



The great wall of debt: Real estate, political risk, and Chinese local government financing cost[☆]



Andrew Ang^a, Jennie Bai^{b,c,*}, Hao Zhou^{d,e}

^aBlackRock, 55 E 52nd St, New York, NY, 10055, USA

^bMcDonough School of Business, Georgetown University, DC, USA

^cNational Bureau of Economic Research, USA

^dPBC School of Finance, Tsinghua University, China

^eSUSTech Business School Chair Professor, Southern University of Science and Technology, China

ARTICLE INFO

JEL classification:

G12
G14
G28
H74

Keywords:

Chinese local government debt
Real estate
Political risk
Government guarantee

ABSTRACT

Chengtou bond is the only asset with market prices that can capture the funding cost of Chinese local government debt. In contrast to the U.S. municipal bonds, Chengtou bonds are issued by private corporations but implicitly guaranteed by local and the central governments, which are reflected by novel risk characteristics—real estate GDP and political risk. One standard deviation increase in local real estate GDP (political risk) corresponds to 10 (9) basis points decrease (increase) in bond yields, respectively. However, conditional on political risk, real estate GDP actually increases bond yields, suggesting that only local governments with low political risk can enjoy the low funding costs driven by high real estate growth.

1. Introduction

As the second largest economy in the world, China does not have *bona fide* municipal bonds, which is rare in both developed and emerging-market countries. Instead, China's tremendous growth in the infrastructure development—ranging from mega-projects like the USD 2.4 billion Shanghai Tower (the second tallest building in the world) to the housing estates sprouting in many cities—is financed to a large extent through *Chengtou bonds*, also known as urban construction and investment bonds. From 2008 to 2014, the Chengtou bond market increased by 85 percent per annum resulting in an outstanding of RMB 4.95 trillions (USD 0.82 trillion) as of

[☆] We thank Jennifer Carpenter, Darrell Duffie, John Griffin, Arvind Krishnamurthy, Stijn Van Nieuwerburgh, Amir Yaron, Zhiguo He (AEA discussant), Wei Xiong (NBER discussant), Bing Han (Texas Finance Festival discussant), Dan Li (SFS Calvacade discussant), Scott Hsu (WFA discussant), Yongheng Deng (EFA discussant), Yi Huang (CFRC discussant), Song Han, and seminar participants at AEA (2016), NBER Chinese Economy conference (2015), SFS Calvacade (2016), Texas Finance Festival (2016), WFA (2016), EFA (2016), China Financial Research Conference (2016), MIT GCFP 4th Annual Conference (2017), the “G2 at GW” conference on U.S.-China Economic Relations and Chinas Economic Development, the Summer Institute of Finance conference (2015), New York University, Stanford GSB, Georgetown, George Washington University, the IMF, the World Bank, Tsinghua University, Federal Reserve Bank of New York, Federal Reserve Board, for helpful comments and suggestions. An earlier version of this paper has been distributed under the title “The Funding Cost of Chinese Local Government Debt.” We also thank Angsheng Gu, Biqing He, and Yichen Li for excellent research assistance.

* Corresponding author.

E-mail addresses: Jennie.Bai@georgetown.edu (J. Bai), zhouh@pbcfs.tsinghua.edu.cn (H. Zhou).

Peer review under responsibility of KeAi Communications Co., Ltd.

December 2014. The brisk increase in Chengtou bonds goes hand-in-hand with the growth of total debt in China, which increased from 130 percent of GDP in 2008 to over 230 percent at the end of 2014.

While its large size, fast growth, and the central role in China's development make the Chengtou bond market interesting to study in and of itself, there are distinctive features that make it uniquely suited to investigate the effect of government guarantees, political risk, and distortions in market pricing induced by such effects. First and foremost, unlike any government bonds or municipal bonds studied in the literature, Chengtou bonds are issued by private corporations but implicitly guaranteed by local governments. In detail, Chengtou bonds are officially issued by local government financing vehicles (LGFVs) using the land-use rights and the alike as collateral. Through LGFVs, local governments raise funds to supplement direct budget transfer they receive from the central government; local governments in turn transfers land-use rights or existing assets such as highways or bridges to LGFVs as capital injection. Under China's fiscal and tax system, the central government takes final responsibility for the revenues and deficits of local governments. Chengtou bonds, therefore, are backed directly by local governments and indirectly by the central government.

This is a crucial feature that distinguishes Chengtou bonds from municipal bonds in the United States.¹

Given this unique feature, one may hypothesize that all Chengtou bonds have similar yields, that is, local governments have similar financing costs. However, we show that despite the tacit endorsement by the central government, Chengtou bond yields exhibit significant *economic* heterogeneity across local governments. In this paper we study the dispersion of Chengtou bond yields and examine the economic determinants driving the cross-sectional variation of Chinese local government financing costs.

Our analysis of local government financing cost relies exclusively on Chengtou bonds, which is the only local government financing resource that have market prices and hence reflect the risk-return perspectives of investors. Based on transaction prices and bond characteristics, we calculate Chengtou bond yields and deduct cash-flow-matched government bond yields in order to get the Chengtou bond yield spreads, the cornerstone of our analysis. Since 2015, the Ministry of Finance in China initiated a plan for local governments to swap riskier Chengtou bonds to safer and cheaper municipal bonds over the next five years. This regulation change will make Chengtou bond a legacy asset, which offers a unique opportunity to examine the market distortion incurred by the government guarantee.

We first examine the role of conventional risk factors in explaining the Chengtou bond yield spreads. Given that Chengtou bonds are issued as corporate bonds but function as municipal bonds, we expect that Chengtou bonds yield spreads should be related to risk factors documented in both the corporate bond literature and the municipal bond literature, that is, bond credit risk and liquidity risk.² Contrary to conventional wisdom, we find that bond liquidity is positively related to bond yield spreads, that is, illiquid bonds tend to have higher prices (lower yields). We postulate that this positive relationship is due to the "reaching-for-yield," in particular under the scenario of the implicit government guarantee. Devoid of default risk, investors would prefer bonds with yields as high as possible, therefore the high-yield bonds become the most actively traded in the market. As for credit risk, we confirm the literature by identifying a positive relationship between bond credit risk and bond yield spreads. Moreover, we show that issuer-level credit risk proxies do not have significant explanatory power, when bond credit rating is included in the regressions.

