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Abstract

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Local Crowding Out in China

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Forthcoming in the Journal of Finance

ABSTRACT

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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. Building on a novel, purpose-built, public debt database for prefecture-level Chinese cities from 2006 to 2013, we show that the increase in local public debt crowded out private investment in the corresponding cities by inducing banks to tighten credit supply to local firms, leading to a reallocation of capital from private firms to the local public sector. We also show that the credit crunch spared state-owned enterprises. As private firms are the most dynamic component of the Chinese economy, such a reallocation of credit is likely to exacerbate the detrimental growth effects of crowding-out, with public debt issuance not only curtailing firm investment, but also hindering its efficient allocation.

The Chinese credit market provides an ideal setting to test this local crowding-out hypothesis, because of its geographical segmentation. In an integrated nation-wide 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, besides possibly raising 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. But if the credit market is geographically segmented, the imbalance and its impact on investment are localized. In China, debt issuance by local governments ends up being absorbed by local banks and, owing to interest rate ceilings, does not trigger a rise in local interest rates and thus a response of local saving.

Not all borrowers should be affected equally, however. If banks maximize profits, they will tighten credit more to riskier borrowers, such as those with less collateral to pledge and higher monitoring costs. If instead banks allocate credit preferentially to politically connected clients, such as state-owned firms, then firms with no political ins will be rationed more strictly. And these two criteria may well coincide, as state-owned firms are often assisted by implicit or explicit government guarantees.

We bring a varied set of complementary firm-level evidence to bear on this local crowding-out hypothesis. We start by showing that the investment of private manufacturing firms is negatively correlated with local government debt, while this is not the case for state-owned manufacturers. Next, we use different approaches to assess whether this relationship is causal and to identify the mechanism through which local government debt affects investment. Each of these approaches exploits a source of within-city firm heterogeneity, which allows us to control for city-year level correlation between investment and public debt, and thus to address concerns about spurious correlation and reverse causality between these variables.

First, we exploit variation in the location of firms within their respective cities: firms close to neighboring cities and to banks located there should be able to access credit outside their local market, and therefore be less exposed to the crowding out due to debt issuance in their own city. Indeed, we find that the investment of these firms drops less in response to government debt issuance in their city. Interestingly, what appears to matter is the firms' distance from the closest banks in nearby cities, rather than its distance from the neighboring city border. This suggests that crowding out refers specifically to financing, rather than more generally to firms' access to other inputs available in nearby cities. As these regressions include city-year fixed effects, they rule out the most obvious problems from omitted variables and reverse causality between city-level investment and public debt issuance.

Second, we exploit firm-level variation in their funding needs, due to technological differences between industries: specifically, we test whether local government debt affects more the investment of firms whose technology requires more external funding. This approach, akin to that of Rajan and Zingales (1998), allows us to investigate whether government debt affects investment by tightening credit constraints. It also mitigates endogeneity problems by permitting the inclusion of city-year, industry-year, and industry-city fixed effects. We find that local government debt is associated with lower investment by more financially dependent private firms but not by state-owned ones.

Third, we test whether local government debt affects the sensitivity of firms' investment to internally generated funds, taken to be a gauge of the severity of firms' financing constraints. This methodology requires no assumptions about the external financing requirements of firms in different industries. We find that local government debt increases the sensitivity of investment to internally generated funds for private firms but not for state-owned ones, and for small firms but not large ones. To overcome the weaknesses of exogenous sample separation rules based on firm characteristics, we also rely on a switching regression model with endogenous sample separation, where firms' investment sensitivities are estimated jointly with their likelihood of being credit-constrained. Consistently with the previous estimates, local government debt affects cash-flow investment sensitivity for credit-constrained firms but for not unconstrained ones, with credit constraints being significantly more likely to bind for private than for state-owned firms, and for small than for large firms.

This paper is related to the vast 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)), establishing the causal nexus has been more difficult, as international comparisons are plagued by problems of reverse causality, omitted variables, and limited degrees of freedom.[1] As noted above, the geographical segmentation and interest rate ceilings of China's credit market enable us to identify a local crowding-out channel whereby government debt reduces investment by tightening the financing constraints on private firms. As such, our work also relates to the corporate finance literature on investment and credit constraints.

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 et al. (2014), Ouyang and Peng (2015), and Wen and Wu (2019), 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 et al. (2019)).[2] 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 investment of private firms but

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

[2]Papers on capital misallocation in China include Bai, Hsieh, and Qian (2006), Chang et al. (2019), 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 (2015), the role of government credit (Ru (2018)), bank competition (Gao et al. (2019)), and the side effects of financial interventions (Brunnermeier, Sockin, and Xiong (2017)).

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.

Finally, our paper adds to existing knowledge about local government debt in China. Previous studies either estimate total local government debt with no geographical breakdown (Zhang and Barnett (2014) and National Audit Office (2013)), or only focus on bond issuances, which account for a small part of total borrowing by local government financing vehicles (Liang et al. (2017)). 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 studies of China's local government debt are Gao, Ru, and Tang (2018), who document that distressed local governments prefer to default on commercial bank loans rather than on politically-sensitive policy bank loans, and Bai, Hsieh, and Song (2016), whose estimate of local government debt aims mostly at measuring national aggregate figures rather than city-level ones.

The paper is organized as follows. Section I sets out our data. Section II describes the drivers of geographical segmentation in the Chinese credit market. Section III shows that investment by private-sector manufacturing firms is negatively correlated with local government debt. We then document that local public debt issuance affects investment differentially depending on firms' within-city location (Section IV) and external funding needs (Section V), and raises investment cash-flow sensitivity for credit-constrained firms (Sections VI and VII). Section VIII concludes.

I. Data

A key element of our study is the purpose-built data set of Chinese local government debt. Our data are at the level of 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.[3] While we build debt data for all 293 prefecture-level cities from 2006 to 2013, 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 176,000 to 29.7 million, and 196 of our sample cities (75% of the sample) have at least 1.5 million inhabitants, with a median population of 3.7 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 for 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.[4] Dividing 60.7 trillion by 1.1 yields 55.2 trillion, which suggests that the

[3]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 (shiqu in Chinese).

[4]For an article in the Financial Times documenting this discrepancy, see:

cities in our sample produce about 93% of China's GDP.

A. 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 governments issue debt. Municipalities cannot borrow from banks or issue bonds directly, but 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 (Clarke (2016)).[5] 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 (Bai and Zhou (2018)). 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 consists mostly of bank loans, as shown by the top left panel of 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

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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.s html

[5]Bai, Hsieh, and Song (2016) provide a description of the activities of two LFGVs.

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. The Online Appendix describes our methodology in detail. [6]

When aggregated to the national level, our data for local government debt can be compared with the official data provided by the National Audit Office (*NAO*) and China International Capital Corporation Limited (*CICC*), available in 2009-13. As shown by the top-right panel of Figure 1, our estimates are slightly lower than the official figures (consistently with them being a lower bound), but match the trend in the official data, and in 2012 and 2013 are within 5% of the official figures. Our data also match closely the geographic distribution of local public debt at the province level, as shown by the two bottom panels of Figure 1: when the cities for

[6] Bai, Hsieh, and Song (2016) estimate local government debt starting from bond-issuing LGFVs, though mostly to estimate national aggregate figures. Both their and our estimates are based on the Wind database, but we complement it by manually collecting balance sheet data for the LGFVs that are absent in the Wind database but present in the list of the China Banking Regulatory Commission (*CBRC*). This data collection strategy allows us to decompose LGFV debt into different categories (short and long-term, account payable, bank loans and bond issuances), identify the rare cases in which the central government issued special bonds for the local government, and avoid double-counting in aggregating data at the city level (as we exclude issues of LGFVs belonging to a holding group). Another difference between the two data sets is that Bai, Hsieh, and Song (2016) use a statistical procedure to infer the debt of hidden LGFVs (i.e., LGFVs that never issued bonds), so as to estimate time series of total debt at the national level, including off-balance sheet hidden debt. In contrast, we choose to be conservative and only count debt observed in LGFVs' balance sheets, as our research question and estimation strategy is based on the cross-sectional distribution of local government debt.

which we have data on local government debt are aggregated into the 30 Chinese provinces, their province-level total debt is closely correlated with province-level official data from the *NAO* surveys in 2012 and 2013.[7]

[Figure 1 about here]

The top panels of Figure 1 show that local government 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)). Also competition between local governors may have contributed to this rise in local government debt: as local officials are promoted via a tournament, they have the incentive to deliver the highest local growth rate, and thus to increase local public debt, as shown by Xiong (2018). Between 2006 and 2010, outstanding local government debt jumped six-fold, from 1.2 trillion to 7.2 trillion yuan (Table I); 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.[8]

[7]In the bottom panels of Figure 1 most provinces are below the 45 degrees line, confirming that our measure is a lower bound. Beijing, Tianjin, Jiangsu and Zhejiang are exceptions. Beijing and Tianjin, which are both cities and provinces, are two of the four Chinese municipalities under the direct control of the central government: in their case, our overestimate compared to the *NAO* data may result from us assigning to them some issuance that in reality is central government debt. For Jiangsu and Zhejiang, our estimates are only slightly higher than those of the *NAO*, as the difference ranges from 5% to 15%. Our results are robust to dropping the observations for these cities.

[8]Figure IA.1 in the online appendix illustrates how the geography of China's local debt-to-GDP ratio changed between 2006 and 2012.

[Table I about here]

B. Other City-level and Firm-level Data

Beside data on local public debt, our empirical analysis relies on other city-level and firm-level data, drawn from a variety of sources (listed in Table II). City-level data such as GDP, total bank loans, population and economic growth, come from the China City Statistical Yearbook. Upon merging these with our data for city-level public debt, we obtain a data set covering 261 cities from 2006 to 2013.

[Table II about here]

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). This survey reports firms' location, ownership structure, and balance-sheet variables, and 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 thresholds listed above to file detailed annual reports to their local statistics bureaus. The data are 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, and services. By exploiting the overlap in coverage between the two databases, we retrieve data for a large number of firms; however, our sample from 2010 to 2012 still remains considerably smaller, on average, than from 2006 to 2009 or in 2013 (61,000 against 387,000 firms per year).

Dropping observations for 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 1,161,180 observations on more than 300,000 firms. 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.

II. Geographical Segmentation

The geographical segmentation of China's credit market is an important element of our empirical strategy. China's 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

[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.

more than 2000 rural banks or credit cooperatives. Policy banks hold some 10% of total Chinese banking assets, large commercial banks about 40%, joint-stock commercial banks 19%, and local banks (city-level and rural banks and credit co-operatives) 30%. Foreign banks control the remaining 1%.[10]

Geographical segmentation arises from two characteristics of the Chinese 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. Although reforms between 2006 and 2009 allowed them to operate across provincial boundaries, only very few inter-province licenses were actually approved: the city commercial banks that were authorized typically have branches only in a few of the 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% of total bank assets, often conduct business on a local basis. Anecdotal evidence suggests that, until recently, the local branches of large banks had substantial decision-making power and autonomy with respect to headquarters (Dobson and Kayshap, 2006), and their decision-making process was greatly affected by the pressure to lend to local governments and local state-owned enterprises. According to Roach (2006), local Communist Party officials, through their influence on bank branches, often had a bigger say in investment project approval than the credit officers at the head offices of the major banks in Beijing. Furthermore, local authorities are crucial to bank managers'

[10]For details on the Chinese banking and capital markets see, among others, Hachem and Song (2016), Hachem and Song (2017), Allen, Qian, and Qian (2005), Allen et al. (2012), Bailey, Huang, and Yang (2011), and Berger, Hasan, and Zhou (2009).

career advancement, and may thus influence lending decisions.[11]

The geographical segmentation of the Chinese financial system is witnessed by limited capital mobility across regions (Boyreau-Debray and Wei (2005)), and systematic dispersion in returns to capital across Chinese regions and cities (Dollar and Wei (2007)). Although this dispersion decreased between 1988 and 2006 (Brandt, Tombe, and Zhu (2013)), it rose again in 2009. Indeed, in 2013 (the last year of our sample) the dispersion in the return to capital across Chinese cities was as high as in 2003, as shown by the top panel of Figure 2.[12] The internal capital market of large banks appears unable to even out differences in the demand for credit across cities: Agarwal et al. (2018), who study the consumer credit granted by the branches of a large national bank, find that individual branches cannot tap the bank's internal capital market to expand credit, and need to curtail lending to non-connected individuals when they lend more to government bureaucrats. Typically, branch managers are assigned monthly and quarterly lending quotas (cao et al. (2018)), so that managers who fulfill their quota by lending to local government financing vehicles are unlikely to make the effort required to screen private firms.

[Figure 2 about here]

[11]Yeung (2009) documents that branch managers give priority to state-owned enterprises and to the government, and quotes a branch manager stating: "I shall lend to an SOE first should there be two equally good applications for loans, one from the SOE and the other from a non-SOE" (p. 294). Ho, Li, Tian and Zhu (2017) report the following remark by a Chinese bank manager: "we have to manage the relationships with these government departments very carefully and skillfully. Otherwise, it will ruin our career" (p.10).

[12]The increase in financial segmentation in 2009 was partly an unintended consequence of the pro-competitive bank reform of April 2009, as suggested by Gao et al. (2019): big banks entering new cities had limited knowledge of local conditions and hence only lent to state-owned firms. However, higher local debt may also have played a role.

A natural question is why the interbank market does not contribute to fill local funding gaps. One reason is that regulation prevents Chinese banks from lending more than 75% of their deposits (Chen, Ren, and Zha (2013), Hachem and Song (2016), and Hachem and Song (2017)). This limits the scope for fund reallocation by banks, especially by small and medium-size ones for which the constraint is typically binding (Hachem and Song (2016)). Second, the repo market is dominated by the largest Chinese banks, which use their market power to limit competition from smaller banks (Hachem and Song (2017)). Limited access to the interbank market leads many banks to seek funding with off-balance-sheet wealth management products whose funding costs typically exceed the interbank market rate (Acharia et al. (2019)). Finally, the People's Bank of China and the China Banking Regulatory Commission set absolute caps on individual banks' lending volumes, which constrain the lending capacity of most banks even further (Elliott, Kroeber, and Qiao (2015)). For banks that face such constraints, underwriting additional local public debt requires a tightening of credit to the local private sector.

China's credit market also features 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% of GDP) in 2008 to 11 trillion (27%) in 2010 (Elliott, Kroeber, and Qiao (2015)), partly as a result of the 2009 stimulus package itself (Chen, He, and Liu (2017)). The doubling in size of this sector coincided with the jump in the spread between the shadow lending rate and the official lending rate following the post-crisis fiscal stimulus. While 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: informal lending accounts for 17% of the total, and entrusted loans (i.e., loans made by a non-financial corporation to another via a bank as servicing agent) constitute almost a third. However, the growth of shadow banking hardly reduced credit market segmentation, as its transactions typically have limited geographical scope, and entrusted loans between firms in the same city carry a significantly lower interest rate (by more than 1 percentage point) than transactions between firms in different cities, other things equal (Allen et al. (2019)).

Beside institutional constraints, credit market segmentation may also stem from asymmetric information between lenders and borrowers located in different jurisdictions and from the fact that the enforcement of credit contracts may be more difficult when the lender and the borrower are located in different jurisdictions: indeed Firth, Rui, and Wu (2011) and Lu, Pan, and Zhang (2015) provide evidence of judicial bias across Chinese regions. From the borrowers' viewpoint, this form of segmentation is functionally equivalent to that arising from regulatory frictions.[13]

A way to test for the presence of this additional cause of segmentation in the Chinese debt market is to ask whether even for local government bonds, which are traded in a centralized nationwide market, issuers located in some locations pay a price penalty that is not accounted by credit risk differentials. To this purpose, we collect the yield at issuance of 9,625 bonds issued by the LGFVs between 2003 and 2014, and regress their yield on the bond maturity, amount issued, credit rating (to control for the issuer's credit risk) and time effects (to control for aggregate shocks). To provide a benchmark, we estimate the same specification for the yields of 3,129 bonds issued in 2005-2015 by U.S. cities and counties, drawn from Thomson Reuters. The two regressions have the same explanatory power for the panel of Chinese and U.S. yields, the R^2 being 0.57 for both. We then recover the residuals of these two models and regress them on a set of city-year fixed effects: the adjusted R^2 of this second regression is 0.10 for China and very close to zero for the US.

[13]We would like to thank an anonymous associate editor for making this point.

Hence, city-level characteristics have some residual explanatory power for Chinese local debt yields, even after controlling for bond characteristics, risk and aggregate shocks, while this is not the case for US local public debt yields.

Moreover, if the residuals from the regressions for Chinese local debt yields are regressed on city fixed effects, the coefficients of these fixed effects turn out to be negatively and significantly related to the depth of the respective credit markets, measured by the total loan-GDP ratio in the corresponding city and year, as illustrated by the binned scatterplot in the bottom panel of Figure 2. Hence, in cities with less developed credit markets local governments pay higher yields, irrespective of their credit risk. This is another indication that return differentials are not fully arbitraged across cities. If such differential funding costs exist in a centralized bond market, a fortiori equally creditworthy firms located in different cities can be expected to face a different cost of credit.

III. Investment and Local Public Debt

We start the empirical analysis with evidence on the correlation between city-level investment by manufacturing firms and local government debt. In subsequent sections we pin causality and transmission channels down more firmly, but these regressions already provide preliminary evidence consistent with the hypothesis of local crowding-out. We start by estimating 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.[14] 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 of the city's manufacturing firms), and then separately for private-sector and state-owned manufacturing firms. We also estimate (1) separately for small and large firms.

