	274,190	231,252	20,561	10,791
N. Cities	261	261	261	238
Firm FE	YES	YES	YES	YES
City-Year FE	YES	YES	YES	YES
Sample	All	Private	State	Foreign

Robust s.e. clustered at the firm level in parenthesis
*** p<0.01, ** p<0.05, * p<0.1