Our primary contribution to the literature is to construct novel explanatory variables tailored to the special features of Chengtou bonds, that is, risk characteristics related to the implicit government guarantee, and to present their additional explanatory power on Chengtou bond yields on top of conventional risk factors. Two forces potentially affect the implicit guarantee. The first force is the capability of offering the guarantee, which is mainly determined by local government economic conditions. It is difficult, however, to find accurate indicators for China's local government economic conditions due to the rudimentary accounting framework. We make the best effort to collect data related to Chinese local governments, and construct variables to capture local government economic conditions, many of them making the first debut in the literature. Among the candidate variables, we find that real estate is a key component in local government revenues and a crucial driver of local economies.

In terms of the impact of real estate on local government financing cost, there are two hypotheses. One hypothesis is that the higher proportion of real estate value in the local GDP helps boost the local government's future revenues, including various real estate related taxes and land sales income, hence there are better cash flow to support LGFVs to pay back the interests and principals of Chengtou bonds. This is basically a "growth engine" story, which *positively* affects the Chengtou bond prices hence decreases bond yields. The opposite hypothesis is that the higher proportion of real estate value in the local GDP may create an overinvestment problem, like the "ghost town" story happened in smaller or inland cities.³ Similar to the vicious circle in the U.S. subprime crisis, any negative shock in the real estate market will dampen the local government's future cash flows, which *negatively* affects Chengtou bond prices hence increases bond yields.

Our empirical findings support the "growth engine" hypothesis: overall, local real estate values strongly and *positively* favor the Chengtou bond market. In particular, the coefficient of the real estate value scaled by local GDP, is negative and significant. An increase of one standard deviation in the cross-section of real estate value corresponds to a decrease in Chengtou bond yield spreads of approximately 10 basis points, even after controlling for bond credit risk, liquidity risk, risk exposures to the central government, and

¹ The muni bonds in the U.S. are issued by municipalities, which are independent from the Federal government. Chengtou bonds are to some degree similar to agency bonds such as those issued by Fannie Mae, Freddie Mac, and Ginnie Mae, since both types of bonds are directly or indirectly backed by the Federal or central government. However, as we explain further in the paper, Chengtou bonds have far more heterogeneous features across issuing local governments which link to the real estate market and political risk, whereas agency bonds in the U.S. are nearly homogeneous.

² See, Collin-Dufresne, Goldstein, and Martin (2001), Bai and Wu (2016), Ang et al. (2015), and Schwert (2017).

³ The "ghost town" story refers to the oversupply, overinvestment, or property bubble in the real estate market. It usually happens in smaller and inland cities in China such as Erdos. This phrase has been used in main medias, for example, "Coming down to earth," in the Economist, April 18, 2015; "China's gleaming ghost cities draw neither jobs nor people," the Wall Street Journal, August 11, 2014.

other proxies of local government economic conditions. Given that the average Chengtou bond yield spread (in excess of the matching central government bond yield) is 1.98 percentage, the impact is about 5 percent which turns out to be a large economic effect. The results suggest that in China, local government with higher proportion of real estate value in local GDP tends to have lower financing cost. The concern on “ghost town” or overinvestment is not supported by our entire sample analysis.

The second force affecting the implicit guarantee is the uncertainty of offering the guarantee. Even with the full capability, a local government may be unable or unwilling to offer the guarantee. Also, though Chengtou bonds are issued with the land-use rights or assets as collateral, there is operational risk to cash out the collateral upon bond defaults which might be intervened by local governments and the central government. In China, the central government has a significant influence at the local level, from appointing local government officials to governing the financing of local governments. For example, after the Bo Xilai political scandal in 2012 (Liu, Shu, and Wei, 2017b), some policies and decisions made earlier by the Chongqing Municipal Government, that is, the Bo administration, were frozen or withdrawn by the central government. The scandal significantly interfered the local real estate market and local companies, especially those with political sensitivity, which then has a rippling effect on local government economic conditions.

To measure the political uncertainty, we utilize a manually collected dataset based on China's anti-corruption campaign since 2012, including a sample of graft probes on 753 officials from 30 local governments. We consider two proxies for the intensity of local government political uncertainty: the total number of officials in a local government involved in graft probes which we label “GRAFT-FLIES,” and the rank-weighted index which we label “GRAFT-TIGERS.”⁴ The two proxies measure the width and depth of the intensity, respectively.

The intensity of local government officials investigated in the campaign is likely to capture the uncertainty for local governments to offer the implicit guarantee. When officials are deposed, especially those in high ranks, political uncertainty in local governments will thwart any effort to bail out distressed LGFVs. In these scenarios, officials are reluctant to take any risky action that potentially hurts their performance or entangle them into the scandals of investigated ex-colleagues. This is the classical “value destruction” hypothesis. Alternatively, local governments with more officials involved in graft probes, especially high-ranking officials, are typically those with good economic development and aggressive political leaders—or so-called “greasing the wheels” hypothesis.⁵ Hence, more corruption would imply lower Chengtou bond yields, as the local governments have better income stream and strong motivation to back up LGFVs. Our findings confirm the “value destruction” hypothesis by documenting a significant and positive relationship between *GRAFT-TIGERS* and Chengtou bond yield spreads, indicating that graft probes on high-ranking officials likely increase the uncertainty for local governments to offer the guarantee.

Ultimately, the capacity and the uncertainty of offering the guarantee, in particular, real estate GDP and political risk, are not independent of each other. In China, real estate is a hotbed for the misuse of power and malpractice. Among the 753 graft probes, we find more than half of the officials had “undesirable working practices” related to the real estate sector. We therefore pay particular attention to the interaction between real estate and political risk in determining the local government financing cost. We find that conditional on the political risk measured by *GRAFT-FLIES*, provinces with higher proportion of real estate value in the local GDP now have higher financing cost, i.e., higher Chengtou bond yields. This conditional finding is important, as it indicates that only in relatively clean (less political risk) local governments, the real estate value is positively related to the capacity to offer the guarantee. In other words, local governments with both higher political risk and higher proportion of real estate value to local GDP will not benefit from local real estate revenues, since such revenues may not be sustainable and likely are impaired by political uncertainty.

1.1. Literature

Since China overtook Japan as the world's second largest economy, there have been fast growing studies on China's economy and policy, such as Brandt and Zhu (1995, 2000), Jiang (2015), Chen et al. (2017), Hsieh and Song (2015), Cong et al. (2017), and Chen et al. (2018). Our paper contributes to this trend of literature by investigating one of the most important problems, that is, Chinese local government debt, in particular, local government financing cost gauged by Chengtou bond yields. We highlight the unique features of Chengtou bonds—government backing and land collateral, which differentiate them from the municipal bonds in the Western world. We further explain the cross-sectional variations of local government financing costs by the joint examination of China's real estate market and political risk.