Column 1 of Table III presents the results of specification (1) including only city and year fixed effects. The correlation between total manufacturing investment and local government debt is negative and statistically significant. The point estimate indicates that a 1-standard-deviation increase in the debt-to-GDP ratio (14 percentage points) is associated with a 1.1 percentage-point decrease in the investment ratio (whose sample average is 7%). Column 2 shows that the results are unchanged controlling for other time-varying city characteristics. Among these, only GDP growth, GDP per capita, and population size are significantly correlated with firm investment.

[Table III about here]

Columns 3 reproduces the specification of column 2 for the aggregate investment ratios of private-sector manufacturing firms only: focusing on private investment leads to a slight increase (in absolute value) of the coefficient of local government debt. When the same specifications are estimated for investment by state-owned manufacturing firms (column 4), the coefficient of local government debt is much lower and not statistically significant.

In the last two columns of Table III, the regression is re-estimated separately for large firms (column 5) and small ones (column 6), respectively defined as those in

[14] Results are robust to scaling investment by fixed assets.

the top and bottom quartile of the firm distribution by asset size.[15] The correlation between local government debt and investment is much smaller and only marginally significant for large firms, while for small ones it is nearly three times as large as for the full sample and more precisely estimated. These correlations are consistent with the idea that local government debt crowds out firm investment, and that such crowding out affects firms that are more likely to be credit constrained, such as private small firms, and not state-owned firms that enjoy preferential treatment by banks and large firms that may be politically connected or have easier access to credit in other cities.

Assuming that these correlations indeed reflect crowding out of private investment by local government debt, it is worth checking whether local government debt is also associated with lower efficiency of capital allocation, as one would expect if private firms are more efficient than state-owned ones (Hsieh and Klenow (2009), Song, Storesletten, and Zilibotti (2011), and Hsieh and Song (2015). To this purpose, we proxy the marginal product of capital by its average product, following Hsieh and Song (2015). If capital markets are segmented and local government debt crowds out more efficient firms, the productivity of capital in private firms should be positively correlated with local government debt, as greater public debt issuance should constrain private investment more severely.[16] This is exactly what we find in Table IV: the correlation of capital productivity with local government debt is positive for all firms (columns 1 and 2) as well as for private sector firms only (columns 3 and 4), while it is not statistically significant for state-owned firms (columns 5

[15] We do not include firms in the 25th to 75th percentile range to minimize the likelihood that firms endogenously transition from being large to small, and viceversa.

[16] We thank an anonymous referee for suggesting this test.

and 6).[17] This finding is consistent with the idea that local crowding-out is at work only for private sector firms, since state-owned enterprises have preferential access to bank credit, as argued in Section II.

[Table IV about here]

To better control for firm heterogeneity across and within cities, we turn to firm-level data and estimate the following specification:

$$I_{i,c,t} = \beta LGD_{c,t} + X_{i,c,t}\Gamma + \alpha_i + \zeta_c + \tau_t + \varepsilon_{i,c,t}, \tag{2}$$

where $I_{i,c,t}$ is the ratio of investment to assets in firm i, city c and year t, $LGD_{c,t}$ is the ratio of local government debt to local GDP in city c, year t, $X_{i,c,t}$ are a set of firm-level controls, and α_i, ζ_c and τ_t are respectively firm, city and year fixed effects.[18] In estimating Equation (2), we double-cluster the standard errors at the firm and city-year level, the latter being the source of variation of our main variable of interest.

Column 1 of Table V presents the estimates of specification (2) controlling for the lagged investment ratio, change in revenue and lagged cash flow (both scaled by total assets). The correlation between manufacturing investment and local government debt is again negative and statistically significant. The firm-level point

[17] We compute city-level capital productivity as the average percentage deviation of firm-level capital productivity from the country-wide industry mean, so as to purge the variable from variation arising from city-level industry composition. This variation would not be fully absorbed by city-level effects, if city-level industry composition changes over time. Since computing the average product of capital requires data on value added that is only available in the *ASIF* firm survey, the regressions of Table IV omit 2008-10.

[18] We include both city and firm fixed effects to allow for the possibility of firms that change city. The results are identical if we only include firm fixed effects.

estimate is smaller than that obtained with city-level data: a 1-standard-deviation increase in the debt-to-GDP ratio is associated with a 0.8 percentage-point decrease in the investment ratio. Column 2 shows that the results are unchanged including a dummy variable that controls for state-owned firms. Since the specification includes firm fixed effects, this dummy captures the effect of firms that change ownership status – the negative point estimate suggesting that privatization is associated with higher investment.

[Table V about here]

The specification of column 3 includes also the interaction between the debt-to-GDP ratio and the state ownership dummy, so that β measures the correlation between local government debt and private firms' investment, the coefficient of the interacted variable captures the differential effect of debt between private and state-owned firms, and the sum of the two coefficients measures the correlation between local government debt and state-owned firms' investment. The coefficient of the interacted variable is positive, statistically significant and approximately half as large as β in absolute value. The sum of the two coefficients is not statistically significant, indicating that the correlation is significant only for private firms.

The last column of Table V reports the results of a specification in which city and year fixed effects are replaced by city-year fixed effects. This model absorbs the coefficient estimate of local government debt, but still yields an estimate of how local government debt correlates with the differential investment of private and state-owned firms, while controlling for any time-varying city-level variable. The estimates of this specification corroborates the previous result that the correlation between investment and local government debt is significantly lower for state-owned firms than for private ones.

We subject these correlations to a battery of robustness checks, reported in the Online Appendix. The baseline results of Table V survive when the model is estimated with the standard difference and system GMM estimators, which are consistent also when the explanatory variables include both fixed effects and the lagged dependent variable. The results are also robust to the inclusion of additional time-varying city-level variables (size of the banking sector, GDP per capita, and GDP growth) and additional firm-level variables (firm size, leverage, average product of capital, export status, and firm age), as well as to replacing the debt-to-GDP ratio with the change in debt over GDP, and total local public debt with its bank-funded component only. Interestingly, in regressions where local public debt does not include bonds, its coefficient is larger in absolute value than in those where it is measured as total debt (-0.62 instead -0.56), consistently with the idea that the bond market is less segmented than bank credit.[19]

Two further pieces of evidence about firm leverage buttress the idea that the negative correlation between private investment and local government debt documented so far is driven by binding financing constraints in geographically segmented credit markets. First, not only private investment, but also firm leverage is negatively correlated with local government debt. The first three columns of Table VI show that such negative correlation exists for the leverage of private manufacturing firms only, while it is absent for state-owned firms. Second, firm leverage is negatively correlated with total bank lending to LGFVs divided by total bank lending to corporations (which includes lending to LGFVs). Also in this case the correlation is statistically significant only for private sector firms, as shown by the regressions reported in columns 4-7 of Table VI.[20]

[19]The results are reported in Tables IA.V-IA.IX of the Online Appendix.

[20]We thank Chong-en Bai and Jun Qian for help in accessing data on the composition of bank lending at city level.

[Table VI about here]

These results are consistent with the idea that banks have less funds to be lent to private firms when they lend more to local LGFVs. In principle, the result could also be driven by local governments implementing countercyclical policies and thus borrowing more when private firms deleverage, but it is worth noting that, besides controlling for year and city fixed effects, our specifications also control for city-level GDP growth, total bank loans, and a host of other variables that capture local economic conditions. Moreover, if high government debt were driven by low private-sector demand for credit, one should observe firm leverage to be positively correlated with city-level return to capital, while the last two columns of Table VI show no statistically significant correlation between these two variables.[21]

While the results reported in this section accord with the thesis that local government debt crowds out private investment, these are simple correlations, likely to suffer from endogeneity bias. The direction of the bias is unclear. On the one hand, local politicians may respond to negative shocks to private investment by instructing LGFV managers to borrow and invest more, so that the negative correlation could be due to reverse causality from investment to local public debt.[22]

[21]Consistently with these results on firm-level leverage, the city-level share of corporate bank lending to private firms is negatively correlated with local government debt, controlling for other factors and city and year fixed effects; in contrast, the share of bank lending to non-LGFV state-owned enterprises is uncorrelated with local government debt (see Table IA.X in the Online Appendix). This is also consistent with the fact that, at city-level bank, bank credit growth to private corporations is negatively correlated with bank credit growth to LGFVs, controlling for city fixed effects and for total bank credit growth (see Figure IA.2 in the Online Appendix).

[22]While column 4 of Table V controls for all possible city-year shocks, it does not fully address the endogeneity problem because cities that implement a countercyclical policy may also require state-owned firms to invest more.

On the other hand, common shocks – such as spending on public infrastructure, which increases both private firms' profitability and public debt issuance – could be driving both variables, biasing the estimates in the opposite direction.

To see this, suppose that the equation capturing the effect of local government debt (D) on investment (I) is $I = \alpha + \beta D + \varepsilon$, but public debt reacts to investment according to the equation $D = a + bI + e$. In estimating the parameter β, two endogeneity problems arise: first, it may be that $b \neq 0$ (for instance, $b < 0$ due to countercyclical local fiscal policy), second, there may be positive correlation $\rho_{\varepsilon e}$ between ε and e (growth and local public debt being positively correlated in our data).[23] The bias of the OLS estimator of β is:

$$E(\widehat{\beta}) - \beta = \frac{1 - b\beta}{\sigma_D^2} \left(b\sigma_\varepsilon^2 + \rho_{\varepsilon e} \right). \tag{3}$$

Under the natural assumption $b\beta < 1$,[24] the direction of the bias depends on the relative importance of reverse causality ($b < 0$) and common unobservable shocks ($\rho_{\varepsilon e} > 0$).

In the two following sections, we use three strategies to address this endogeneity problem. In Section IV, we exploit information about the precise geographical location of each firm within its city to build firm-specific measures of access to the credit market of the closest city, and thus a gauge of its ability to escape crowding-out due to its own city's public debt issuance. In Sections V, VI and VII, we probe

[23] If we assume that D is positively correlated with investment by LGFVs, the positive correlation between ε and e could be driven by common shocks to private and public investment. In other words, we could have $\varepsilon = \zeta + \epsilon$ and $e = \zeta + u$, with $E(\epsilon u) = 0$.

[24] This assumption obviously holds if β and b differ in sign. If instead they have the same sign, the assumption $b\beta < 1$ is necessary for the level of I and D solving these two equations to be positive.

further whether the channel through which public debt affects private investment is a tightening of credit constraints on private firms. Specifically, in Section V, we test whether higher government debt tighten credit constraints for private firms more dependent on external funding and show that this channel is not at work for state-owned firms; in Sections VI and VII, we show that higher government debt tighten credit to firms that are more likely to face financing constraints.[25]

IV. Local Crowding Out and Firm Location

So far, we assumed that, conditional on their ownership and size, all firms located in the same city are equally affected by local government borrowing. However, firms that are closer to the city border may find it easier to tap the capital market of a neighboring city, and thus escape any credit shortage due to government borrowing in their own city. Hence, they should be less affected by local crowding-out.

Exploiting this within-city source of firm-level heterogeneity has two related advantages over the approach used in the previous section. First, it allows the estimates to be based on the *differential* response to public debt issuance by otherwise identical firms differently located within the same city, rather than on the city-level relationship between investment and local debt issuance: as such, it does not depend on whether at the city level causality goes from local debt issuance to investment or in the opposite direction. Second, by the same token, this strategy enables us to saturate our specification with city-time effects, and thus purge the estimates from the effect of any macroeconomic city-year level variable, including

[25] In a previous version of the paper, we also experimented with an instrumental variable estimation of the specifications reported in this section (Huang, Pagano, and Panizza (2016)). While the IV results corroborate the OLS estimates in this section, we dropped this exercise for brevity.

those that may induce spurious correlation between investment and local public debt issuance.

To implement this strategy, we use the address of each firm in our sample to measure its location within the relevant city and build a dummy variable (BD_i) that equals 1 for firms that are within 20 kilometers from the city border.[26] This border proximity variable is intended to measure the firm's potential access to funding outside the city borders. However, this measure is inappropriate if no banks are located next to border in the neighboring city: then, firms located in high-debt cities cannot borrow elsewhere, even if they are close to the border. To address this issue, we measure the average distance of each firm from the 10 closest bank branches located in another city, and create another dummy equal to 1 if this distance is less than 20 kilometers (BK_i).[27]

These two proximity variables enable us to test whether firms closer to banks in a neighboring city or to the border are less likely to be crowded out by local debt issuance. Specifically, we estimate a model where the investment of firm i depends on the interaction of BK_i and BD_i with the government debt-to-GDP ratio of firm

[26] To illustrate how we compute a firm's distance from the border, assume that city C has borders with cities A, B and D, and that in city C there are 10 firms; for each of these firms we check the distance from the border of each neighboring city (in this example, each firm will have 3 distances, one from the border with A, one from the border with B, and one from the border with D) and then assign to this firm the minimum value among the distances with all neighboring cities. Ideally, we would like to measure the distances in terms of driving times or road length, but our data do not allow to do this computation. Therefore, we proxy driving time with the shortest line between the firm location and the closest city border. As we are not able to recover the location for all firms in our sample, in this exercise we lose about 240,000 observations.

[27] We restrict the analysis to branches within 100 kilometers from the firm. If there are no bank branches in neighboring cities within 100 kilometers, we set the value of distance at 100. This is similar to the approach used by Hau et al. (2019).

i's city:

$$I_{i,c,t} = (\delta_1 BK_i + \delta_2 BD_i) \times LGD_{c,t} + X_{i,c,t}\Gamma + \alpha_i + \theta_{c,t} + \varepsilon_{i,c,t}, \qquad (4)$$

where the coefficients δ_1 and δ_2 capture the extent to which proximity to nearby-city banks and proximity to the city border mitigate the crowding-out effect of local public debt, while $\theta_{c,t}$, are city-year fixed effects, and other variables are defined as in Equation (2). The inclusion of city-year fixed effects absorbs the main effect of local public debt, but controls for all possible city-year shocks and thus rules out the most obvious sources of reverse causality or omitted variable bias.

Column 1 of Table VII shows that the point estimates of δ_1 and δ_2 are positive. This finding suggests that, controlling for all possible city-year shocks, the negative correlation between local government debt and investment is smaller (in absolute value) for firms which are closer to nearby-city banks and closer to the border. Of the two coefficients, only δ_1 is statistically significant at the 10% confidence level. The low precision of the estimates is likely to arise from the high correlation (0.7) between BD and BK: in fact, an F-test shows that δ_1 and δ_2 are jointly statistically significant with a p-value of 0.02. If BK_i and BD_i are included in separate regressions, they are both statistically significant with p-values of 0.013 and 0.017, respectively (columns 2 and 3 of Table VII).[28]

[Table VII about here]

[28]To appreciate how much the nearby-city-bank attenuates the crowding-out effect of local government debt, we estimate a simpler specification in which city-year fixed effects are replaced with city and year fixed effects and include LGD among the regressors. The estimated coefficient of LGD is approximately -0.06 (close to the estimate in the regressions of Table V) and that of δ_1 is about 0.03: hence the correlation between local government debt and investment for firms close to the border is about half as large as for other firms.

The fact that, when both interacted variables are included, the firm's proximity to nearby-city banks appears to dominate the proximity to the city border itself suggests that crowding out refers specifically to financing, rather than more generally to firms' access to other inputs available in nearby cities, such as land, workers or construction materials.[29] Hence, in subsequent specifications of Table VII, we rely on distance from banks located in other cities rather than from the border (all the results are robust to using distance from the border and to alternative thresholds for defining firms close to the border; see Table IA.XI in the online appendix).

Column 4 of Table VII reproduces the results of column 2 by measuring proximity with a continuous variable (PX_i) defined as 100 Km. minus the average distance of firm i from the closest 10 banks located in another city. This finding confirms that our results do not depend on the particular choice of the threshold distance to measure proximity.

A possible concern is that the investment of firms that are more peripheral in their city may respond less to their own city's growth and to the depth of the local financial market than more centrally located firms in the same city: insofar as these variables are correlated with local government debt issuance, this could bias the estimate of the proximity coefficient δ. To address this concern, we expand the specification of column 2 by adding the interaction of the proximity dummy BK_i with city-level growth (GR) and the ratio of local bank lending to GDP (BL): the coefficients of these interacted variables are not statistically significant, while the estimate of the interaction of the proximity dummy with LGD remains positive and significant (column 5), and in fact becomes larger than in the baseline estimate

[29] If we split the sample between private and state-owned firms, we find that δ is only statistically significant for private firms. This finding is in line with the hypothesis that state-owned firms are less likely to be credit constrained than private firms.

of column 2.

Finally, one should consider that the investment of firms close to banks in neighboring cities may be affected by the issuance of government debt in these cities. To control for this possibility, we construct a variable measuring the local government debt of the city where the 10 banks closest to firm i are located ($NLGD_{i,t}$, where the initial N is a mnemonic for "neighbor"), and expand the specification of column 2 by including the interaction between proximity variables and government debt in the neighboring city. We expect this variable to carry a negative coefficient, capturing crowding out of firm i's investment also in the credit market of the neighboring city. The specification also includes neighboring-city-year effects, to control for all time-varying shocks in neighboring cities (including the main effect of $NLGD_{i,t}$). The resulting estimates (column 6) show that the proximity coefficient δ remains positive and significant, and actually becomes larger than in the previous specifications. Moreover, the coefficient of the interaction between the proximity variables and neighboring-city public debt issuance is negative, though not significantly different from zero, in line with the idea that neighboring cities' debt issuance tends to crowd out the investment of firms close to other cities' banks. The results are also robust to including the interaction of the proximity dummy BK_i with GDP growth (NGR) and local bank lending (NBL) of the closest city (column 7).