Real estate is an important driver of the Chinese economy, also a soaring concern for the impact of its meltdown on the Chinese even the global economy. Recent studies such as Fang et al. (2015), Wu et al. (2015), and Chen and Wen (2017) try to calculate housing prices and examine the economic determinants of the housing bubble from the channels like household income or housing supply. Our paper complements these studies by focusing on the fundamental resource supply, the land-use rights authorized by local governments, and consequently, the importance of real estate sector on local government financing cost.

Our paper also contributes to the literature on political risk, especially China's anti-corruption campaign. While political risk influences market prices even in developed countries,⁶ there is a significantly higher level of corruption, combined with the greater

⁴ President Xi Jinping has vowed to crack down on both “tigers” and “flies”—a reference to powerful senior and low-level government officials—in his anti-corruption campaign initiated in the late 2012.

⁵ There is a debate in the literature on the role of corruption on economic growth, for example, Wei (1999), and Mauro (1995). The positive impact of corruption on growth is evidenced in emerging-market countries.

⁶ Butler et al. (2009), for example, uncover a significantly positive relationship between high levels of corruption and the high yields of the U.S. municipal bonds at issue.

opacity of the political system, in China (see, among many others, [Fisman and Wang, 2015](#); [Griffin et al., 2016](#); [Lin et al., 2016](#)). An advantage of studying the Chengtou bond market is that its collateral is closely linked to the real estate market, allowing us to measure the fundamental economic health of the provinces issuing Chengtou bonds. Our finding further suggests that the influence of political risk on local government financing cost is partially through impairing the real estate channel, which has not yet been studied in the literature.

There are very few papers providing economic analysis on Chengtou bonds. [Lu and Sun \(2013\)](#) describe the function of LGFVs and discuss their role in China's credit expansion. [Liu, Lyu, and Yu \(2017a\)](#) examine how the firm characteristics of issuer LGFVs can price Chengtou bonds. We go beyond the standard bond pricing exercise, instead focus on the economic factors affecting local government's backing cash flow, especially real estate, political risk, and their interaction in driving the sharp and large economic variations across provinces, even under the implicit guarantee from local governments and indirect backing from central government.

The rest of this paper is organized as follows. Section 2 provides institutional background on local government finances and Chengtou bond's unique features. In Section 3, we present an example of Chengtou bonds and analyze the potential determinants of bond yield spreads. Section 4 introduces the data and construct the main variables. Sections 5 and 6 present the explanatory power of conventional risk factors and novel risk factors related to the government guarantee, respectively. We conclude in Section 7.

2. Institutional background

In this section, we first provide institutional background on China's local government finances. We then analyze the unique features of Chengtou bonds, emphasizing the special relationship between Chengtou bonds' issuers and the central and local governments.

2.1. Local government finances

The history of local government debt in China can be traced back to 1978 when the economic reform began. Since then, the decision-making power of the central government has been gradually delegated to local governments, and economic growth motives have been driving local governments to search for additional funding resources. The situation has been exacerbated since the early 1990s, when national budget reforms channeled more tax revenues to the central government, while the local spending remained roughly the same. The mismatch was normally balanced by direct budget transfer from the central government and/or extra revenues through channels such as land sales. However, a major proliferation of local government debt was triggered by the 2008–2009 global financial crisis and China's fiscal stimulus of RMB 4 trillions, among which only 1.18 trillions were provided by the central government, while the rest needed to be shouldered by local governments ([Lu and Sun, 2013](#)).

In the presence of increasing fiscal pressure, China's local governments however cannot alleviate the pressure by directly borrowing from banks or issuing bonds, except with the approval from the State Council.⁷ Unlike municipal governments in the United States, local governments in China are also not authorized to levy additional taxes on sales, property, or income, with this arrangement dating from the budget law enacted in 1994. In addition, China's promotion scheme for local government officials, in which officials are rewarded for increasing revenues and meeting the targets set by the central government (see [Li and Zhou, 2005](#)), imparts additional pressure to seek funding resources.

To meet the growing financing challenge while circumventing regulations, China's local governments have created a special purpose vehicle: local government financing vehicles (LGFVs), which act as the principal financing agents for local governments. LGFVs are corporations that can apply for bank loans and issue corporate bonds. This type of bonds, different from standard corporate bonds, has a special name: Chengtou bonds, literally “urban construction and investment bonds.” LGFVs play a crucial role in promoting China's infrastructure development and economic growth, as they provide off-balance-sheet quasi-fiscal support for local governments. For example, they are primarily engaged in the construction of public welfare projects, such as affordable housing, highways, high-speed trains, social services, and environmental protection.

There are other resources of local government finances in addition to Chengtou bonds, for example, direct budget transfer from the central government, loans, and pseudo-municipal bond issues (through the central government). Except for Chengtou bonds, none of the alternative financing channels have market prices. Insofar as Chengtou bonds reflect risks shared by other types of local government financing, the relatively transparent Chengtou bond market provides a clear window to appraise the local governments financing cost.

2.2. Chengtou bond: unique features

As discussed in the introduction, Chengtou bonds have special features different from municipal bonds in the United States. First and foremost, Chengtou bonds are implicitly guaranteed by the local hence central governments, whereas the U.S. Federal government bears no responsibility for muni bonds. [Fig. 1](#) illustrates the relationships of Chengtou bonds' issuers, LGFVs, with the local and central governments. Local governments incorporate LGFVs by injecting capital through budget revenues, usually by transferring land-use rights and existing assets such as highways and bridges. LGFVs then raise funding through bank loans or Chengtou bonds, often using land-use rights or assets as collateral. Through the capital injection, LGFVs are directly and implicitly guaranteed by local governments (we will present a detailed example in [Section 3.1](#)).

⁷ When approved by the State Council, pseudo municipal bonds are issued by the Ministry of Finance on behalf of local governments. With an explicit guarantee from the central government, these local government bonds are quasi treasuries and indeed behave like treasuries.