Note that the regressions of Table VII focus on investment. However, if the mechanism goes through financing, being close to the border should also mitigate the negative correlation between local government debt and leverage documented in Table VI. Table IA.XII in the online appendix shows that this is the case for private sector firms, but not for state-owned firms.[30]

[30] We would like to thank an anonymous referee for suggesting this test.

V. Crowding Out and Industry Financial Needs

As explained in the introduction, given the institutional features of China's financial market, in cities that issue more public debt banks can be expected to allocate more funds to the public sector, and tighten credit to private firms, while state-owned firms are spared the crunch. One way of testing whether the data are consistent with this thesis is to determine whether government debt reduces investment more in industries that for technological reasons need more external funds – an approach akin to that used by Rajan and Zingales (1998) to test the effect of financial development on investment. Hence we aggregate our data at the industry-city-level and estimate the following equation:

$$I_{j,c,t} = \beta I_{j,c,t-1} + \delta \left(EF_j \times LGD_{c,t} \right) + \alpha_{jt} + \theta_{ct} + \eta_{cj} + \varepsilon_{j,c,t}, \tag{5}$$

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 fund dependence of industry j, $LGD_{c,t}$ is local government debt scaled by GDP in city c and year t, and α_{jt}, $\theta_{c,t}$, and η_{cj} are industry-year, city-year, and city-industry fixed effects, respectively.

The parameter δ measures the incremental impact of local government debt on the investment of industries that depend more heavily on external finance. Due to the inclusion of industry-year, city-year, and city-industry fixed effects, Equation (5) controls for any industry- or city-level time-varying factor, and therefore does not suffer from any obvious reverse causality from city-level investment to local public debt issuance. The estimate of δ could be biased only if Equation (5) omitted some source of credit constraints that is itself correlated with local government debt. We address this potential problem by expanding the specification so as to control for the interaction of EF_j and a set of city-level time-varying variables potentially correlated with both local government debt and credit constraints.

The index of external financial dependence devised by Rajan and Zingales (1998) is the industry median ratio of capital expenditures minus operating cash flow, scaled by 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, owing 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.

There are two issues with using the original Rajan-Zingales index in our sample. First, in some cases we are not able to match the Chinese three-digits industry code of our survey with the original Rajan and Zingales ISIC code. Second, the technological parameters of Chinese firms are likely to be different from those of large US firms. To deal with these issues, we use the methodology used by Rajan and Zingales for US firms to construct an industry-level measure of external financial dependence for Chinese firms based on data from the four cities with the most developed financial markets: Beijing, Shanghai, Hangzhou, and Wenzhou.[31] Then we use this measure to estimate equation (5) for the remaining 257 cities in our sample. However, we also test the robustness of our results to using the original Rajan and Zingales index.

The baseline estimates, shown in column 1 of the top panel of Table VIII, indi-

[31] Among the large Chinese cities, these are the cities with the highest ratios of bank loans to GDP. As this index of external finance is based on our institutional knowledge to choose the cities for which we compute the index, we also experiment with an alternative strategy. Specifically, we first estimate the correlation between local government debt and corporate investment in each city, and then recompute the index of external financial dependence based on data for the three largest cities where the correlation is estimated to be positive and statistically significant. Our results are robust to the use of this alternative measure of external financial dependence.

cate that the coefficient δ of the interaction between external financial dependence and local government debt is negative and statistically significant: local crowding-out is particularly severe for firms that belong to industries that need more external financial resources. Column 2 uses the original Rajan-Zingales index. Even though this implies losing many observations because not all the Chinese industries can be matched with the Rajan-Zingales index, we still find a negative and statistically significant coefficient.

[Table VIII about here]

Next, we explore heterogeneity by estimating separate regressions for the industry-level investment of private and of state-owned manufacturing firms (columns 3 and 4, respectively). The interaction between local government debt and external financial dependence turns out to be statistically significant only for private sector firms, and four time as large in absolute value than for state-owned ones. This finding corroborates our previous result that crowding out is not at work for state-owned firms.

Firms may differ in their exposure to projects funded by local government financing vehicles: when local governments undertake large infrastructure projects, suppliers to these projects are likely to need less external funding, as they may discount invoices or borrow directly from the LGFVs that funds the projects. To test for this possibility, we build an industry-specific index of exposure to government spending and estimate separate regressions for total manufacturing investment of firms in sectors with high and low exposure to government spending, respectively.[32]

[32] High- and low-exposure firms are respectively defined as those belonging to industries with above- and below-median values of the exposure index. Since most LGFVs manage public infrastructure projects, the sectors taken to be *directly* affected by LGFV-funded public spending are (i) electricity production and distribution; (ii) heat production and distribution; (iii) gas

The estimates in columns 5 and 6 of Table VIII are consistent with the hypothesis that local government debt is less important for firms that operate in industries with high exposure to government spending, the coefficient of the interaction between local government debt and the index of external financial needs being not statistically significant.

The bottom panel of Table VIII shows that all the results described above 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 may be jointly correlated with local government debt and credit constraints.[33]

To illustrate the economic significance of the estimated parameter δ, we use the point estimates of column 3 (bottom panel) in Table VIII to evaluate the effect of local public debt for the industries at the 25^{th} and 75^{th} percentile of the distribution of the index of external financial dependence (the paper and batteries production industries, respectively).[34] The left panel of Figure 3 shows the relationship between local government debt and the investment ratio for the industry at the 25^{th}

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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 (using the input-output table for 2007). Finally, we match these exposure indexes with the manufacturing firms in our survey.

[33] Table IA.XIII in the Online Appendix shows that he results are robust to estimating the model using firm-level data instead of industry-level aggregates. In those regressions we also use firm size and age as proxy for financial constraints (see Hadlock and Pierce (2010)). We would like to thank an anonymous referee for suggesting this exercise.

[34] Industries with indexes of external financial dependence close to paper include cigarette manufacturing and glass manufacturing. Industries with indexes of external financial dependence close to batteries include transmission, distribution and control equipment and communication equipment.

percentile of the distribution of the external financial dependence 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 dependence is not significantly different from the average (and rises slightly as in this industry the index of external financial dependence is negative). The right panel of Figure 3 shows the relationship between debt and the investment ratio in the industry at the 75^{th} percentile of the distribution of the external financial dependence index, comparing it with the average investment ratio for this industry (the horizontal line drawn at 10.5%). As local government debt rises, in this financially dependent industry the investment ratio decreases rapidly: it becomes significantly lower than its 10.5% industry average once local public debt exceeds 15% of GDP, and drops to about 9% when local public debt climbs to 50%.

[Figure 3 about here]

VI. Cash-flow Sensitivity with Exogenous Sample Split

The Rajan-Zingales approach enables us to point to credit rationing as the economic channel through which local crowding-out operates, but is based on strong assumptions about the 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. However, manufacturers in the same industry may well adapt their 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.[35]

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 of private firms. Fazzari, Hubbard, and Petersen (1988) were the first to exploit the idea that investment sensitivity to internally generated funds should be greater for credit-constrained firms.[36] Love (2003) extended this approach to an international data set and showed that financial market depth is associated with lower sensitivity of investment to internal funds. Applying a variant of this approach to our sample of 261 Chinese cities, we demonstrate that local government debt tightens the financing constraints on private-sector manufacturing firms, and also confirm Love (2003)'s finding that financial depth reduces the cash-flow sensitivity of investment.

The sensitivity of investment to cash flow has been criticized as a measure of financing constraints (Kaplan and Zingales (2000)), as cash flow may proxy for investment opportunities and the sensitivity could be driven by influential outliers or by firm distress.[37] We address this criticism in two ways. The first is to split the sample in groups of constrained and unconstrained firms using an exogenous sample

[35]Moreover, the Rajan-Zingales methodology measures only the differential impact of government debt on firms that belong to industries characterized by different degrees of dependence, not the total effect of local government debt on investment.

[36]They proxied credit constraints by average dividend payout. Bond and Meghir (1994) used the same proxy of credit constraints, while others applied a similar methodology using other measures of financing constraints (Hoshi, Kashyap, and Scharfstein (1991), Whited (1992), and Gertler and Gilchrist (1993)).

[37]Fazzari, Hubbard, and Petersen (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.

separation rule. In the Chinese case, it is natural to base such a sample split on private vs. state ownership, since state-owned firms enjoy preferential treatment by banks and thus are less likely to be credit-constrained. Hence, investment should be more sensitive to cash flow in private firms than in state-owned ones, and such sensitivity should be greater the larger is the debt-GDP ratio in the city where the firm is located. We also explore differences between large and small firms.

Second, we endogenize the sample separation rule by estimating a switching regression model of investment in which the probability of a firm's facing financing constraints is estimated jointly with firms' cash-flow investment sensitivity, along the lines of Hu and Schiantarelli (1998) and Almeida and Campello (2007). This approach does not hinge on a predetermined sample separation between constrained and unconstrained firms.

A. Baseline Regressions

Many studies model the impact of financing constraints on investment in the context of an Euler equation, i.e., the optimality condition for a firm that maximizes the present value of dividends subject to adjustment costs and external financial constraints.[38] In particular, Love (2003) shows that linearizing the Euler equation yields a specification in which the investment-asset ratio depends on its lagged value, sales, cash flow, the interaction between cash flow and a measure of credit availability (i.e., an inverse measure of financing constraints), and a set of fixed effects.[39] We use a similar model, but with city-level government debt as a measure

[38]See, for instance, Whited (1992), Hubbard and Kashyap (1992) and Gilchrist and Himmelberg (1995). The alternative approach by Hayashi (1982), based on the Q-theory of investment, requires share prices, and therefore is unsuited to our sample, which is mostly composed of unlisted firms.

[39]The model in Love (2003) does not allow for borrowing, and the external financial constraint consists in the condition that the firm cannot pay negative dividends. Allowing for borrowing

of financing constraints:

$$I_{i,c,t} = \beta I_{i,c,t-1} + \delta REV_{i,c,t-1} + (\gamma_1 + \gamma_2 LGD_{c,t})\, CF_{i,c,t-1} + \alpha_i + \theta_{ct} + \varepsilon_{i,c,t}, \qquad (6)$$

where $I_{i,c,t}$, $REV_{i,c,t}$ and $CF_{i,c,t}$ are fixed capital investment, change in revenue and cash flow of firm i in city c and year t (all scaled by beginning-of-year total assets), and $LGD_{i,c}$ 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 time-variant macroeconomic variables. Hence, as in the regressions based on differential within-city location of firms reported in Section IV, also in these regressions identification rests on a within-city-year source of firm-level heterogeneity, and filters out macroeconomic city-level shocks that may induce spurious correlation between investment and local public debt.

In the presence of 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 γ_2, instead, is consistent with government debt crowding out private investment via tighter financing constraints. This is the main hypothesis to be tested here.

Even though Equation (6) exploits only within-firm and within-city-year variation in investment, cash flow, and in the interaction between local public debt and cash flow, there could be an omitted variable bias if the equation failed to control for sources of credit constraints correlated with local government debt. For instance, weak firms could become more credit constrained during recessions, exactly when

complicates the model but does not alter the first-order conditions for investment.

local government increases borrowing for countercyclical purposes. If this were the case, our results would pick up this weakening effect and not the tightening of credit constraints brought about by higher government debt. To control for this possibility, we control for the interaction between cash flow and a host of variables that capture local economic conditions (local GDP growth, local budget balance, local bank loans, GDP per capita, and land prices) and show that our baseline results are robust to augmenting the model with all these confounding variables.

When equation (6) is estimated on the full sample, the coefficient of γ_1 is positive and significant (column 1 in Table IX). 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, although it may also result from cash flow capturing investment opportunities not captured by other control variables (Kaplan and Zingales (2000)).[40] More important for our purposes, the estimate γ_2 is positive and statistically significant: this result is consistent with the hypothesis that local government debt crowds out investment via tighter financial constraints, and 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 4 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 public debt crowds out private investment by tightening local credit

[40] 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.

availability, this effect should be weaker for safer borrowers. As small firms are typically riskier than large ones, and so are private firms compared to state-owned ones (that benefit from public guarantees), we split the sample along the size and ownership dimension, and test whether γ_2 is larger for private and small firms than for state-owned and large ones: we expect to find that local government debt tightens credit to the former more than to the latter.

[Table IX about here]

When equation (6) is estimated for the subsample of private firms (column 2 of Table IX), the results are essentially the same as for the whole sample but with tighter confidence intervals (see the middle panel on top of Figure 4). For state-owned firms, the results are dramatically different. State-owned firms are less credit-constrained than the average (γ_1 decreases from 6.7 to 4.3, column 3 of Table IX), 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 (top-right panel of Figure 4). This suggests that at least some of the funds raised by Chinese cities via public debt issuance are actually channeled to local state-owned firms, mitigating or removing the credit constraints that they would otherwise face.

[Figure 4 about here]

We obtain similar results upon splitting the sample between large firms (top quartile of their distribution by assets) and small ones (bottom quartile). The interaction between cash flow and local government debt is negative and not statistically significant for large firms (column 4 of Table IX, and bottom left panel of Figure 4), and positive and statistically significant for small firms (column 5 and bottom-right panel of Figure 4).

[Table X about here]

These specifications may however omit an important variable, namely the interaction between cash flow and total bank loans relative to GDP. Bank loans are likely to belong in equation (6) because they are correlated both with local government debt (as shown by Tables IA.II and IA.III in the Online Appendix) and with credit to the private sector, a variable that other studies have found to relax credit constraints. As bank loans are correlated positively with local government debt and negatively with credit constraints, their exclusion from the model should generate a downward bias in the estimate of γ_2.[41] This is exactly what we find when specification (6) 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 IX to 0.08 in column 1 of Table X): 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, more bank lending also reduces the sensitivity of investment to cash flow, consistent with the thesis that bank loans can proxy for local financial depth and thus relax credit constraints, as found by Love (2003).

[41] Suppose that the true model is

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

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

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

These results are robust to restricting the sample to private firms (column 2 of Table X), while government debt and bank loans have no statistically significant effect on the correlation between cash flow and investment in state-owned firms (column 3). As before, government debt does not appear to tighten the credit constraints faced by large firms (column 4), while it does for small firms (column 5). Finally, the presence of large banks does not appear to mitigate the crowding-out effect of local government debt: the coefficient of the interaction between cash-flow and government debt is slightly smaller in cities where the share of branches of large banks exceeds the sample median, but the difference between the two groups of cities is not statistically significant (column 6). However, in these cities the cash-flow sensitivity of firms. investment is significantly lower, probably a reflection of their greater financial development.

To explore how these results are related to credit market segmentation, we conduct an experiment analogous to that of Table IV. We use city-level returns to capital as a proxy for the geographic heterogeneity in credit frictions and check whether the credit scarcity due local government debt issuance is particularly severe in cities with high return to capital, which presumably feature high barriers to capital flows. Specifically, we interact city-level return to capital data similar to those computed by Bai, Hsieh, and Qian (2006) with firm-level cash flow and local government debt, and then check if government debt triggers a larger increase in the cash-flow sensitivity of investment in cities where the return to capital is higher.[42]

To this purpose, we split the sample into city-years with above- and below-median return to capital, and then estimate Equation (6) separately for the two subsamples. Columns 1 and 2 of Table XI show that γ_2 is positive, large, and

[42]We thank an anonymous referee for suggesting this test, and Chong-En Bai for sharing his data on city-level return to capital.

statistically significant in the subsample with high return to capital, and negative, close to zero and not statistically significant in the low-return subsample. Columns 3 and 4 show that the results are essentially identical if we limit our sample to private sector firms. In column 5, instead of relying on a sample split, we estimate the model with a triple interaction ($CF \times LGD \times RC$, where RC is a city-year continuous measure of return to capital) aimed at testing if the estimated γ_2 is increasing in the return to capital. Indeed the coefficient of this triple interaction is positive and statistically significant, supporting the hypothesis that the credit scarcity due to high government debt issuance is more severe when the return to capital is particularly high, which is also when the efficiency cost of local crowding-out is greatest. The results are unchanged controlling also for the interaction among return to capital, cash flow and local financial depth (column 6).

[Table XI about here]

B. Robustness

We carry out a vast battery of robustness checks to make sure that the results reported so far survive to the inclusion of additional controls, the use of alternative sub-samples, and different estimation techniques. None of the robustness checks alter our main finding, namely that higher local government debt increases the sensitivity of investment to cash flow in private firms. The coefficient of the interaction between local government debt and cash flow is always positive, statistically significant and almost equal to that in our baseline estimates.

We start by showing that our results are robust to augmenting our model with the interaction between local government debt and each of city-level budget balance, GDP per capita, GDP growth, and land price (Table IA.XIV in the online appendix). Next, we test for the possibility that firms exposed to government projects may have easier access to credit. While we find that private firms more exposed to LGFV-funded projects are less credit-constrained than less exposed firms, all our baseline results are robust to controlling for exposure to LGFV-funded projects (Table IA.XV in the online appendix).