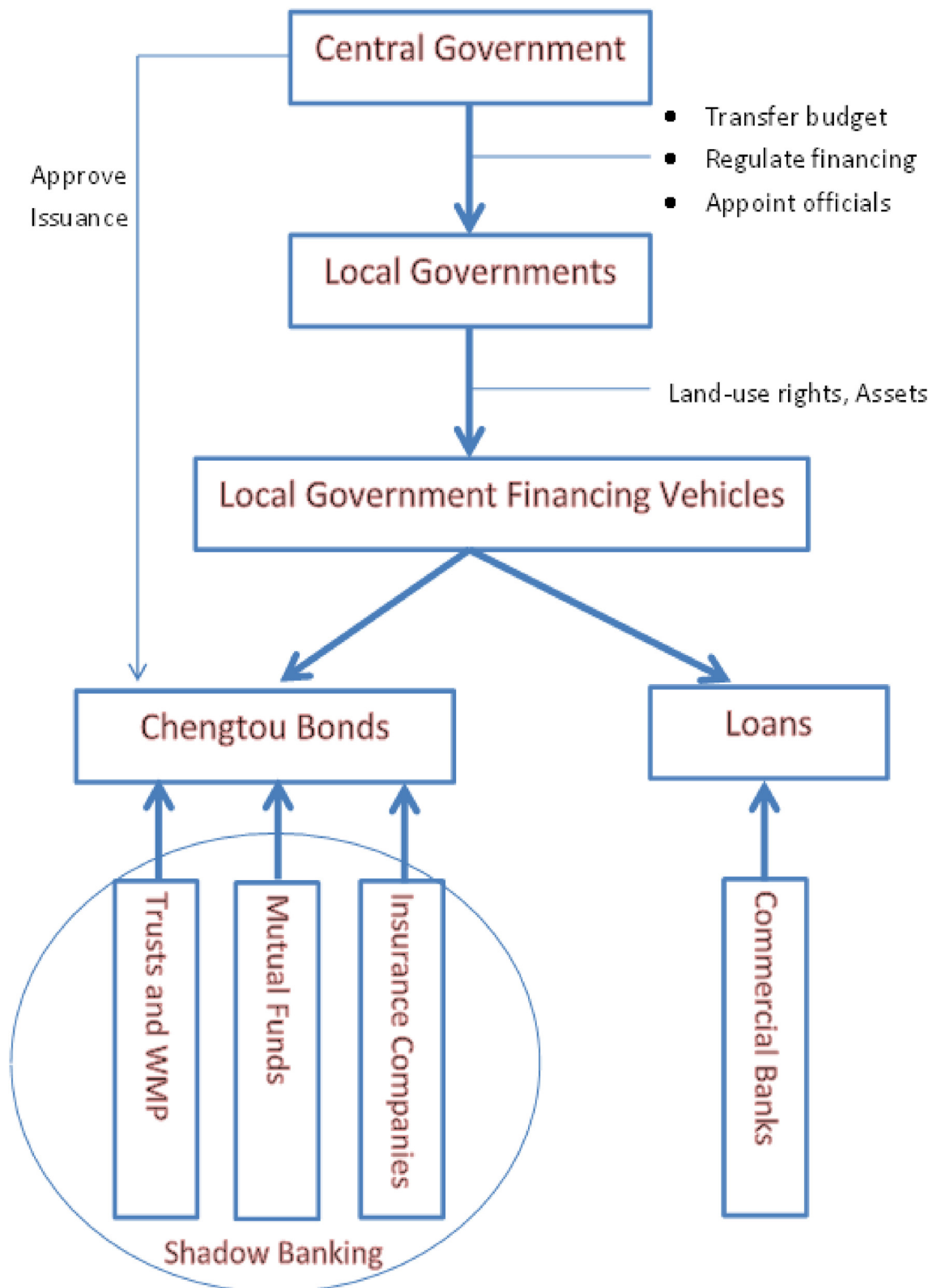


Fig. 1. Illustration of chengtou bonds and the implicit government guarantee.

The central government also exerts interventions to the Chengtou bond market. As explained in the previous subsection, local governments rely on budget transfer from the central government as another major financing channel; local government financing is regulated by the central government; even more, local government officials' promotion are determined by the central government. Thus the central government provides indirect guarantee through its relationship to local governments. For example, the issuance of Chengtou bonds requires the approval from the National Development and Reform Commission (NDRC). In 2012, the NDRC relaxed the approval constraints for Chengtou bond issuance, resulting in the double issue amount from the previous year (see [Xu and Wang, 2013](#)). Investors could have interpreted the central government's "warming up" to the Chengtou bond market as a signal of its willingness to guarantee local government debts. Another example is that as the regulatory institution of local government finances, the State Council released a document in October 2014 giving detailed instructions on Chengtou bond exiting strategy. Meanwhile, the Ministry of Finance and the NDRC began encouraging the refinancing of riskier LGFV debts with low-cost municipal bonds. Effectively, this allowed LGFV debts to be partially shifted off the balance sheet of local governments.

The feature of implicit guarantee results in a phenomenon of zero default in the Chengtou bond market, except several pseudo defaults. For example, Yunnan Highway Development and Investment Co. Ltd. made an announcement in April 2011 that they would pay interest only but not principal of its debts including Chengtou bonds. The announcement sets off panic in the debt market, calling the attention to local government implicit guarantee. Two days after the announcement, the Yunnan Municipal Government asked the company to withdraw the claim, then coordinated the payment.

The second primary feature of Chengtou bonds is that they are often issued with collateral such as land-use rights and assets. In contrast, the U.S. municipal bonds do not have to be backed by physical collateral. The role of land-use rights as collateral naturally links the Chengtou bond market to the real estate market. In absence of defaults and with attractive yields, Chengtou bonds become the most sought-after asset among investors. The primary investors of Chengtou bonds are, according to China Central Depository & Clearing Co., trusts and wealth management products (31.0 percent), mutual funds (24.8 percent), and insurance companies (21.4 percent). Given that trusts and wealth management products are an important part of China's shadow banking, the Chengtou bond market increases local governments' risk exposure to the fragile shadow banking system (see [Chen et al., 2017](#)) and further has a potential impact on China's financial stability. In this sense, China is special since other local government bond markets, like the U.S. municipal bonds, do not carry systemic risk (see [Ang and Longstaff, 2013](#); [Gospodinov et al., 2014](#)). We summarize the distinguishing features of Chengtou bonds and its comparison to the municipal bonds in [Table A.1](#) of the Appendix.

3. Risk analysis of chengtou bonds

In this section we start with a real example of Chengtou bond, then analyze risk characteristics potentially driving the prices of Chengtou bonds.

3.1. An example of chengtou bond

Ordos City Construction Development Group Co. Ltd. issued one billion RMB bonds on April 11, 2011, with a financing cost of 6.99%. Both the bonds and the issuer are assigned a rating of AA by the Lianhe Credit Rating Co. Ltd. (a joint venture with Fitch Ratings). According to the fund-raising statement, the company's primary business is housing construction and real estate development in the Kangbashi District, and the funds raised via these bonds will be used for municipal road construction, demolition and renovation of the old city, and public facilities management.

The fund-raising statement also shows important information on the company's ownership, funding resource, solvency, and profitability. First, the company was founded by Ordos Municipal Government. Registered as a corporation, the company has a board of directors; however, the company does not have shareholders; instead, the government, as the sole owner, controls the board of directors to setup and oversee policies for corporate management as well as to make decisions on major company issues. For example, the chairman of the board of directors is directly assigned by the government, who is the previous deputy secretary general of the municipal government.

Second, the Ordos Municipal Government funds the company by transferring the land-use rights in the Kangbashi District. The company has the full right to rent and develop the land in the district, including granting leases, changing land conditions, setting-up the land usage restrictions, and anything related to real estate development. Having land as the main funding resource naturally exposes the company's financial stability to the risks in the local real estate market.

Third, the primary debt payment funding relies on account receivables which the company will collect from the local government. Under a build-operate-transfer (BOT) contract, the Ordos government grants a concession to the company to construct the roads and to build housing in the district, then the government will pay the projects in a ten-year term. Other debt payment funding sources listed in the statement include the financing from National Development Bank and several primary commercial banks, as well as the asset realization from additional land sales and land development.

According to its financial statement, the company has solid profitability, good liquidity, robust cash-flow, and reasonable leverage. However, during the period of 2011–2014, the media discourses suggested the opposite. From Chinese domestic media to BBC News, Time, CNN, WSJ, Forbes, the New York Times, Ordos (in particular the Kangbashi District) is uncritically presented as an epitome of

“ghost cities.”⁸ The city is filled with office towers, government buildings, museums, theaters and sports fields, not to mention acre on acre of subdivisions overflowing with middle-class duplexes and bungalows. The only problem is that the district was originally designed to house, support and entertain 1 million people, yet hardly anyone lives there. Broad boulevards are unimpeded by traffic; office buildings stand vacant; pedestrians are in short supply; and weeds are beginning to sprout up in luxury villa developments that are devoid of residents. Undoubtedly, there exists an oversupply problem, which will put downward pressure on the revenue of the issue company as well as the local government.

3.2. Determinants of chengtou bond yield spreads

Motivated by the above example, we consider two sets of risk characteristics that potentially determine the price of Chengtou bonds. The first set of variables are conventional risk factors well documented in the credit spread literature, including bond characteristics such as credit rating, trading liquidity, size, and time-to-maturity. The second set of variables are unique and novel, tailored to the special features of Chengtou bonds, that is, risk characteristics related to the implicit government guarantee.

3.2.1. Conventional risk factors

Corporate bond yield spreads are primarily driven by credit risk and liquidity risk (see Collin-Dufresne et al., 2001); municipal bond yield spreads are driven by credit risk, liquidity risk, and tax (see Ang et al., 2015; Wang et al., 2008; Schwert, 2017). Chengtou bonds are issued as corporate bonds but function as municipal bonds, therefore, we expect that Chengtou bonds yield spreads should also be related to its credit and liquidity risk. Different from the U.S. muni bonds.

Chengtou bonds are not tax-exempt; in addition, China has a single corporate tax rate across corporations in the country. Therefore we do not consider tax as an explanatory variable for Chengtou bond yield spreads.

For bond credit risk, the conventional proxy is either credit rating or credit default swap spread. Only a handful of corporations in China has credit default swap spreads, thus we use credit rating as the measure of default risk. Chengtou bonds in our sample are rated from A to AAA, 18.6 percent of bonds have a rating of AAA, 29.7 percent are rated AA+, and 49.3 percent are rated AA.⁹

There is a concern that Chengtou bond ratings in China are inflated thus fail to capture the true default risk. To mitigate this concern, we also consider firm characteristics that reflect the issuer-level credit risk, such as firm profitability, financial leverage, and firm size. Information embedded in these variables is supposed to be fully captured in credit ratings. Only when ratings are not informative, these firm risk characteristics might be useful in explaining the bond yield spreads. In that case, we expect Chengtou bond yield spreads to be positively related to firm leverage and negatively related to firm profitability and firm size.

For bond trading liquidity, we consider two proxies. One is the bid-ask spread calculated using the daily highest and lowest prices following the method in Corwin and Schultz (2012). The other proxy is the trading volume scaled by bond outstanding amount. The literature also documents that bonds with larger issue size and longer remaining maturities tend to have better liquidity.¹⁰ Thus we also consider bond size, which is the logarithm of bond outstanding amount, and bond maturity, which is the remaining years to maturity.

3.2.2. New risk factors

In the above Chengtou bond example, the issuer company is fully funded and owned by the local government. Also, the company's debt payment primarily relies on funding to be collected from the local government. Not surprisingly, investors of Chengtou bonds may perceive the risk not merely based on conventional risk factors, but also based on the implicit government guarantee. To measure the guarantee is, however, a challenge.

Two factors can affect the implicit guarantee. The first factor is the capability of offering the guarantee, which is mainly determined by local government economic conditions. It is difficult however to find accurate indicators of local government economic conditions. Chinese local government's current accounting framework is rudimentary.¹¹ For example, it does not categorize expenditure as operating or capital spending, but rather according to functional purpose, e.g., health, education, or municipal services. As illustrated by the accounts of the Shanghai Municipal Government (see), a typical local government financial report comprises four categories: (1) general budget; (2) government funds; (3) social security fund; and (4) state-owned capital management. The general budget category is the most important, which sets out revenues. In the category of government funds, land related funds is \$219.7 billion RMB, accounting for 87% of the total government funds or 23% of the total annual revenue, indicating that real estate plays an important role in local government revenues. The Ministry of Finance's report as of 2014 confirms this indication. Across all local governments, land sales on

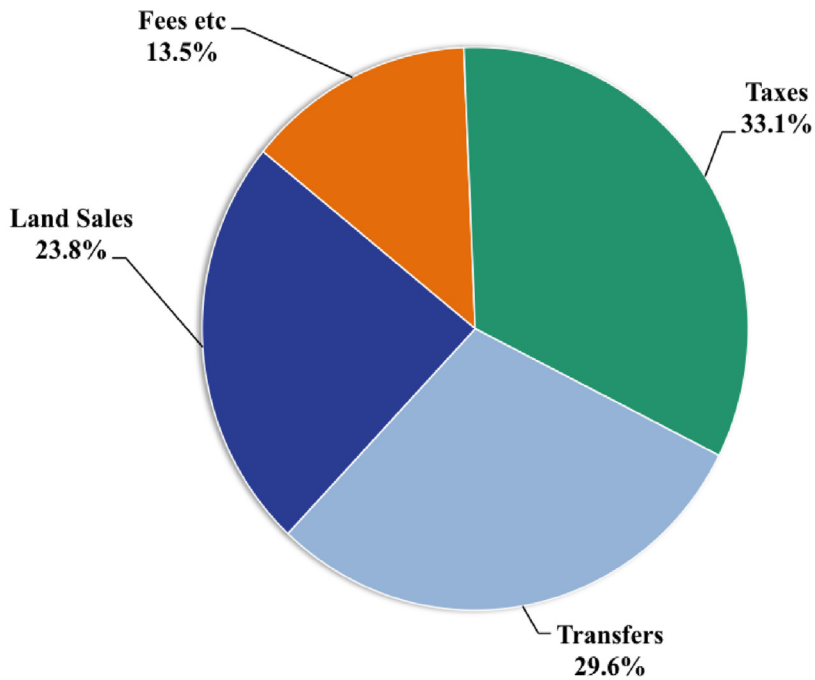
⁸ For example, “Ordos: The biggest ghost town in China.” in BBC News, March 17th, 2012; “Chinese City Has Many Buildings, but Few People.” in the New York Times, October 9th, 2010.