In an additional battery of robustness tests we find that our results become stronger if we focus on highly leveraged firms and that they are robust to: estimating our baseline models with a standard system GMM estimator; dropping the lagged dependent variable; dropping firms located in the provinces for which our debt measure exceeds the official debt as published by the *NAO* (namely Beijing, Tianjin, and fourteen other cities located in Jiangsu and Zhejiang provinces); restricting the sample to 212 medium-sized cities (population of 1-10 million); restricting our estimates to post-2007 period, when local government borrowing began to soar; and only using data drawn from the Annual Survey of Industrial Firms.[43]

VII. Cash Flow Sensitivity with Endogenous Sample Split

In the regressions presented so far, a firm's financing status – credit-constrained or not – is identified by exogenously splitting the sample. There are two problems with this approach (Hu and Schiantarelli (1998)): first, it does not jointly control for all the factors that affect the substitution of external funds with internal ones by firms; second, it does not allow for firms switching from being credit-constrained to unconstrained or viceversa.

We address these issues by estimating an endogenous switching regression model with unknown sample separation. As in Hu and Schiantarelli (1998) and Almeida

[43]See Tables IA.XVII-IA.XXII of the Online Appendix.

and Campello (2007), at each point in time a firm is assumed to operate in one of two regimes: credit-constrained, where investment is 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 frictions it faces at a given time.

Formally, we jointly estimate the following three equations:

$$W^*_{i,c,t} = M_{i,c.t}\psi + u_{i,c,t}, \tag{7}$$

$$I_{1,i,c,t} = X_{i,c,t}\alpha_1 + \epsilon_{1,i,c,t}, \tag{8}$$

$$I_{2,i,c,t} = X_{i,c,t}\alpha_2 + \epsilon_{2,i,c,t}, \tag{9}$$

where W^* is a latent variable capturing the probability that firm i in period t is in one of the two regimes and equation (7) is the selection equation that estimates the likelihood that the firm is in the unconstrained regime 1 ($I_{i,c,t} = I_{1,i,c,t}$ if $W^*_{i,c,t} < 0$) or in the constrained 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 thus 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.[44]

[44] Almeida and Campello (2007) also consider dividend payments, bond ratings, short-term and long-term debt, and financial slack. Unfortunately, our dataset does not contain these variables. In building the Z-score we use emerging market-specific weights as suggested by Altman (2005). 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 $X_4 = \frac{Book\ Value\ of\ Equity}{Total\ Liabilities}$. In the literature there is an lively debate as to which are the true determi-

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 (8) and (9) are the investment equations, respectively for unconstrained and for constrained firms. Their specification is the same as in the baseline model of Equation (6), but allows for different coefficients in the two financing regimes.[45] The regimes are not observable but are determined endogenously by the system of equations (7)-(9).

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

Column 1 of Table XII 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 unconstrained is increasing in firm age, size, distance to default, and asset tangibility; and it is lower for private-sector firms and in city-years with high local government debt.

[Table XII about here]

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

nants of financial constraints (Farre-Mensa and Ljungqvist (2016)).

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

are mostly state-owned and so enjoy more generous funding from local governments. For credit-constrained firms, instead (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.

Column 2 of Table XII reports the results for a model that includes city-year fixed effects, which absorb the variation in local government debt in the regime selection equation. The probability of being unconstrained is again estimated to be lower for private-sector firms and increasing 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, column 3 shows the estimates of a specification that includes city-year effects and industry-year effects, which absorb the effect of asset tangibility (defined at the industry-level). The results are almost identical to those of column 2.

VIII. Conclusions

China reacted to the global financial crisis with a massive fiscal stimulus package, mainly funded by the issuance of local government debt and mostly focused on public 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 (2019)). This surge in investment was achieved by injecting enormous financial resources into state-owned firms: the leverage of state-owned manufacturing firms rose from 57.5% in 2008Q1 (pre-crisis) to 61.5% in the first quarter of 2010, while for private-sector manufacturing firms it slipped from 59% to 57% (Wen and Wu (2019)).

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. Our estimates suggest, however, that the massive increase in local government debt had an adverse impact on investment by private manufacturing firms. As these are much more productive than their state-owned counterparts (Song, Storesletten, and Zilibotti (2011)), this reallocation of investment from the private to the public sector could 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 forcefully demonstrated (see Acharya, Drechsler, and Schnabl (2014), Acharya and Steffen (2015), and Altavilla, Pagano, and Simonelli (2017), among others).

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Table I

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 % 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	5.7	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	15.8	293	248
2010	24.7	80.5	0.0	789	7,249	17.4	293	281
2011	28.5	93.7	0.0	951	8,336	16.8	293	291
2012	35.6	113.0	0.0	1,145	10,425	18.8	293	292
2013	42.9	132.1	0.0	1,303	12,556	20.1	293	291

Table II

Data Description and Sources

Variable	Description and Sources
Age	Firm Age. Source: *ASIF* and *ATS*.
Assets	Firm total assets. $SIZE$ is the log of total assets. Source: *ASIF* and *ATS*.
BD	dummy variable that equals 1 for firms within the 25th percentile of firms closer to the city border, and 0 otherwise. In robustness checks, it equals 1 for firms at the 50th percentile of the distribution or within 20Km from the border, and 0 otherwise. Source: Own calculations using *ASIF* and GIS data
BK	Dummy variable that equals 1 if the average distance between the firm and the 10 closest bank branches in another city is less than 20 KMs, and 0 otherwise. PX is a continuous measure of proximity to banks based in another city defined as 100 minus the average distance of the closest 10 banks located in another city. Source: Own calculations using *ASIF* and GIS data
BL	City-level bank loans scaled by city-level GDP. NBL measures bank-loans over GDP in neighboring cities. Source: *China City Statistical Yearbook*.
CF	Cash flow (profits minus taxes plus depreciation) scaled by beginning-of year total assets. Source: *ASIF* and *ATS*.
EF	Industry-level index of external finance requirements computed as the industry median ratio of capital expenditures minus cash flow from operations to capital expenditures for all firms based in Beijing, Shanghai, Hangzhou, and Wenzhou. Source: own elaboration based on *ASIF* and *ATS* data.
GB	City-level budget balance over GDP. Source: *China City Statistical Yearbook*.
GDP PC	City-level GDP per capita. Source for GDP and population: *China City Statistical Yearbook*.
GR	City-level GDP growth. NBL measures GDP growth in neighboring cities. Source: *China City Statistical Yearbook*.
I	Fixed investment scaled by beginning-of-year total assets. Fixed investment is computed as the first difference of total fixed assets at historical price. Source: *ASIF* and *ATS*.
LB	Dummy variable that equals 1 if in the relevant city the share of the branches of the largest 4 Chinese banks in the total number of city branches exceeds the sample median, and 0 otherwise.
LEV	Firm-level leverage, computed as total debt over total assets. Source: *ASIF* and *ATS*.
LGD	City-level local government debt scaled by city-level GDP. $NLGD$ measures local government debt-over GDP in neighboring cities. See Section 2 for the construction of local government debt.
LP	City-level land prices computed as the 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.
Private	Dummy variable that equals 1 if the firm belongs to the private sector and is not foreign-owned, and 0 otherwise. Firms in which the public sector or foreigners own less than 30% of total shares are classified as private. Source: *ASIF* and *ATS*.
RC	City-level return to capital.
REV	Change in operating revenues scaled by total assets at the beginning of the period. Source: *ASIF* and *ATS*.
State	Dummy variable that equals 1 if the firm is state-owned, and 0 otherwise. Firms in which the public sector owns more than 30% and foreigners own less than 30% of total shares are classified as state-owned. Source: *ASIF* and *ATS*.
Z-score	Firm distance to default computed as in Altman (2005). Source: *ASIF* and *ATS*.

Table III

Investment and Local Government Debt: City-Level Regressions

This table reports the results of regressions where the dependent variable is the city-level investment ratio of the manufacturing sector (computed as the weighted average of investment scaled by total assets of all manufacturing firms in a given city and year) and the dependent variables are local government debt over GDP (LGD), bank loans scaled by GDP (BL), local government balance scaled by 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). Columns 1 and 2 include all manufacturing firms, column 3 only private sector manufacturing firms, column 4 only state-owned manufacturing firms, columns 5 only large manufacturing firms, and column 6 only small manufacturing firms. Robust s.e. clustered at the firm and city-year level in parenthesis.*** p<0.01, ** p<0.05, * p<0.1.

	(1)	(2)	(3)	(4)	(5)	(6)
LGD	-0.083**	-0.093*	-0.104**	-0.029	-0.081*	-0.229**
	(0.033)	(0.041)	(0.039)	(0.050)	(0.040)	(0.080)
BL		-0.011	-0.002	-0.027	-0.008	-0.028
		(0.022)	(0.025)	(0.016)	(0.021)	(0.074)
GB		0.019	0.028	-0.139	0.055	-0.430
		(0.218)	(0.234)	(0.242)	(0.233)	(0.600)
GR		0.408**	0.332*	0.632***	0.424**	0.084
		(0.146)	(0.143)	(0.163)	(0.140)	(0.310)
$ln(GDP\ PC)$		4.858*	6.761*	-5.851*	2.919	18.121
		(2.542)	(3.228)	(3.060)	(2.153)	(11.760)
$ln(POP)$		7.889**	9.774**	-5.674	5.761*	27.243*
		(3.077)	(3.822)	(3.237)	(2.480)	(13.491)
$ln(LP)$		0.583	0.489	-0.411	0.568	1.624
		(0.561)	(0.564)	(0.992)	(0.603)	(2.406)
N. Obs.	1,862	1,800	1,798	1,514	1,800	1,800
N. Cities	261	261	261	261	261	261
Firms	All	All	Private	State	Large	Small
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
City FE	Yes	Yes	Yes	Yes	Yes	Yes

Table IV

Capital Productivity and Local Government Debt

This table reports the results of regressions where the dependent variable is the city-level capital productivity of the manufacturing sector (computed as the average percentage deviation of firm-level capital productivity from the the industry mean) and the dependent variables are local government debt scaled by GDP (*LGD*), bank loans scaled by GDP (*BL*), local government balance scaled by 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*). Columns 1 and 2 report estimates obtained using the sample of all manufacturing firms; columns 3 and 4 report estimates based on the subsample of private-sector manufacturing firms; columns 5 and 6 report estimates based on the subsample of state-owned manufacturing firms. Robust s.e. clustered at the firm and city-year level in parenthesis.*** p<0.01, ** p<0.05, * p<0.1.

	(1)	(2)	(3)	(4)	(5)	(6)
LGD	0.236***	0.271***	0.251***	0.275***	0.099	0.075
	(0.087)	(0.091)	(0.090)	(0.094)	(0.172)	(0.194)
BL		0.026		0.019		0.178*
		(0.059)		(0.062)		(0.091)
GB		-1.206**		-0.914		-1.923*
		(0.579)		(0.571)		(1.011)
GR		0.209		0.256		-0.096
		(0.319)		(0.331)		(0.855)
ln(GDP PC)		17.891*		14.673		49.286**
		(10.293)		(10.533)		(21.094)
ln(POP)		52.470***		53.205***		64.286**
		(17.591)		(18.136)		(28.770)
ln(LP)		0.352		0.609		-4.573
		(2.124)		(2.187)		(3.961)
N. Obs.	782	739	782	739	782	739
N. Cities	260	257	260	257	260	257
Firms	All	All	Private	Private	State	State
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
City FE	Yes	Yes	Yes	Yes	Yes	Yes

Table V

Investment and Local Government Debt: Firm-Level Regressions

This table reports the results of regressions where the dependent variable is the firm-level investment ratio (computed as investment scaled by total assets at the beginning of the year), and the explanatory variables are the lagged investment ratio (I_{t-1}), change in revenue scaled by total assets (REV_{t-1}), lagged cash flow scaled by total assets (CF_{t-1}), a state ownership dummy ($STATE$), local government debt scaled by city-level GDP (LGD), and the interaction between LGD and $STATE$. The regressions of columns 1, 2 and 3 control for firm, city, and year fixed effects; the regression of column 4 controls for firm and city-year fixed effects. Robust s.e. clustered at the firm and city-year level in parenthesis.*** p<0.01, ** p<0.05, * p<0.1.

	(1)	(2)	(3)	(4)
I_{t-1}	-0.271***	-0.271***	-0.271***	-0.274***
	(0.006)	(0.006)	(0.006)	(0.002)
REV_{t-1}	4.050***	4.050***	4.050***	3.772***
	(0.089)	(0.089)	(0.089)	(0.079)
CF_{t-1}	7.779***	7.780***	7.780***	6.987***
	(0.519)	(0.519)	(0.519)	(0.195)
$STATE$		-0.386**	-0.697***	-0.253
		(0.174)	(0.224)	(0.176)
LGD	-0.055***	-0.055***	-0.056***	
	(0.016)	(0.016)	(0.016)	
$STATE \times LGD$			0.027***	0.013*
			(0.009)	(0.007)
N. Obs.	1,035,427	1,035,427	1,035,427	1,035,400
N. Cities	261	261	261	261
Firm FE	Yes	Yes	Yes	Yes
City FE	Yes	Yes	Yes	No
Year FE	Yes	Yes	Yes	No
City-Year FE	No	No	No	Yes
$LGD + STATE \times LGD$			-0.029	
P value			0.12	

Table VI

Firm Leverage, Local Government Debt, and Share of Local Bank Lending to LGFVs

This table reports the results of a set of regressions where the dependent variable is the firm-level leverage, and the explanatory variables are local government debt scaled by GDP (LGD), local bank lending to local government financing vehicles scaled by total local bank lending to corporates ($LGFV$), total bank loans scaled by GDP (BL), budget balance (GB), log of GDP per capita ($ln(GDP\ PC)$), GDP growth (GR), land price (LP), and firm size ($SIZE$). Columns 1, 4, 7 and 8 show estimates based on the sample of all manufacturing firms; columns 2, and 5 focus on the subsample of private manufacturing firms; and columns 3 and 6 on the subsample of state-owned manufacturing firms. The specifications of columns 7 and 8 also control for city-level return to capital (RC). Robust s.e. clustered at the firm and city-year level in parenthesis *** p<0.01, ** p<0.05, * p<0.1.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
LGD	-0.009**	-0.013***	-0.001					
	(0.004)	(0.004)	(0.015)					
$LGFV$				-0.073***	-0.077***	0.003	-0.066***	
				(0.006)	(0.007)	(0.027)	(0.022)	
BL	0.025***	0.029**	-0.006	0.022***	0.025***	-0.006	0.024***	0.027***
	(0.001)	(0.002)	(0.007)	(0.002)	(0.002)	(0.007)	(0.006)	(0.006)
GB	-0.067***	-0.063***	-0.234***	-0.077***	-0.075***	-0.235***	-0.058	-0.046
	(0.020)	(0.022)	(0.069)	(0.020)	(0.022)	(0.069)	(0.073)	(0.075)
$ln(GDP\ PC)$	-2.610***	-2.776***	-0.278***	-2.671***	-2.789***	-0.277	-4.682***	-4.710***
	(0.214)	(0.238)	(0.821)	(0.214)	(0.238)	(0.821)	(1.050)	(1.053)
GR	0.058	0.065***	-0.121***	0.068***	0.072***	-0.121***	0.102***	0.089**
	(0.011)	(0.013)	(0.044)	(0.011)	(0.013)	(0.044)	(0.036)	(0.038)
LP	0.163***	0.057	0.735***	0.111*	-0.006	0.735***	0.216	0.248
	(0.060)	(0.070)	(0.230)	(0.060)	(0.070)	(0.230)	(0.170)	(0.175)
$SIZE$	-0.454***	-1.245***	-1.677***	-0.446***	-1.228***	-1.677***	-0561*	-0.568*
	(0.050)	(0.057)	(0.264)	(0.050)	(0.057)	(0.264)	(0.335)	(0.336)
RC							0.932	0.619
							(2.389)	(2.455)
N. Obs	751,974	591,084	40,332	751,974	591,084	40,332	591,152	591,152
N. Cities	261	261	261	261	261	261	261	261
Sample	All	Private	State	All	Private	State	All	All
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table VII

Investment, Local Government Debt, and Proximity to Other Cities

This table reports the results of regressions where the dependent variable is the firm-level investment ratio, and the explanatory variables are the lagged investment ratio (I_{t-1}), change in revenue scaled by total assets (REV_{t-1}), lagged cash flow scaled by total assets (CF_{t-1}), a dummy variable equal to 1 only for firms for which the average distance of the ten closest bank branches located in another city is less than 20 KMs (BK), a dummy variable equal to 1 only for firms for which are located less than 20 KM from the city border (BD), the interaction between each of BK and BD and each of local government debt scaled by GDP (LGD), bank loans over GDP (BL), and with GDP growth (GR). In column 4, BK is replaced with a continuous measure of proximity (PX) defined as 100 minus the average distance of the closest 10 banks located in another city. Columns 6 and 7 also control for the interaction between BK and each of government debt ($NLGD$), growth (NGR), and bank loans (NBL) in the city where the neighboring banks are located. Robust s.e. clustered at the firm, city-year, and neighboring city-year (in columns 7 and 8) level in parenthesis *** p<0.01, ** p<0.05, * p<0.1.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
I_{t-1}	-0.258***	-0.258***	-0.258***	-0.258***	-0.259***	-0.263**	-0.263**
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.007)	(0.007)
REV_{t-1}	2.187***	2.187***	2.187***	2.187***	2.186***	2.210***	2.224***
	(0.047)	(0.047)	(0.047)	(0.047)	(0.048)	(0.054)	(0.056)
CF_{t-1}	4.409***	4.408***	4.412***	4.408***	4.437***	4.650***	4.642***
	(0.330)	(0.330)	(0.330)	(0.330)	(0.333)	(0.371)	(0.378)
$LGD \times BK$	0.017*	0.022**			0.028**	0.031**	0.036**
	(0.008)	(0.008)			(0.012)	(0.012)	(0.015)
$LGD \times BD$	0.015		0.023**				
	(0.010)		(0.010)				
$LGD \times PX$				0.004***			
				(0.001)			
$GR \times BK$					0.023		0.087**
					(0.021)		(0.044)
$BL \times BK$					-0.003		-0.007
					(0.003)		(0.004)
$NLGD \times BK$						-0.002	-0.007
						(0.014)	(0.017)
$NGR \times BK$							-0.089*
							(0.047)
$NBL \times BK$							0.006*
							(0.004)
N. Obs.	792,900	792,900	792,900	792,900	769,328	603,127	581,973
N. Cities	251	251	251	251	251	251	251
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
C-Y FE	No	Yes	Yes	Yes	Yes	Yes	Yes
N. C-Y FE	No	No	No	No	No	Yes	Yes

Table VIII

Industry-Level Regressions

This table reports the results of regressions where the dependent variable is the investment ratio (computed as investment over total assets at the beginning of the year) aggregated at the city-industry-year level. The regressions control for the initial investment ratio (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 regression in column 1 reports estimates based on the sample of all manufacturing firms and the EF index computed using Chinese data, column 2 reports estimates based on the same sample and on the original Rajan-Zingales EF index. The regressions shown in the subsequent columns are all based on the EF index computed using Chinese data, but are estimated on different subsamples: private-sector manufacturing firms in column 3, state-owned manufacturing firms in column 4, only firms in industries with below-median exposure to government expenditure in column 5, and only firms in industries with above-median exposure to government expenditure in column 6. Robust s.e. clustered at the city-industry level in parenthesis. *** p<0.01, ** p<0.05, * p<0.1.