⁹ Chengtou bonds are rated at issue by one of the five major credit rating agencies: (i) China Chengxin International Credit Rating Co., Ltd. (a joint venture with Moody's); (ii) China Lianhe Credit Rating Co. Ltd. (a joint venture with Fitch Ratings); (iii) Dagong Global Credit Rating Co., Ltd.; (iv) Pengyuan Credit Rating Co., Ltd.; and (v) Shanghai Brilliance Credit Rating & Investors Service Co., Ltd. (in partnership with S&P).

¹⁰ The list of supporting literature is long. See Houweling et al. (2005) for a brief summary.

¹¹ The U.S. local government account framework, in comparison to the Chinese counterpart, is well established. Under the independent Governmental Accounting Standards Board standards, the U.S. local governments reports two sets of financial statements: the Government-Wide Statements and the Fund Statements, which provide a consolidated picture of the government's financial operations. The reports include a balance sheet, an income statement, and a statement of cash flows, with detailed disclosure for each debt category such as the total liability, the amount due within one year, and, for bonded debt, scheduled debt service payments for the next five years.

A. Composition of Local Government Revenues



B. Composition of Local Government's Tax Receipts

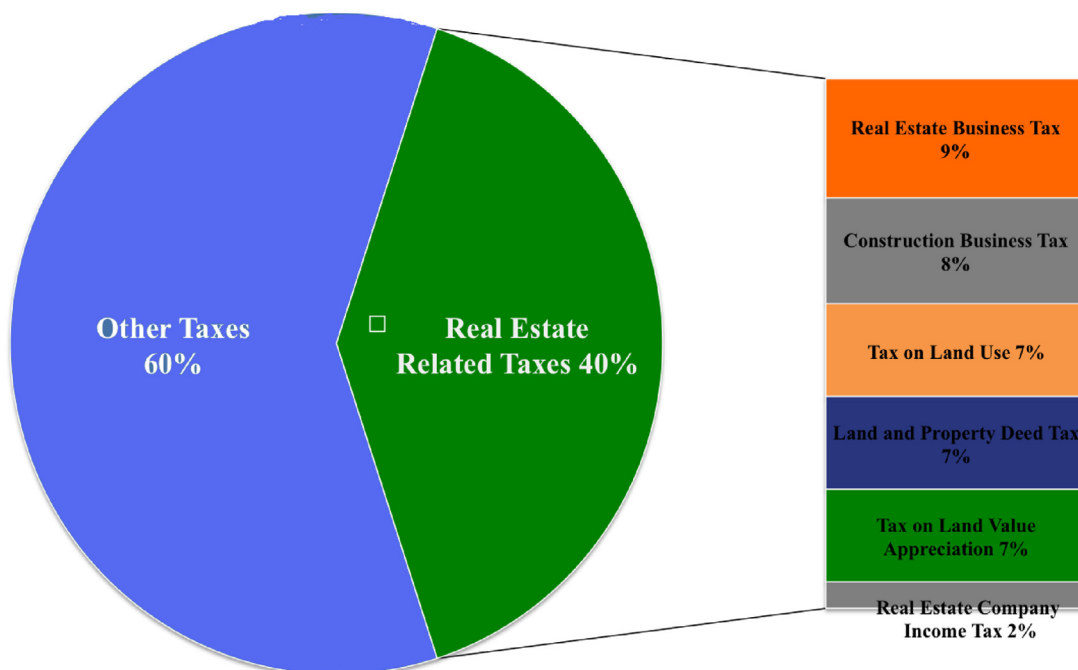


Fig. 2. Land Sales Are a Key Revenue Source for Local Governments. Statistics are based on the report released by the Ministry of Finance in 2014.

average accounts for 23.8% of the total avenue, as shown in Fig. 2. Other important components contributing to the total revenue are Taxes (33.1%) and central government direct transfers (29.6%). In the total taxes, real estate related taxes account for 40%, including real estate business tax (9%), construction business tax (8%), tax on land use (7%), land and property deed tax (7%), tax on land value appreciation (7%), and real estate company income tax (2%).

These stylized facts offer two useful guidelines in measuring the local government's capability of offering the guarantee. First, real estate is undoubtedly a key component in local government revenues and a crucial driver of local economies. Thus we try to explore real estate related variables such as the real estate value-added GDP, real estate tax, real estate prices, etc. Second, the rudimentary financial report, in particular the lack of debt disclosure, sets a significant obstacle to construct leverage and other conventional variables that capture local government's solvency risk.¹² Instead, we should construct alternative variables such as the fiscal gap between revenues and expenditures, as well as the GDP growth. We will introduce the variables collected and constructed in Section 4.3, which probably makes the best effort in the existing literature to capture local government economic conditions in China.

The second factor affecting the implicit guarantee is the uncertainty of offering such guarantee. Even with full capability, a local government may be unable or unwilling to fulfill the guarantee. In the aforementioned Chengtuo bond example, the bond's fund-raising statement has one chapter discussing its potential risks for investors. In addition to redemption and liquidity risk, there is one particular risk related to the policy changes of the local and central government. For example, "any changes in related government policies can potentially affect the issuer's capability of redemption." In particular, "land-use rights serve as an important collateral for the issuer's financing. However, the land-use rights transferred from the local government are exposed to the risk of any change in the real estate policies and that in the local real estate market."

In China, the central government has a significant influence at the local level, from appointing local government officials to governing the financing of local governments. For example, in the Bo Xilai political scandal in 2012 (Liu, Shu, and Wei, 2017b), some policies and decisions made by the Chongqing Municipal Government, that is, the Bo administration, were frozen or withdrawn later by the central government. The scandal significantly interfered with the local real estate market and local companies, especially those with political connections or exposures, which then has a rippling effect on local government economic conditions.