	(1)	(2)	(3)	(4)	(5)	(6)
I_{t-1}	-0.216***	-0.168***	-0.213***	-0.394***	-0.232***	-0.221***
	(0.007)	(0.011)	(0.007)	(0.031)	(0.011)	(0.011)
$EF \times LGD$	-0.017***	-0.014**	-0.017**	-0.004	-0.018**	-0.011
	(0.008)	(0.007)	(0.001)	(0.015)	(0.009)	(0.012)
N. Obs	46,379	18,398	44,527	3,655	21,461	17,370
N. Cities	257	257	257	197	256	256
With additional interactions						
I_{t-1}	-0.217***	-0.174***	-0.214***	-0.398***	-0.234***	0.220***
	(0.006)	(0.011)	(0.007)	(0.111)	(0.001)	(0.011)
$EF \times LGD$	-0.021***	-0.017***	-0.021***	-0.007	-0.023***	-0.012
	(0.007)	(0.006)	(0.007)	(0.079)	(0.009)	(0.011)
$EF \times BL$	0.004***	0.017***	0.004***	0.001	0.004	0.006***
	(0.001)	(0.001)	(0.001)	(0.006)	(0.002)	(0.002)
$EF \times ln(GDP\ PC)$	0.4078*	-0.543***	0.352	0.788	0.456	-0.062
	(0.22)	(0.166)	(0.223)	(2.501)	(0.327)	(0.380)
$EF \times GR$	0.025	0.104***	0.030	0.083	0.067*	-0.015
	(0.019)	(0.013)	(0.020)	(0.189)	(0.034)	(0.034)
$EF \times LP$	-0.174	0.408***	-0.175	-0.311	-0.018	-0.213
	(0.112)	(0.106)	(0.121)	(1.353)	(0.180)	(0.187)
N. Obs	45,753	18,138	43,958	3,554	21,161	17,138
N. Cities	257	257	257	197	255	255
City-Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Ind.-Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Ind.-City FE	Yes	Yes	Yes	Yes	Yes	Yes
Sample	All	All	Private	State	Low Exp.	High Exp.

Table IX

Cash-Flow Sensitivity of Investment

This table reports the results of regressions where the dependent variable is the firm-level investment ratio (computed as investment scaled by total assets at the beginning of the year), and the explanatory variables are the lagged investment ratio (I_{t-1}), the change in revenue scaled by total assets (REV_{t-1}), lagged cash flow scaled by total assets (CF_{t-1}), and the interaction between CF_{t-1} and local government debt scaled by GDP (LGDestimates based on the full sample of manufacturing firms, column 2 those based on subsample of private-sector manufacturing firms, column 3 those based on the subsample of state-owned manufacturing firms, column 4 those based on the subsample of large firms (top 25% of the distribution by assets) and column 5 those based on the subsample of small fims (bottom 25% of the distribution by assets). Robust s.e. clustered at the firm level in parenthesis. *** p<0.01, ** p<0.05, * p<0.1.

	(1)	(2)	(3)	(4)	(5)
I_{t-1}	-0.273***	-0.280***	-0.371***	-0.230***	-0.333***
	(0.002)	(0.002)	(0.008)	(0.004)	(0.005)
REV_{t-1}	3.773***	3.799***	2.398***	5.955***	1.954***
	(0.031)	(0.034)	(0.167)	(0.117)	(0.057)
CF_{t-1}	6.725***	7.334***	4.328***	5.815***	4.472***
	(0.231)	(0.256)	(1.190)	(0.660)	(0.539)
$CF_{t-1} \times LGD$	0.028**	0.029**	-0.097	-0.020	0.075*
	(0.011)	(0.013)	(0.055)	(0.026)	(0.030)
N. Obs.	1,035,400	858,624	45,922	110,091	107,694
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	Large	Small

Table X

Cash-Flow Sensitivity of Investment: Controlling for Bank Loans

This table reports the results of regressions where the dependent variable is the firm-level investment ratio (computed as investment over total assets at the beginning of the year), and the explanatory variables are the lagged investment ratio (I_{t-1}), the change in revenue scaled by total assets (REV_{t-1}), lagged cash flow scaled by total assets (CF_{t-1}), and the interaction between CF_{t-1} and each of the following variables: local government debt scaled by GDP (LGD) and bank loans scaled by GDP (BL). Column 1 shows the estimates based on the full sample of manufacturing firms, column 2 those based on subsample of private-sector manufacturing firms, column 3 those based on the subsample of state-owned manufacturing firms, column 4 those based on the subsample of large firms (top 25% of the distribution by assets) and column 5 those based on the subsample of small fims (bottom 25% of the distribution by assets). In the specification shown in column 6 cash flow is interacted with a dummy (LB) that equals 1 if in the relevant city the share of the branches of the largest 4 Chinese banks in the total number of city branches exceeds the sample median, and 0 otherwise. Robust s.e. clustered at the firm level in parenthesis. *** p<0.01, ** p<0.05, * p<0.1.

	(1)	(2)	(3)	(4)	(5)	(6)
I_{t-1}	-0.274***	-0.281***	-0.371***	-0.230***	-0.333***	-0.274***
	(0.002)	(0.002)	(0.008)	(0.004)	(0.005)	(0.002)
REV_{t-1}	3.770***	3.796***	2.393***	5.954***	1.951***	3.774***
	(0.031)	(0.033)	(0.168)	(0.135)	(0.067)	(0.031)
CF_{t-1}	8.343***	9.141***	6.020***	6.367***	7.062***	10.073***
	(0.374)	(0.411)	(1.902)	(1.193)	(1.037)	(0.447)
$CF_{t-1} \times LGD$	0.075***	0.083***	-0.044	-0.016	0.157***	0.073***
	(0.014)	(0.016)	(0.069)	(0.038)	(0.045)	(0.017)
$CF_{t-1} \times BL$	-0.022***	-0.025***	-0.023	-0.007	-0.035***	-0.031**
	(0.004)	(0.004)	(0.019)	(0.011)	(0.011)	(0.004)
$CF_{t-1} \times LGD \times LB$						-0.033
						(0.028)
$CF_{t-1} \times BL \times LB$						0.034***
						(0.007)
$CF_{t-1} \times LB$						-5.258***
						(0.708)
N. Obs.	1,035,400	868,624	45,922	110,091	107,694	1,035,383
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	Private	State	Large	Small	All

Table XI

Cash-Flow Sensitivity of Investment and the Return to Capital

This table reports the results of regressions where the dependent variable is the firm-level investment ratio (computed as investment scaled by total assets at the beginning of the year), and the explanatory variables are the lagged investment ratio (I_{t-1}), change in revenue scaled by total assets (REV_{t-1}), lagged cash flow scaled by total assets (CF_{t-1}), and the interaction between CF_{t-1} and local government debt scaled by GDP (LGD). Columns 1 and 2 report the estimates respectively obtained for the subsamples of manufacturing firms located in cities with above-median and below-median return to capital. Column 3 and 4 show the estimates for the same models of columns 1 and 2 for the subsample of private-sector firms. Column 5 interacts government debt and cash flow with a continuous measure of city-level return to capital (RC), and column 6 also adds interactions with city-level bank loans scaled by GDP (BL). Robust s.e. clustered at the firm level in parenthesis. *** p<0.01, ** p<0.05, * p<0.1.

	(1)	(2)	(3)	(4)	(5)	(6)
I_{t-1}	-0.304***	-0.228***	-0.313***	-0.235***	-0.272***	-0.272***
	(0.002)	(0.004)	(0.003)	(0.004)	(0.002)	(0.002)
REV_{t-1}	3.611***	4.151***	3.655***	4.137***	3.782***	3.782***
	(0.048)	(0.068)	(0.053)	(0.072)	(0.036)	(0.036)
CF_{t-1}	7.597***	6.500***	8.254***	6.851***	6.907***	6.791***
	(0.330)	(0.435)	(0.377)	(0.472)	(0.238)	(0.238)
$CF_{t-1} \times LGD$	0.167***	-0.018	0.162***	-0.019	0.051**	0.048***
	(0.033)	(0.020)	(0.037)	(0.022)	(0.021)	(0.021)
$CF_{t-1} \times RC$					-29.889***	-32.054***
					(3.065)	(3.170)
$CF_{t-1} \times LGD \times RC$					0.898***	0.868***
					(0.228)	(0.228)
$CF_{t-1} \times BL$						3.002***
						(0.6667)
$CF_{t-1} \times BL \times RC$						25.651***
						(8.521)
N. Obs	469,038	219,659	373,025	188,808	764,769	764,769
N. Cities	147	143	147	143	171	171
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
City-Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Sample	High Ret. Cities All Firms	Low Ret. Cities All Firms	High Ret. Cities Private	Low Ret. Cities Private	All Cities All Firms	All Cities All Firms

Table XII

Switching Regression Model

This table reports the switching regression model described in Equations (7)-(9). 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 for private sector firms ($Private$), and time-variant measures of city-level local government debt (LGD). The coefficients (And standard errors) in the selection equation are multiplied by 100 to improve readability. 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 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). Robust s.e. clustered at the firm level in parenthesis. *** p<0.01, ** p<0.05, * p<0.1.

	(1)		(2)		(3)	
A. Selection Equation						
$ln(Age)$	10.770***		7.176***		8.437***	
	(0.077)		(0.072)		(0.066)	
$ln(Assets)$	0.396**		0.685***		1.680***	
	(0.034)		(0.002)		(0.027)	
$Zscore$	0.097***		0.994***		0.918***	
	(0.018)		(0.016)		(0.011)	
$Private$	-8.943***		-5.063***		-4.248***	
	(0.141)		(0.132)		(0.117)	
$Tangible$	8.401***		4.642***			
	(0.280)		(0.261)			
LGD	-0.012*					
	(0.001)					
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}	15.65***	4.158***	2.969***	8.208***	13.931***	7.125***
	(0.030)	(0.183)	(0.240)	(0.187)	(xxx)	(0.028)
$CF_{t-1} \times LGD$	−0.410***	0.142***	-0.056***	0.047***	-0.333***	0.114***
	(0.001)	(0.009)	(0.001)	(0.010)	(0.01)	(0.001)
LGD	-0.013***	-0.041***				
	(0.001)	(0.004)				
N. Obs.	305,603	754,800	2745,048	785,355	231,967	828,436
City FE	Yes		No		No	
Year FE	Yes		No		No	
City-Year FE	No		Yes		Yes	
Ind-Year FE	No		No		Yes	

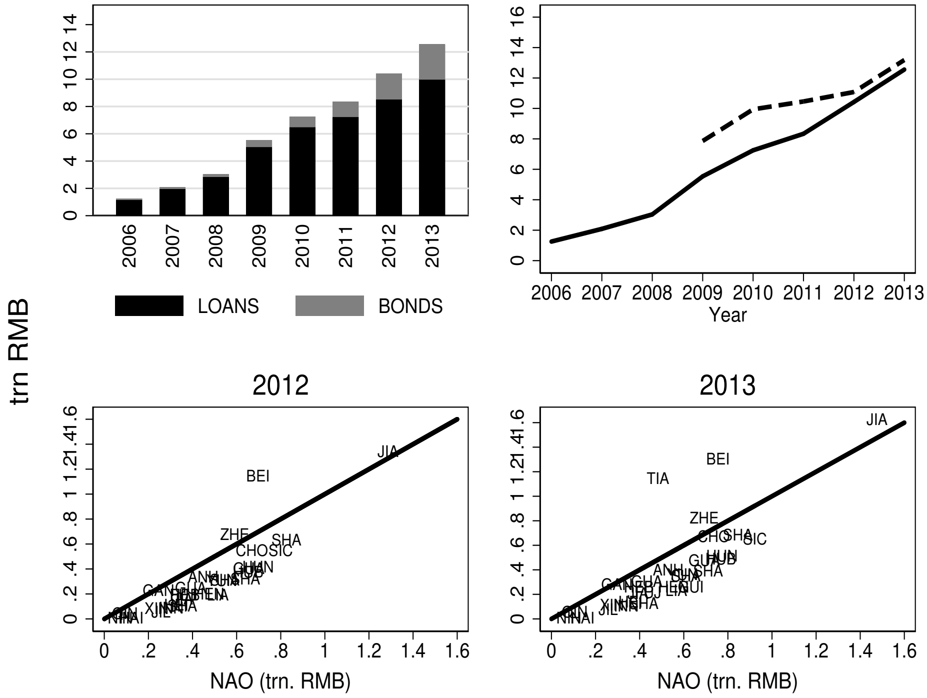

Figure 1. Local Government Debt in China Top-left panel: composition of local government debt. Top-right panel: total local government debt according to our data (solid line) and *NAO* data (dashed line). Bottom panels: our data for province-level local government debt plotted against *NAO* data in 2012 (left) and 2013 (right).

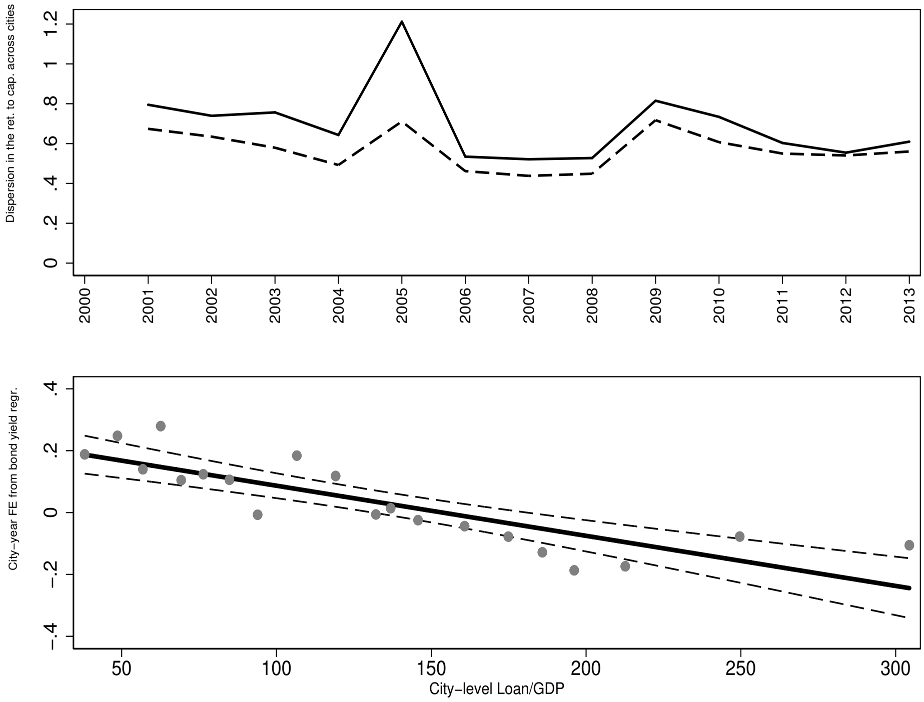

Figure 2. Geographic segmentation of China's credit market Top panel: time series of the between-cities coefficient of variation of the return to capital; the solid line plots the raw data, the dashed line plots the data after a 5% Winsorization of the return to capital. Bottom panel: binned scatterplot of the estimated city-time effects from a regression of the residuals of LGFV bond yield residuals against the loan/GDP ratio of the corresponding cities and years.