To measure the political uncertainty, we propose a novel measure based on the data manually collected from China's anti-corruption campaign since 2012. We posit that the intensity of local government officials investigated in the campaign captures the uncertainty for local governments to offer the implicit guarantee. When officials are deposed, especially those in high ranks, the political uncertainty in local governments will thwart any effort to bail out distressed local government financing vehicles. In these scenarios, officials are reluctant to take any risky action that potentially hurts their performance or entangle them into the scandals of investigated ex-colleagues. We consider two proxies for the intensity of local government officials investigated in the anti-corruption campaign: the total number of officials which we label *GRAFT-FLIES*, and the weighted index of investigations which we label *GRAFT-TIGERS*. The two proxies measure the width and depth of the intensity, and their construction will be explained in Section 4.4.

On top of the above two factors, we also consider local government risk exposures to the central government as control variables, which can affect both the capability and the uncertainty of offering the guarantee. When a policy is issued by the central government, its implementation at the local level may differ. Moreover, given the large proportion of the central government direct transfer in local government revenues, 29.6% as shown in Fig. 2, there is an uncertainty on whether or not the central government will help a distressed local government, or to what degree to help a particular local government. For example, local governments in provinces like Gansu and Ningxia rely heavily on the central government direct transfer, thus any policy change or any shock to the national financial and economic conditions may expose these local governments to even higher risk. In sum, it is necessary to take into consideration of the local government risk exposure to central government.

4. Data and main variables

Our analysis of local government financing cost relies exclusively on the prices of Chengtuo bonds, which is the only financing resource with market prices. We collect Chengtuo bond transaction prices, as well as bond issuance and bond characteristics from Wind Information Co. (WIND), the primary provider of Chinese financial and economic data. Chengtuo bonds trade mainly in the interbank bond market, about 68 percent of all transactions, and another 30 percent trade in the Shanghai and Shenzhen stock exchange markets. To get accurate bond pricing information, we only keep bonds which are matured or listed in the interbank or exchange markets and screen out bonds with special terms such as callable.

We consider a sample period from August 2007 to December 2014. We start the sample in August 2007 due to the concern on Chengtuo bond market liquidity. The monthly trading frequency, measured as the ratio of the number of traded bonds to the total number of outstanding bonds in each month, is below 30 percent before 2006, jumps to 65 percent in 2007, and remains stable between 60 and 70 percent after August 2007. We end the sample in December 2014 to ensure a clean analysis. Since 2015, China's Ministry of Finance initiated a bond swap plan for local government debts over the next five years. The swap plan aims to reform the local government financing from riskier Chengtuo bonds to standard municipal bonds. That is, local governments are no longer permitted to rely on LGFV's bonds as the financing channel, meanwhile, the outstanding Chengtuo bonds will be gradually swapped into municipal bonds.

¹² China adopted a new budget law in January 2015 to overhaul the public finance system. The law requires local governments to report debt statistics on their balance sheets and to disclose it publicly by 2020. This will provide investors with a more accurate picture of local government revenues, expenditures, operating costs, and cash flows. However, until the planned measures take full effect in 2020, there is likely to be a continued shortage of transparent information on local government debt and leverage.

This regulation change will make Chengtou bonds a legacy asset. Our study hence becomes more valuable as Chengtou bonds offer the unique opportunity to examine the price distortion incurred by the government guarantee.

4.1. Chengtou bond issuance

The history of the Chengtou bond market started with Pudong development bond, a first of such bonds, issued in Shanghai in 1992 with a value of RMB 500 millions. Both the number of bonds issued and the issue amounts were negligible before 2005 but since the fiscal stimulus in the late 2008, the Chengtou bond market has expanded dramatically, as shown in Table 1 and Fig. 3. The number of bonds issued in 2009 jumped to 258 compared to just 79 in 2008. The post-2008 average growth rate of new issues has been 85 percent per annum. In 2014, the number of Chengtou bond issuance reached 1,704, with a total outstanding amount of RMB 4.95 trillions (USD 0.82 trillions). Panel B of Table 1 summarizes Chengtou bond issuance by province. By the end of 2014, there were 30 provinces which had issued and had outstanding Chengtou bonds. The top five provinces with the largest issue amount are Jiangsu, Zhejiang, Beijing, Shanghai, and Guangdong. These provinces represent 40 percent of the total RMB 5.92 trillions Chengtou bonds issuance. These are all coastal provinces, except for Beijing which is the capital. The five provinces with the smallest issuance are Ningxia, Hainan, Jilin, Qinghai, and Shanxi. With the exception of Hainan, these are all interior provinces. Decomposing the issue amount by maturity, as shown in Panel B of Fig. 3, it is clear that the bonds issued before 2008 are mainly long-term and very short-term bonds. Since the global financial crisis of 2007–2008, the newly issued bonds mainly have a maturity of three to seven years, accounting for 66 percent as of 2014.

The rapid expansion of the Chengtou bond market goes hand-in-hand with higher yields, which is consistent with investors perceiving greater risk in the increasing LGFV liabilities. Panel A of Table 1 also shows that the yields of newly issued bonds increased from an average value of 3.89 percent in 2006 to 6.75 percent in 2014. There are increases in yields even for short-term bonds with a maturity less than one year; such bonds exhibit the yield increase from 2.72 percent in 2009 to 5.60 percent in 2014.

4.2. Chengtou bond yield spread

Chengtou bond yield spread, as the measure of local government financing cost, is the cornerstone of our analysis. We define the yield spread as the difference between the Chengtou bond yield and the (synthetic) matching central government bond yield:

$$Y_{ij}(t) = y^{CT}(t) - y^{CGB}(t), \quad (1)$$

where $y^{CT}(t)$ is the yield for Chengtou bond i in province j at time t , which we calculate based on the transaction price at time t and bond characteristics such as coupon rate, interest payment frequency, and maturity; $y^{CGB}(t)$ is the matching central government bond yield at time t , which has the same cash flow characteristics as Chengtou bond i . The detailed methodology is introduced in the appendix.

We calculate the Chengtou bond yield spreads at the daily frequency, and then aggregate to the monthly frequency. Fig. 4 plots the dispersion of Chengtou bond yield spreads. Evidently, there is a large heterogeneity and the average range between the 10th and 90th percentiles is 1.84 percent with a standard deviation of 0.87 percent. In addition, the dispersion of yield spreads changes over time, and tends to increase when the median yield spread level is high. This suggests that the market finely distinguishes the underlying risk of Chengtou bonds across local governments when the overall market condition deteriorates.