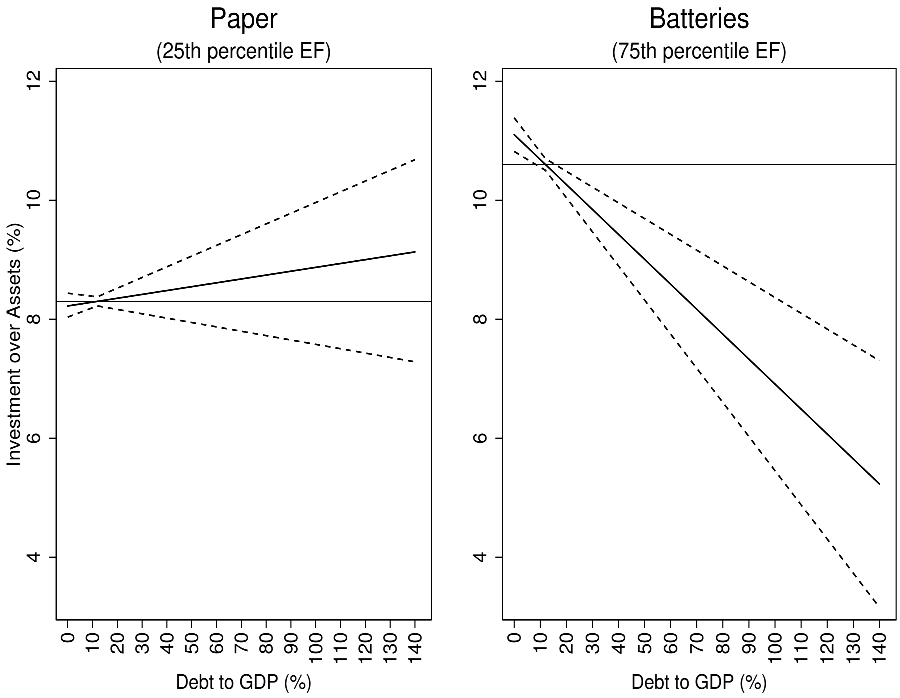

Figure 3. Local Government Debt and Investment Ratios in Different Industries This figure plots how investment ratios vary with the level of government debt for manufacturing firms in the paper industry (25th percentile of the distribution of the index of external financial dependence) and the battery industry (75th percentile of the distribution of the index of external financial dependence). The graphs are based on the the estimations of column 3, Table VIII. 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).

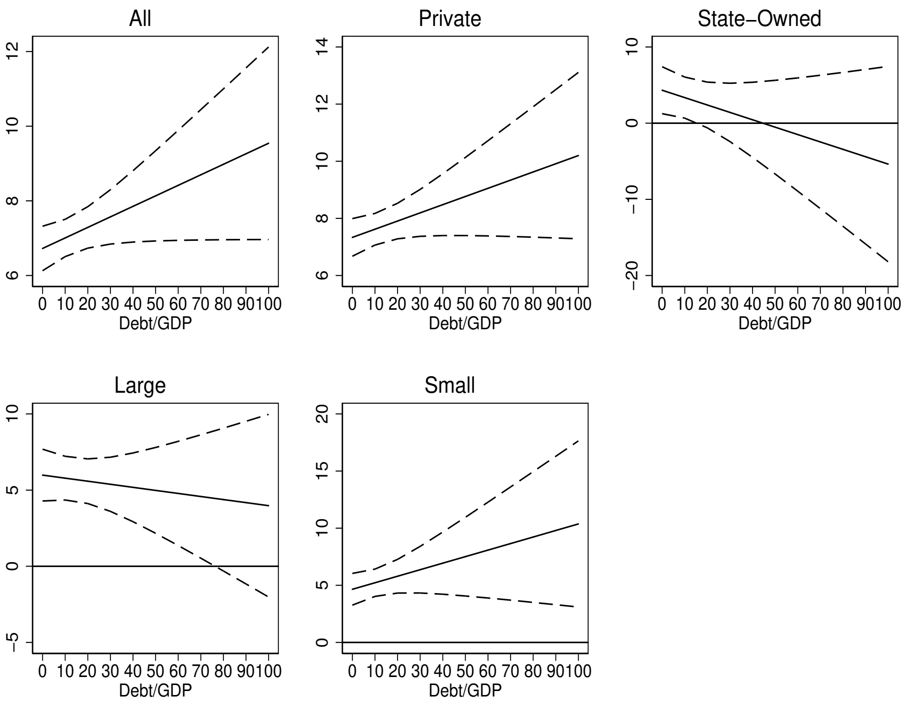

Figure 4. Investment Sensitivity to Cash Flow The figures plot how the sensitivity of investment to cash flow changes with the level of local government debt. These marginal effects are based on the estimates reported in Table IX.

Internet Appendix for:
"Local Crowding Out in China"

YI HUANG, MARCO PAGANO, and UGO PANIZZA[1]

ABSTRACT

This Internet Appendix provides aditional tables and figures supporting the main text.

[1]Citation format: Huang, Yi, Marco Pagano, and Ugo Panizza, Internet Appendix for "Local Crowding Out in China," *Journal of Finance* [DOI String]. Please note: Wiley-Blackwell is not responsible for the content or functionality of any additional information provided by the authors. Any queries (other than missing material) should be directed to the authors of the article.

The first section of this appendix describes the construction of the local public debt data used in the paper, the remaining sections report various robustness checks that corroborate the results reported in the text of the paper.

IA.A. Construction of the Local Public Debt Data

IA.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 necessary balance-sheet data manually. We estimate total debt of each LGFV by adding up its short-term and long-term debt.[2]

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

[2]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.

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 National Audit Office (NAO) breaks local government debt down into three components: (i) direct debt (NAO 1 in Table IA.I); (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 equal to NAO 2 plus this third component).[3] Summing the first two components (NAO 2 in Table IA.I) yields a stock of total outstanding government debt that is close to the figure generated by our own data (the column labeled HPP).

IA.A.2. City-level Correlates of Local Government Debt

Table IA.II 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 ($\ln(GDP)$), local government budget balance (GB, i.e. the unconsolidated budget balance of the city itself, which does not include the LGFVs issuing 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).[4] The correlation

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

[4] 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, Henderson,

between local government debt and economic growth (GR) is negative if one does not control for other city-level variables (column 4 of Table IA.II), but becomes positive and statistically significant if one controls jointly for the latter (column 9 of Table IA.II).

As most of our analysis consists of within-city regressions, Table IA.III shows the within-city correlation of the variables described above (i.e., controlling for city-fixed effects). In this case, local government debt is not correlated with per-capita income, total income or population, but is positively and significantly correlated with growth, budget balance, bank loans, and 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 high. This finding is also consistent with 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.

IA.B. Further Robustness Checks

Tables IA.V-IA.IX show that the baseline correlations of Table 4 are robust to estimating the model with the system and difference GMM estimators of Arellano and Bond (1991), Arellano and Bover (1995), and Blundell and Bond (1998), and to controlling for additional time-varying city-level variables (size of the banking sector, GDP per capita, and GDP growth). The results are also robust to using

and Zhang (2009).

the change in debt over GDP instead of the debt-to-GDP ratio and to replacing total local government with government debt extends by banks (i.e., not considering bonded debt).

Table IA.X shows that local government debt is negatively correlated with the share of bank lending to private corporations and positively correlated with the share of bank lending to non-LGFV state-owned firms. Figure IA.2 shows that the city-level growth rate of bank lending to private corporations is negatively correlated with the growth rate of bank lending to LGFVs.

Table IA.XI shows that the distance from the border effect documented in Table VII of Section IV is robust to different definitions of distance from the border. Table IA.XII shows that distance from the border affects the relationship between local government debt and firm-level leverage.

Table IA.XIII shows that the Rajan and Zingales results are robust to estimating the model using firm-level (instead of industry-level) data and to substituting the index of external financial dependence with a measure of firm age and size.

Tables IA.XIV-IA.XXII report a series of robustness check that corroborate the finding that local government debt increases the sensitivity of investment to cash flow for private sector firms.

As a first step, we show that our baseline results survive when we control for a battery of city-level variables. We start with the local government budget balance relative to GDP. This variable is not correlated mechanically with our measure of local government debt: 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. Yet, more profligate local governments may have over-indebted LGFVs, or else LGFVs backed by financially sound governments may be able to borrow more. In fact, Table IA.III shows 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 IA.XIV). The same occurs if the specification is expanded to include the interaction between cash flow and the log of the city's per capita GDP: the additional variable is not significant and its inclusion does not alter our baseline result (column 2, Table IA.XIV). When one controls for GDP growth (which in our data 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. Hence, our results are not driven by the fact that weaker firms become more credit-constrained in periods of low economic growth. One may expect land prices to be a potentially important omitted variable: high land prices may ease the collateral constraints of land-owning firms (Chaney, Sraer and Thesmar, 2012), but may also induce banks to lend to collateral-rich local public governments and land developers rather than to manufacturing firms that require intensive screening (Manove, Padilla and Pagano, 2001; Chakraborty, Goldstein and MacKinlay, 2018). Our results are consistent with the latter interpretation (column 4, Table IA.XIV) as we find that the coefficient of the interaction between land prices and cash flow is positive and statistically significant.[5] More interesting for our purposes is that our baseline results is robust to including this additional variable. Finally, we estimate a specification that includes all these additional controls. We find some evidence that faster economic growth

[5]This is not surprising, considering that land is the main collateral for LGFVs' debt, and land sales are 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).

and higher per capita GDP relax financing constraints, while a larger municipal budget tightens them. However, the baseline result that local government debt tightens financing constraints is unaffected.

As mentioned in the text, firms exposed to government projects may have easier access to credit. To test for this possibility, we allow for the effect of the interaction between cash flow and local government debt to vary with the industry-specific measure of exposure to government expenditure (EXP) described in the previous section.[6] Indeed, the estimates in Table IA.XV show that private firms more exposed to LGFV-funded projects are less credit-constrained than less exposed firms, the coefficient of the interaction between exposure and cash flow being negative and statistically significant (see column 1 in Table IA.XV). However, all our baseline results are robust to controlling for exposure to LGFV-funded projects, even though including the exposure index entails losing nearly 200,000 observations.[7] 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. The results are also robust if the estimation is restricted to private firms (column 3). In this case, we find that greater exposure to government-funded projects mitigates the credit constraints arising from local government debt (the triple interaction being negative and significant). As before, there is no evidence that local government debt affects financing constraints of state-owned firms (column 4). As a final experiment, we convert our continuous variable of exposure

[6] 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.

[7] Column 2 of Table IA.XV reports the baseline results of Table 10 by restricting the sample to firms for which we have data on 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 IA.XV).

We also show that our results are robust to scaling firm-level variables by fixed assets instead of total assets (Table IA.XVI). We also look at the role of leverage. If local government debt affects credit constraints, it should only affect firms that participate in the credit market. In our sample more than 95% of firms have positive debt and dropping firms that do not have debt does not alter our results. If, instead, we concentrate our analysis to leveraged firms (defined as those with a debt-to-asset ratio of at least 30%), we find that the coefficient of the interaction between local government debt and cash-flow investment sensitivity increases by more than 10%, from 0.075 to 0.084 (Table IA.XVII). Hence the crowding-out effect of local government debt appears to be greater for leveraged firms.

One possible source of concern with the regressions shown in Tables 9-11 is that lagged investment correlates 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). Our results are robust to these estimation techniques. As a further battery of robustness tests, 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, namely Beijing, Tianjin, and fourteen other cities located in Jiangsu and Zhejiang provinces (column 1 of Table IA.XX). Our results are also robust to restricting the sample to 212 medium-sized cities (population of 1-10 million, column 2 of Table IA.XX). Finally, the results survive when the sample is restricted to the period after 2007, when local government borrowing began to soar (Table IA.XXI), and to using only data drawn from the Annual Survey of Industrial Firms (Table IA.XXII).

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Arellano, Manuel, and Olympia Bover, 1995, Another look at the instrumental variable estimation of error-components models, *Journal of Econometrics* 68, 29–51.

Blundell, Richard, and Stephen Bond, 1998, Initial conditions and moment restrictions in dynamic panel data models, *Journal of Econometrics* 87, 115–143.

Nickell, Stephen, 1981, Biases in dynamic models with fixed effects, *Econometrica* 49, 1417–1426.

Table IA.I. 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. The table also reports the correlation between HPP data aggregated at the province level and the NAO's three different definitions 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 IA.II. 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 scaled by GDP (GB, i.e, the budget of the city government, which does not include the activities of the LGFVs issuing the debt), total bank loans scaled by GDP (BL these are local bank loans and include lending to LGFVs), 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).

	(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 IA.III. 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 scaled by GDP (GB, this is the budget of the city government and does not include the activities of the LGFVs that issue the debt), total bank loans scaled by 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).

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
$ln(GDP\ PC)$	-0.575								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

Table IA.IV. Summary Statistics

	Mean	Median	Std. Dev.	P25	P75	Min	Max	N. Obs
				Firm-level variables				
I	8.7	1.8	19.9	0.0	9.6	-1.9	74.7	1,161,180
REV	0.5	0.1	1.2	-0.1	0.65	-1.0	4.3	1,161,180
LCF	0.15	0.7	0.21	0.02	0.18	-0.09	0.81	1,161,180
AGE	9.1	8.0	5.0	5.0	12.0	0	20	1,141,726
Assets	145,512	28,283	738,415	11,275	82,754	0	2.5e+08	1,161,180
				City-year variables				
LGD	7.3	3.1	13.6	0.4	7	0	147.8	2,093
BL	89.1	75.3	50.7	53.1	108.9	7.5	381.3	2,093
GB	-8.0	-6.7	5.9	-11.5	-.35	-22.0	5.0	2,093
GR	13.2	13.4	3.3	11.5	15.1	5.0	24.0	2,093
GDP PC	3.6	2.4	4.0	1.5	4.2	0.4	46.7	2,093
GDP	15,307	8,413	21,336	4,713	16,451	701	216,021	2,093
POP	4,464	3.712	3,279	2,396	5,834	176	29,700	2,093
*LP*1	6.1	6.1	0.8	5.6	6.6	3.9	8.1	2,093
*LP*2	6.3	6.3	0.8	5.9	6.8	4.3	8.5	v

LGD, *BL*, *BB*, *GR* are % of GDP; *GDP PC* and *POP* are in thousands units, and *GDP* is in millions.

Table IA.V. Correlation between Firm-Level Investment and Local Government Debt: SYS and DIFF GMM Estimation

This table reports the results of regressions where the dependent variable is the firm-level investment ratio (computed as investment scaled by total assets at the beginning of the year), and the explanatory variables are lagged investment (I_{t-1}), change in revenue scaled by total assets (REV_{t-1}), lagged cash flow scaled by total assets (CF_{t-1}), a dummy variable that equals 1 for state-owned firms and 0 otherwise ($STATE$), local government debt scaled by city-level GDP (LGD), and the interaction between LGD and $STATE$. Columns 1-4 use the system GMM estimator and columns 5-8 use the difference GMM estimator.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
I_{t-1}	-0.085***	-0.085***	-0.086***	-0.088***	-0.095***	-0.096***	-0.096***	-0.087***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
REV_{t-1}	3.982***	3.992***	3.996***	3.501***	2.176***	2.188***	2.209***	1.501***
	(0.044)	(0.044)	(0.044)	(0.045)	(0.074)	(0.073)	(0.073)	(0.077)
CF_{t-1}	7.225***	7.290***	7.327***	6.243***	-4.243***	-4.185***	-4.065***	-5.993***
	(0.301)	(0.301)	(0.301)	(0.315)	(0.506)	(0.506)	(0.505)	(0.526)
$STATE$		-0.041	-0.721**	0.453		-2.532***	-2.780***	-2.193***
		(0.252)	(0.329)	(0.338)		(0.460)	(0.518)	(0.529)
LGD	-0.081***	-0.081***	-0.082***		-0.323***	-0.322***	-0.320***	
	(0.002)	(0.002)	(0.002)		(0.012)	(0.012)	(0.012)	
$STATE \times LGD$			0.024**	-0.006			0.034	0.070***
			(0.010)	(0.010)			(0.022)	(0.022)
N. Obs.	679,227	679,227	679,227	679,227	391,108	391,108	391,108	391,108
N. Cities	261	261	261	261	261	261	261	261
AR1 p value	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
AR2 p value	0.24	0.23	0.24	0.23	0.79	0.8	0.82	0.54
Sargan test p value	0.28	0.17	0.11	0.07	0.25	0.22	0.25	0.13
Estimation method	SYS GMM				DIFF GMM			

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

Table IA.VI. Correlation between Firm-Level Investment and Local Government Debt

This table reports the results of regressions where the dependent variable is the firm-level investment ratio (computed as investment scaled by total assets at the beginning of the period), and the explanatory variables are lagged investment scaled by total assets (I_{t-1}), change in revenue scaled by total assets (REV_{t-1}), lagged cash flow scaled by total assets (CF_{t-1}), a dummy variable that equals 1 for state-owned firms and 0 otherwise ($STATE$), local government debt scaled by city-level GDP (LGD), bank loans scaled by city-level GDP (BL), log of city-level GDP per capita ($ln(GDPPC)$), city-level GDP growth (GR) and the interaction between each of LGD, BL, $ln(GDPPC)$, and GR and $STATE$. All regressions include city, year, and firm fixed effects.

I_{t-1}	-0.271***	-0.271***	-0.271***	-0.271***	-0.271***	-0.271***	-0.271***	-0.271***
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
REV_{t-1}	4.052***	4.043***	4.052***	4.052***	4.051***	4.043***	4.052***	4.051***
	(0.089)	(0.089)	(0.089)	(0.089)	(0.089)	(0.089)	(0.089)	(0.089)
CF_{t-1}	7.775***	7.686***	7.734***	7.692***	7.775***	7.687***	7.735***	7.693***
	(0.519)	(0.522)	(0.529)	(0.532)	(0.520)	(0.522)	(0.529)	(0.532)
$STATE$	-0.384**	-0.368**	-0.325*	-0.321*	-1.503***	-0.773**	0.362	-1.097
	(0.173)	(0.174)	(0.185)	(0.184)	(0.356)	(0.331)	(0.626)	(0.740)
LGD	-0.051***	-0.056***	-0.063***	-0.060***	-0.051***	-0.057***	-0.064***	-0.060***
	(0.016)	(0.016)	(0.016)	(0.016)	(0.016)	(0.016)	(0.016)	(0.016)
BL	-0.011			-0.006	-0.012			-0.006
	(0.007)			(0.007)	(0.007)			(0.007)
$ln(GDPPC)$		2.084***		1.090		2.086***		1.109
		(0.793)		(0.730)		(0.795)		(0.731)
GR			0.250***	0.232***			0.254***	0.236***
			(0.056)	(0.055)			(0.057)	(0.057)
$STATE \times LGD$					0.003	0.028***	0.020**	0.005
					(0.011)	(0.010)	(0.010)	(0.012)
$STATE \times BL$					0.011***			0.011***
					(0.003)			(0.004)
$STATE \times ln(GDPPC)$						-0.077		-0.440*
						(0.212)		(0.237)
$STATE \times GR$							-0.068	-0.063
							(0.043)	(0.043)
N. Obs.	1,035,427	1,034,068	1,007,450	1,006,091	1,035,427	1,034,068	1,007,450	1,006,091
N. Cities	261	261	261	261	261	261	261	261

Robust s.e. clustered at the firm and city-year level in parenthesis, p-values in brackets. *** p<0.01, ** p<0.05, * p<0.1

Table IA.VII. Correlation between Firm-Level Investment and Bank-Financed Local Government Debt

This table reports the results of regressions where the dependent variable is the firm-level investment ratio (computed as investment scaled by total assets at the beginning of the year), and the explanatory variables are lagged investment scaled by total assets (I_{t-1}), change in revenue scaled by total assets (REV_{t-1}), lagged cash flow scaled by total assets (CF_{t-1}), a dummy variable that equals 1 for state-owned firms and 0 otherwise ($STATE$), local government debt excluding local government bonds, scaled by city-level GDP ($LGDBNK$), and the interaction between $LGDBNK$, and $STATE$.

	(1)	(2)	(3)	(4)
I_{t-1}	-0.272***	-0.272***	-0.272***	-0.274***
	(0.008)	(0.008)	(0.008)	(0.007)
REV_{t-1}	4.132***	4.131***	4.131***	3.803***
	(0.103)	(0.103)	(0.104)	(0.092)
CF_{t-1}	7.156***	7.157***	7.157***	6.373***
	(0.579)	(0.579)	(0.579)	(0.534)
$LGDBNK$	-0.060***	-0.060***	-0.062***	
	(0.019)	(0.019)	(0.019)	
state		-0.405**	-0.882***	-0.430
		(0.199)	(0.283)	(0.270)
$STATE \times LGDBNK$		0.035***	0.019*	
			(0.012)	(0.011)
N. Obs.	868,615	868,615	868,615	868,591
N. Cities	261	261	261	261
Firm FE	Yes	Yes	Yes	Yes
City FE	Yes	Yes	Yes	No
Year FE	Yes	Yes	Yes	No
City-Year FE	No	No	No	Yes

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

Table IA.VIII. Correlation between Firm-Level Investment and Change in Local Government Debt

This table reports the results of regressions where the dependent variable is the firm-level investment ratio (computed as investment scaled by total assets at the beginning of the year), and the explanatory variables are lagged investment scaled by total assets (I_{t-1}), change in revenue scaled by total assets (REV_{t-1}), lagged cash flow scaled by total assets (CF_{t-1}), a dummy variable that equals 1 for state-owned firms and 0 otherwise ($STATE$), the change in local government debt scaled by city-level GDP (ΔLGD), and the interaction between ΔLGD, and $STATE$.

	(1)	(2)	(3)	(4)
I_{t-1}	-0.291***	-0.291***	-0.291***	-0.293***
	(0.009)	(0.009)	(0.009)	(0.008)
REV_{t-1}	4.328***	4.328***	4.328***	3.983***
	(0.100)	(0.100)	(0.100)	(0.088)
CF_{t-1}	7.453***	7.453***	7.451***	6.666***
	(0.576)	(0.576)	(0.576)	(0.541)
ΔLGD	-0.059***	-0.059***	-0.066***	
	(0.021)	(0.021)	(0.021)	
$STATE$		-0.556**	-0.923***	-0.577**
		(0.237)	(0.277)	(0.259)
$STATE \times \Delta LGD$			0.096***	0.058**
			(0.030)	(0.028)
N. Obs.	831,852	831,852	831,852	831,824
N. Cities	261	261	261	261
Firm FE	Yes	Yes	Yes	Yes
City FE	Yes	Yes	Yes	No
Year FE	Yes	Yes	Yes	No
City-Year FE	NO	NO	NO	YES

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

Table IA.IX. Correlation between Firm-Level Investment and Local Government Debt: Controlling for City-Level Variables

This table reports the results of regressions where the dependent variable is the firm-level investment ratio (computed as investment scaled by total assets at the beginning of the year), and the explanatory variables are lagged investment scaled by total assets (I_{t-1}), change in revenue scaled by total assets (REV_{t-1}), lagged cash flow scaled by total assets (CF_{t-1}), a dummy variable that equals 1 for state-owned firms and 0 otherwise ($STATE$), local government debt scaled by city-level GDP (LGD), bank loans scaled by GDP (BL), the log of city-level GDP per capita ($ln(GDPPC)$), city-level GDP growth (GR) and the interaction between each of LGD, BL, $ln(GDPPC)$, GR, and $STATE$.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
I_{t-1}	-0.271***	-0.271***	-0.271***	-0.271***	-0.289***	-0.289***	-0.289***	-0.289***
	(0.006)	(0.006)	(0.006)	(0.006)	(0.009)	(0.009)	(0.009)	(0.009)
REV_{t-1}	4.051***	4.043***	4.052***	4.051***	4.394***	4.390***	4.392***	4.395***
	(0.089)	(0.089)	(0.089)	(0.089)	(0.109)	(0.110)	(0.109)	(0.109)
CF_{t-1}	7.775***	7.687***	7.735***	7.693***	7.042***	7.008***	7.011***	6.993***
	(0.520)	(0.522)	(0.529)	(0.532)	(0.625)	(0.629)	(0.627)	(0.631)
$State$	-1.503***	-0.773**	0.362	-1.097	-2.523***	-0.832**	-0.207	-2.758***
	(0.356)	(0.331)	(0.626)	(0.740)	(0.541)	(0.389)	(0.720)	(0.896)
LGD	-0.051***	-0.057***	-0.064***	-0.060***	-0.060***	-0.061***	-0.066***	-0.065***
	(0.016)	(0.016)	(0.016)	(0.016)	(0.021)	(0.021)	(0.021)	(0.021)
BL	-0.012			-0.006	-0.010			-0.009
	(0.007)			(0.007)	(0.009)			(0.008)
$State \times LGD$	0.003	0.028***	0.020**	0.005	-0.014	0.029**	0.025*	-0.016
	(0.011)	(0.010)	(0.010)	(0.012)	(0.016)	(0.014)	(0.014)	(0.017)
$State \times BL$	0.011***			0.011***	0.020***			0.021***
	(0.003)			(0.004)	(0.004)			(0.004)
$ln(GDPPC)$		2.086***		1.109		0.948		0.541
		(0.795)		(0.731)		(0.963)		(0.906)
$STATE \times ln(GDPPC)$		-0.077		-0.440*		0.098		-0.248
		(0.212)		(0.237)		(0.309)		(0.330)
GR			0.254***	0.236***			0.219***	0.210***
			(0.057)	(0.057)			(0.073)	(0.072)
$State \times GR$			-0.068	-0.063			-0.050	-0.003
			(0.043)	(0.043)			(0.054)	(0.056)
N. Obs.	1,035,427	1,034,068	1,007,450	1,006,091	740,271	739,430	735,190	734,349
N. Obs.	964,586	963,338	937,309	936,061	964,586	963,338	937,309	936,061
N. Cities	261	261	261	261	261	261	261	261
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
LGD is	Total debt				Total debt exended by banks			

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

Table IA.X. Share of Local Bank Lending to Private and State-Owned Firms and Local Government Debt

This table reports the results of regressions where the dependent variable is either the share of bank credit to private sector firms (columns 1 and 2) or the share of bank credit to state-owned firms (excluding LGVF), and the explanatory variables are local government debt scaled by GDP (LGD), bank loans scaled by GDP (BL), budget balance (GB), log of GDP per capita ($ln(GDPPC)$), GDP growth (GR), land price (LP), the log of population ($ln(POP)$)

	(1)	(2)	(3)	(4)
	Share of lending to private sector firms		Share of lending to state-owned firms	
LGD	-0.178***	-0.061**	0.055**	0.0197
	(0.0320)	(0.030)	(0.026)	(0.025)
GR	-0.413***	0.162***	0.218***	0.019
	(0.096)	(0.056)	(0.079)	(0.047)
GB	-0.187***	0.0314	0.089**	-0.027
	(0.046)	(0.042)	(0.038)	(0.035)
BL	-0.056***	0.0196*	-0.001	0.002
	(0.008)	(0.010)	(0.007)	(0.008)
$ln(GDPPC)$	-0.017**	-0.001	0.017***	0.001
	(0.008)	(0.008)	(0.006)	(0.007)
LP	2.720***	-0.717	-3.549***	0.279
	(0.542)	(0.443)	(0.445)	(0.373)
$ln(POP)$	-3.320***	-1.262	-0.186	-0.070
	(0.530)	(1.181)	(0.436)	(0.996)
Constant	81.70***		33.93***	
	(4.083)		(3.359)	
N. Obs.	2,018	2,018	2,018	2,018
N. Cities	261	261	261	261
City FE	No	Yes	No	Yes
Year FE	No	Yes	No	Yes

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

Table IA.XI. Investment, Local Government Debt, and Distance from the Border

This table reports the results of regressions where the dependent variable is the firm-level investment ratio (computed as investment scaled by total assets at the beginning of the year), and the explanatory variables are lagged investment scaled by total assets (I_{t-1}), change in revenue scaled by total assets (REV_{t-1}), lagged cash flow scaled by total assets (CF_{t-1}), and firm distance from the border (BD) interacted with local government debt scaled by GDP (LGD). In columns 1 and 5 BD is a dummy variable that equals 1 for firms in the 25th percentile of firms closest to the border, and 0 otherwise; in columns 2 and 6 BD is a dummy variable that equals 1 for firms in the 50th percentile of firms closest to the border, and 0 otherwise, in column 3 BD is a continuous measure of proximity to the border; in column 4, BD is a dummy that equals 1 only for firms within 20Km from the border, and 0 otherwise; in columns 4, 5, and 6 the border dummy is also interacted with the level of government debt in the closes neighboring city ($NLGD$).

	(1)	(2)	(3)	(4)	(5)	(6)
I_{t-1}	-0.258***	-0.258***	-0.258***	-0.260***	-0.260***	-0.260***
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.00597)
REV_{t-1}	2.187***	2.187***	2.187***	2.169***	2.169***	2.169***
	(0.047)	(0.047)	(0.047)	(0.047)	(0.047)	(0.0470)
CF_{t-1}	4.410***	4.411***	4.409***	4.434***	4.433***	4.433***
	(0.330)	(0.330)	(0.330)	(0.333)	(0.334)	(0.334)
$LGD \times BD$	0.027***	0.020***	0.067***	0.025**	0.027**	0.0265**
	(0.009)	(0.007)	(0.020)	(0.013)	(0.012)	(0.0125)
$NLGD \times BD$				-0.012	-0.005	-0.00548
				(0.014)	(0.015)	(0.0145)
N.Obs	792,900	792,900	792,900	773,515	773,515	773,515
N. Cities	251	251	251	251	251	251
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
C-Y FE	Yes	Yes	Yes	Yes	Yes	Yes
Neigh. C-Y FE	No	No	No	Yes	Yes	Yes
BD is	25^{th}	50^{th}	Dist.	20 Km	25^{th}	50^{th}

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

Table IA.XII. Leverage, Local Government Debt, and Distance from the Border

This table reports the results of regressions where the dependent variable is the firm-level leverage, and the explanatory variables are local government debt scaled by GDP (LGD), bank loans scaled by GDP (BL), budget balance (GB), log of GDP per capita ($ln(GDP\ PC)$), GDP growth (GR), land price (LP) and firm size ($SIZE$), and the interaction between a dummy variable equal to 1 only for firms for which the average distance of the ten closest bank branches located in another city is less than 20 KMs (BK) and each of LGD, BL, GB, $ln(GDP\ PC)$, GR, and LP. Column 1 and 2 show estimates based on the sample of all manufacturing firms; columns 3 and 4 shows estimates based on the subsample of private manufacturing firms; and columns 5 and 6 show based on the subsample of state-owned manufacturing firms. Columns 1, 3, and 5 countrol for, firm, city and year fixed effects, columns 2, 4, 5, controld for firm and city-year fixed effects

	(1)	(2)	(3)	(4)	(5)	(6)
LGD	-0.018***		-0.023***		0.023	
	(0.005)		(0.006)		(0.021)	
BL	0.023***		0.027***		-0.005	
	(0.002)		(0.002)		(0.008)	
$ln(GDP\ PC)$	-2.431***		-2.681***		0.416	
	(0.274)		(0.287)		(1.078)	
GB	-0.036		-0.017		-0.318***	
	(0.026)		(0.028)		(0.097)	
GR	0.063***		0.068***		-0.063	
	(0.015)		(0.016)		(0.057)	
LP	0.362		0.072		5.341***	
	(0.476)		(0.498)		(1.804)	
$LGD \times BK$	0.011	0.014	0.020*	0.022**	-0.105**	-0.124***
	(0.011)	(0.011)	(0.011)	(0.011)	(0.044)	(0.045)
$BL \times BK$	-0.004	-0.004*	-0.004*	-0.005**	0.001	-0.002
	(0.002)	(0.002)	(0.002)	(0.002)	(0.010)	(0.010)
$GB \times BK$	-0.044	-0.040	-0.023	-0.027	0.334*	0.391**
	(0.052)	(0.052)	(0.055)	(0.055)	(0.183)	(0.196)
$ln(GDP\ PC) \times BK$	-0.546*	-0.691**	-0.611*	-0.776**	1.437	1.327
	(0.311)	(0.310)	(0.326)	(0.325)	(1.307)	(1.372)
$GR \times BK$	-0.061**	-0.066***	-0.053**	-0.056**	-0.162	-0.179*
	(0.025)	(0.024)	(0.026)	(0.026)	(0.102)	(0.106)
$LP \times BK$	-0.143	0.072	0.699	1.014	-10.945***	-10.823***
	(0.918)	(0.914)	(0.955)	(0.951)	(3.651)	(3.779)
$SIZE$	0.940***	1.158***	1.075***	1.297***	-0.566*	-0.334
	(0.062)	(0.063)	(0.064)	(0.066)	(0.331)	(0.346)
N. Obs.	557,080	557,021	516,170	516,110	29,076	28,880
N. Cities	251	251	251	251	251	251
Sample	All	All	Private	Private	State	State
City FE	Yes	No	Yes	No	Yes	No
Year FE	Yes	No	Yes	No	Yes	No
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
C-Y FE	No	Yes	No	Yes	No	Yes

Robust s.e. clustered at the firm and city-year in parenthesis.
*** p<0.01, ** p<0.05, * p<0.1

Table IA.XIII. Local Government Debt and Investment, using the Rajan-Zingales Index

This table reports the results of regressions where the dependent variable is the firm-level investment ratio (computed as investment scaled by total assets at the beginning of the year). The regressions control for initial investment scaled by total assets (I_{t-1}) and the interaction between each of local government debt scaled by GDP (LGD), bank loans scaled by GDP (BL), log of GDP per capita ($ln(GDPPC)$), and GDP growth (GR) and the Rajan-Zingales index of external financial dependence (EF) computed on firms in Beijing, Shanghai, Hangzhou, and Wenzhou. In Column 3, $Young$ is a dummy variable that equals 1 for firms created after the year 2000, and 0 otherwise, and in column 4 $Small$ is a dummy that equals 1 for firms belonging to the bottom 50 percent of the distribution by firm size. Columns 5 and 6 present separate coefficients estimates for private and state-owned firms.

	(1)	(2)	(3)	(4)	(5)		(6)	
$EF \times LGD$	-0.629**	-0.860**			-0.637**	0.518	-0.881**	0.310
	(0.304)	(0.392)			(0.315)	(0.547)	(0.394)	(0.655)
$Young \times LGD$			-0.033***					
			(0.003)					
$Small \times LGD$				-0.031***				
				(0.003)				
$EF \times BL$		-0.037					-0.0547	0.165
		(0.174)					(0.174)	(0.249)
$EF \times ln(GDPPC)$		0.805*					0.818*	0.734*
		(0.431)					(0.430)	(0.435)
$EF \times GR$		-0.001					-0.001	-0.001
		(0.012)					(0.012)	(0.021)
I_{t-1}	-0.270***	-0.270***	-0.274***	0.274***	-0.270***		-0.270***	
	(0.003)	(0.003)	(0.002)	(0.002)	(0.003)		(0.003)	
CF_{t-1}	3.738***	3.735***	3.382***	3.366***	3.738***		3.736***	
	(0.246)	(0.249)	(0.184)	(0.182)	(0.246)		(0.249)	
REV_{t-1}	2.105***	2.109***	2.058***	2.067***	2.105***		2.109***	
	(0.036)	(0.037)	(0.028)	(0.028)	(0.036)		(0.037)	
N. Obs.	520,585	511,111	925,214	943,793	520,585		511,111	
Firm FE	Yes	Yes	Yes	Yes	Yes		Yes	
City-Year FE	Yes	Yes	Yes	Yes	Yes		Yes	
Industry-Year FE	Yes	Yes	Yes	Yes	Yes		Yes	
City-Industry FE	Yes	Yes	Yes	Yes	Yes		Yes	
Sample	All	All	All	All	Private	SOE	Private	SOE

Robust s.e. clustered at the firm and city-industry-year level in parenthesis. *** p<0.01, ** p<0.05, * p<0.1

Table IA.XIV. Cash-Flow Sensitivity of Investment: Additional Controls

This table reports the results of regressions where the dependent variable is the firm-level investment ratio (computed as investment scaled by total assets at the beginning of the year), and the explanatory variables are the lagged investment ratio (I_{t-1}), change in revenue scaled by total assets (REV_{t-1}), lagged cash flow scaled by total assets (CF_{t-1}), and the interaction between CF_{t-1} and each of the following variables: local government debt scaled by GDP (LGD), bank loans scaled by GDP(BL), local government budget balance scaled by GDP(GB), city-level log of GDP ($GDP\ PC$), GDP growth (GR), and the log of average land prices (LP).

	(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)	(0.031)	(0.032)
CF_{t-1}	8.138***	9.151***	18.602***	2.039	19.152***
	(0.426)	(0.492)	(0.799)	(1.482)	(2.400)
$CF_{t-1} \times LGD$	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**			-0.795**
		(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.	1,035,400	1,034,041	1,007,423	1,026,629	997,476
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 IA.XV. Sensitivity of Investment to Cash Flow: Exposure to Government Expenditure

This table reports the results of regressions where the dependent variable is the firm-level investment ratio (computed as investment scaled by total assets at the beginning of the year), and the explanatory variables are lagged investment (I_{t-1}), change in revenue scaled by total assets (REV_{t-1}), lagged cash flow scaled by total assets (CF_{t-1}), the interaction between CF_{t-1} and bank loans scaled by GDP (LGD), and the interaction between CF_{t-1} and local government debt scaled by GDP (LGD), further interacted with exposure to government expenditure (EXP). Columns 1 and 2 show estimates based on the sample of all manufacturing firms; those in column 3 are based on the subsample of private-sector manufacturing firms, and those in column 4 on the subsample of state-owned manufacturing firms. Column 5 shows a specification based on a discrete measure of exposure to government expenditure.

	(1)	(2)	(3)	(4)	(5)
I_{t-1}	-0.277***	-0.278***	-0.283***	-0.375***	-0.278***
	(0.002)	(0.002)	(0.002)	(0.009)	(0.002)
REV_{t-1}	3.757***	3.756***	3.786***	2.368***	3.756***
	(0.035)	(0.035)	(0.038)	(0.193)	(0.035)
CF_{t-1}	9.051***	8.456***	9.517***	7.913***	8.554***
	(0.443)	(0.421)	(0.487)	(2.373)	(0.477)
$CF_{t-1} \times LGD$	0.090***	0.078***	0.106***	0.029	0.083***
	(0.017)	(0.016)	(0.019)	(0.079)	(0.020)
$CF_{t-1} \times BL$	-0.021***	-0.021***	-0.024***	-0.031	-0.021***
	(0.004)	(0.004)	(0.005)	(0.023)	(0.004)
$CF_{t-1} \times EXP$	-4.640***		-2.076*	-6.877***	
	(1.010)		(1.237)	(2.141)	
$CF_{t-1} \times EXP \times LGD$	-0.064		-0.125**	-0.111	
	(0.046)		(0.052)	(0.106)	
$EXP \times LGD$	-0.034**		-0.039**	-0.056	
	(0.014)		(0.016)	(0.039)	
$CF_{t-1} \times HEXP$					-0.196
					(0.451)
$CF_{t-1} \times HEXP \times LGD$					-0.009
					(0.024)
$HEXP \times LGD$					0.003
					(0.004)
N. Obs.	836,089	836,089	696,752	37,218	836,089
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	Private	State	All

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

Table IA.XVI. Sensitivity of Investment to Cash Flow: Investment Scaled by Fixed Assets

This table reports the results of regressions similar to those of Table 9 but with firms levels variables scaled by fixed assets insetad of total assets.

	(1)	(2)	(3)	(4)	(5)
I_{t-1}	-0.310***	-0.319***	-0.412***	-0.268***	-0.360***
	(0.002)	(0.002)	(0.009)	(0.005)	(0.004)
REV_{t-1}	3.398***	3.473***	2.451***	4.667***	2.133***
	(0.027)	(0.029)	(0.141)	(0.108)	(0.058)
CF_{t-1}	14.235***	14.940***	13.391***	12.952***	13.279***
	(0.217)	(0.241)	(1.200)	(0.688)	(0.601)
$CF_{t-1} \times LGD$	0.048***	0.046***	-0.016	0.024	0.055*
	(0.009)	(0.010)	(0.045)	(0.024)	(0.031)
N. Obs.	1,017,313	842,028	45,524	115,901	119,178
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	Large	Small

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

Table IA.XVII. Sensitivity of Investment to Cash Flow: Leveraged Firms

This table reports the results of regressions where the dependent variable is the firm-level investment ratio (computed as investment scaled by total assets at the beginning of the year), and the explanatory variables are lagged investment scaled by total assets (I_{t-1}), change in revenue scaled by total assets (REV_{t-1}), lagged cash flow scaled by total assets (CF_{t-1}), and the interaction between CF_{t-1} and local government debt over GDP (LGD). The sample is restricted to firms with a leverage ratio of at least 33 percent. The sample used in the regression shown in column 1 includes all manufacturing firms, that in column 2 only private sector domestically owned manufacturing firms, and column 3 only state-owned manufacturing firms.

	(1)	(2)	(3)
I_{t-1}	-0.267***	-0.273***	-0.366***
	(0.002)	(0.002)	(0.009)
REV_{t-1}	3.510***	3.540***	2.455***
	(0.036)	(0.039)	(0.190)
CF_{t-1}	6.375***	7.300***	3.872*
	(0.440)	(0.482)	(2.294)
$CF_{t-1} \times LGD$	0.083***	0.091***	-0.098
	(0.016)	(0.018)	(0.078)
$CF_{t-1} \times BL$	-0.023***	-0.027***	-0.011
	(0.004)	(0.005)	(0.024)
N. Obs.	816,638	686,151	34,989
N.Cities	261	261	256
Firm FE	Yes	Yes	Yes
City-Year FE	Yes	Yes	Yes
Sample	All	Private	State

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

Table IA.XVIII. System GMM Regressions

The top panel of this table estimates the models of Table 10 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, and column 3 only state-owned manufacturing firms.

	(1)	(2)	(3)
	SYS GMM		
I_{t-1}	-0.121***	-0.158***	-0.266**
	(0.005)	(0.019)	(0.105)
REV_{t-1}	10.483***	10.319***	4.660**
	(0.322)	(0.372)	(1.933)
CF_{t-1}	2.474*	7.437***	15.077
	(1.407)	(1.822)	(9.382)
$CF_{t-1} \times LGD$	0.350***	0.119	-0.344
	(0.075)	(0.091)	(0.257)
$CF_{t-1} \times BL$	0.054***	0.070***	0.060
	(0.010)	(0.012)	(0.062)
AR1 (p-value)	0.00	0.00	0.03
AR2 (p-value)	0.07	0.03	0.15
Sargan (p-value)	0.15	0.07	0.00
	Standard FE on same sample		
I_{t-1}	-0.121***	-0.158***	-0.266**
	(0.005)	(0.019)	(0.105)
REV_{t-1}	10.483***	10.319***	4.660**
	(0.322)	(0.372)	(1.933)
CF_{t-1}	2.474*	7.437***	15.077
	(1.407)	(1.822)	(9.382)
$CF_{t-1} \times LGD$	0.350***	0.119	-0.344
	(0.075)	(0.091)	(0.257)
$CF_{t-1} \times BL$	0.054***	0.070***	0.060
	(0.010)	(0.012)	(0.062)
N. Obs.	674,066	546,552	26,619
N. Cities	261	261	261
Firm FE	Yes	Yes	Yes
City-Year FE	Yes	Yes	Yes
Sample	All	Private	State

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

Table IA.XIX. Sensitivity of Investment to Cash Flow 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, and column 3 only state-owned manufacturing firms.

	(1)	(2)	(3)
REV_{t-1}	3.901***	3.936***	2.634***
	(0.032)	(0.035)	(0.180)
CF_{t-1}	-9.433***	-9.196***	-17.350***
	(0.378)	(0.416)	(1.991)
$CF_{t-1} \times LGD$	0.106***	0.116***	-0.045
	(0.014)	(0.016)	(0.072)
$CF_{t-1} \times BL$	-0.004	-0.008*	-0.014
	(0.004)	(0.004)	(0.021)
N. Obs.	1,044,740	866,965	46,401
N. Cities	261	261	261
Firm FE	Yes	Yes	Yes
City-Year FE	Yes	Yes	Yes
Sample	All	Private	State

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

Table IA.XX. Sensitivity of Investment to Cash Flow: Different Samples

This table reports the results of regressions where the dependent variable is the firm-level investment ratio (computed as investment scaled by total assets at the beginning of the year), and the explanatory variables are lagged investment scaled by total assets (I_{t-1}), change in revenue scaled by total assets (REV_{t-1}), lagged cash flow scaled by total assets (CF_{t-1}), and the interaction between CF_{t-1} and each of the following variables: local government debt scaled by GDP (LGD) and bank loans scaled by 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 to 10 million.

	(1)	(2)
I_{t-1}	-0.282***	-0.277***
	(0.002)	(0.002)
REV_{t-1}	3.955***	3.803***
	(0.037)	(0.033)
CF_{t-1}	7.929***	8.191***
	(0.416)	(0.422)
$CF_{t-1} \times LGD$	0.057***	0.106***
	(0.019)	(0.019)
$CF_{t-1} \times BL$	-0.015***	-0.020***
	(0.004)	(0.005)
N. Obs.	701,031	879,633
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 IA.XXI. Sensitivity of Investment to Cash Flow After 2007

This table reports the results of regressions where the dependent variable is the firm-level investment ratio (computed as investment scaled by total assets at the beginning of the year), and the explanatory variables are lagged investment scaled by total assets (I_{t-1}), chang in revenue scaled by total assets (REV_{t-1}), lagged cash flow scaled by total assets (CF_{t-1}), and the interaction between CF_{t-1} and each of the following variables: local government debt scaled by GDP (LGD) and bank loans scaled by GDP (BL).

	(1)	(2)	(3)	(4)	(5)
I_{t-1}	-0.312***	-0.319***	-0.319***	-0.496***	-0.496***
	(0.002)	(0.002)	(0.002)	(0.014)	(0.014)
REV_{t-1}	4.409***	4.395***	4.395***	2.753***	2.753***
	(0.043)	(0.047)	(0.047)	(0.262)	(0.262)
CF_{t-1}	11.184***	11.609***	11.609***	10.725***	10.725***
	(0.499)	(0.544)	(0.544)	(2.845)	(2.845)
$CF_{t-1} \times LGD$	0.164***	0.167***	0.167***	0.123	0.123
	(0.016)	(0.018)	(0.018)	(0.093)	(0.093)
$CF_{t-1} \times BL$	-0.074***	-0.074***	-0.074***	-0.114***	-0.114***
	(0.004)	(0.005)	(0.005)	(0.026)	(0.026)
N. Obs.	599,361	509,572	509,572	17,405	17,405
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		

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

Table IA.XXII. Sensitivity of Investment to Cash Flow, Using Only Data from ASIF

This table estimates the baseline models of Table 10 restricting the sample to the observations available in the ASIF survey.

I_{t-1}	-0.306***	-0.310***	-0.391***
	(0.002)	(0.002)	(0.010)
REV	2.734***	2.747***	2.035***
	(0.043)	(0.046)	(0.199)
CF_{t-1}	11.282***	12.114***	8.386***
	(0.570)	(0.622)	(2.358)
$CF_{t-1} \times LGD$	0.213***	0.232***	-0.054
	(0.028)	(0.031)	(0.101)
$CF_{t-1} \times BL$	-0.055***	-0.061***	-0.025
	(0.006)	(0.007)	(0.026)
N. Obs.	479,370	400,650	28,534
N. Cities	261	261	261
Firm FE	Yes	Yes	Yes
City-Year FE	Yes	Yes	Yes
Sample	All	Private	State

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

Table IA.XXIII. Data Description and Sources: Variables only used in Appendix Tables

Variable	Description and Sources
EXP	Industry-level exposure to government expenditure computed by matching 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. $HEXP$ is a dummy variable that takes value one when equal to 1 for industries with above-median exposure and 0 for the others
$LGDBNK$	City-level local government debt excluding local government bonds, scaled by city-level GDP. See Section I for the construction of local government debt.
$LP1$	City-level land prices computed as the 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 the average of auction prices. Source: *Chinese Yearbook of Land and Resources*, published annually by the Ministry of Land and Resources.

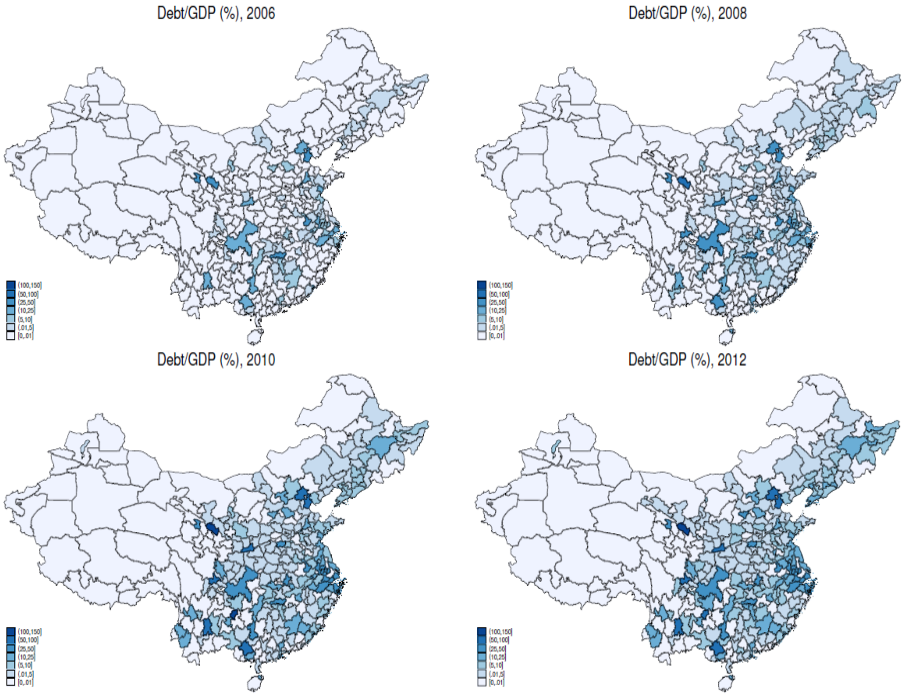

Figure IA.1. The Evolution of Local Government Debt across Chinese Cities

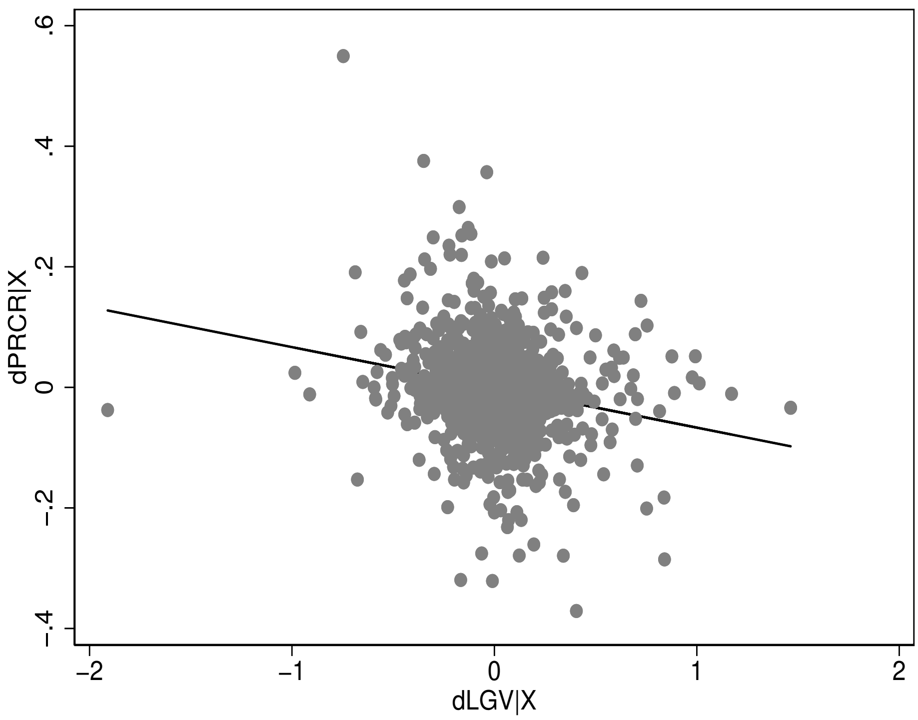

Figure IA.2. City-level Growth of Bank Loans to Private Firms over City-level Growth of Bank Loans to LGFV This graph plots the correlation between the growth rate of city-level bank-credit to private corporations (dPCR) and the growth rate of city-level bank credit to local government financing vehicles (dLGV), conditional on city-fixed effects and the growth rate of total corporate bank credit. The correlation is negative and statistically significant at the 1% confidence level (the point estimate is -0.067 and the s.e. 0.015).