4.3. Local government economic conditions

We consider province-level economic barometers that potentially affect the local government's capability of offering the guarantee. It is worth noting that Chengtou bonds can be issued by LGFVs in the province, city or county level. We study the financing cost of local government specifically referring to the province level for three reasons. First, due to China's administration system, a potential 'bail-out', even if it is at city or county level, needs to be proved and instructed by provincial officials. It is thus local province governments who shoulder the responsibility of guarantee. Second, the financial reports of local province governments consolidate the finances of lower tier governments. Unconsolidated information for individual cities and counties is compiled as well. Third, the data for city- and county-level economic conditions are in poor quality in terms of coverage and accuracy, thus not suitable for a rigorous analysis.

As discussed in Section 3, the rudimentary accounting framework of local governments, in particular the lack of debt disclosure, sets a significant obstacle to construct leverage and other conventional variables that capture solvency risk of local governments. Instead, we construct variables such as the fiscal gap between revenues and expenditures, as well as the GDP growth. We also collect the various components of local GDP, for example, the real estate value contributing to the local GDP. In addition, we consider other real estate related measures such as the land cost, the real estate price, the loans to the real estate sector, the tax on real estate, and the local real estate related investment.

REAL ESTATE GDP The proportion of real estate business contributing to the local GDP

SERVICE GDP The proportion of lease and business service contributing to the local

GDP RETAIL GDP The proportion of wholesale and retail business contributing to the local

GDP CONSTN GDP The proportion of construction business contributing to the local GDP

TRANS GDP The proportion of transportation and logistic business contributing to the local.

GDP.

Table 1
Chengtou bond issuance.

Panel A: Issuance over Time															
Year	Number of Bonds Issued (Years)					Issue Amount (¥Bil)					Issue Yield(%)				
	(0,1]	(1,3]	(3,7]	(7,30]	Total	(0,1]	(1,3]	(3,7]	(7,30]	Total	(0,1]	(1,3]	(3,7]	(7,30]	Average
1997–2002	0	6	8	6	20	0.0	1.4	4.5	13.3	18.3	–	5.05	7.65	4.16	5.62
2003	0	0	0	6	6	0.0	0.0	0.0	18.3	18.3	–	–	–	4.55	4.55
2004	0	0	1	2	3	0.0	0.0	1.4	3.0	4.4	–	–	5.30	5.05	5.18
2005	12	0	3	14	29	18.2	0.0	3.5	20.9	42.6	2.95	–	4.58	4.90	4.14
2006	19	0	1	17	37	23.1	0.0	0.6	20.9	44.6	3.55	–	4.00	4.12	3.89
2007	34	0	2	36	72	42.1	0.0	3.2	36.8	82.1	4.38	–	3.25	5.30	4.31
2008	36	3	41	14	94	49.3	6.3	68.3	32.5	156.4	5.03	5.72	5.97	6.01	5.68
2009	40	13	160	42	255	45.6	23.2	258.5	88.1	415.4	2.72	4.19	5.67	5.60	4.55
2010	68	17	141	37	263	79.4	19.9	183.0	54.8	337.1	3.32	3.99	5.53	5.85	4.67
2011	74	30	254	38	396	70.7	35.6	326.4	56.1	488.7	5.64	5.89	6.61	6.86	6.25
2012	139	131	637	58	965	133.1	133.4	734.9	89.1	1090.5	5.09	5.98	6.76	6.77	6.15
2013	193	226	550	54	1023	221.9	190.0	659.7	130.5	1202.0	5.43	6.63	6.42	5.87	6.09
2014	484	492	902	64	1942	471.2	328.2	1023.2	110.0	1932.5	5.60	7.46	7.07	6.87	6.75
Total	958	330	3182	462	4932	1053.9	229.0	3882.5	756.9	5922.3					

Panel B: Issuance by Province							
Province	Amount(¥Bil)	Bonds	Issuers	Amount(¥Bil)	Bonds	Maturity (year)	Rating
Jiangsu	949.89	844	223	745.78	689	5.20	3.80
Zhejiang	418.58	426	120	360.09	362	6.11	3.63
Beijing	390.37	199	25	246.10	125	5.14	4.68
Shanghai	296.83	221	43	162.93	119	5.09	4.45
Guangdong	280.10	198	56	227.65	145	5.92	4.12
Shandong	272.57	246	73	256.07	232	6.56	3.67
Hunan	270.90	207	56	249.58	193	6.39	3.56
Chongqing	268.55	219	61	254.55	205	6.49	3.74
Tianjin	259.62	155	38	209.07	124	5.44	4.03
Anhui	258.24	229	53	222.64	196	6.02	3.64
Sichuan	233.97	216	64	202.92	183	5.27	3.53
Hubei	194.92	169	43	176.30	151	6.72	3.76
Liaoning	192.45	152	47	190.55	145	6.96	3.25
Jiangxi	185.05	165	35	154.20	135	5.80	3.81
Fujian	175.54	189	46	148.54	154	5.51	3.62
Henan	143.35	124	38	133.85	109	6.82	3.57
Shaanxi	128.70	103	30	101.10	85	5.06	3.69
Hebei	118.05	98	26	112.15	89	7.40	3.73
Yunnan	117.60	105	26	105.95	94	5.95	3.57
Guangxi	116.61	119	29	98.81	98	5.91	3.63
Guizhou	102.50	80	30	100.80	78	7.15	3.20
Xinjiang	96.22	103	34	85.52	84	5.86	3.26
Gansu	95.00	63	13	71.90	52	5.43	3.82
Inner Mongolia	92.25	80	29	85.30	72	6.72	3.38
Heilongjiang	80.98	74	19	77.58	70	6.75	3.40
Shanxi	59.55	44	15	57.85	41	7.06	3.36
Qinghai	49.10	41	8	44.00	34	7.15	3.63
Jilin	44.47	39	10	42.47	37	6.90	3.68
Hainan	16.40	12	3	16.40	12	6.51	3.67
Ningxia	13.90	12	5	13.90	12	8.22	3.75
Total	5922.25	4932	1298	4954.54	4125	6.25	3.69

The table reports Chengtou bond issuance in terms of the number of bonds issued each year, the issue amount in billions of RMB, and the yield at issue in percentage broken down by maturity buckets (Panel A) and by province (Panel B). Maturity buckets include less than or equal to one year, (0,1]; between one and three years, (1,3]; between three and seven years, (3,7]; and between seven and thirty years, (7,30]. *Amount* in Panels A and B is in RMB billions. We assign integer values to ratings: one for A increasing to six for AAA. We report the average maturity and the average rating at issue.

FOODLOD GDP The proportion of food and lodging business contributing to the local GDP.

GDP GROWTH The log difference of real GDP.

FISCAL GAP Difference of revenue and expenditure scaled by local

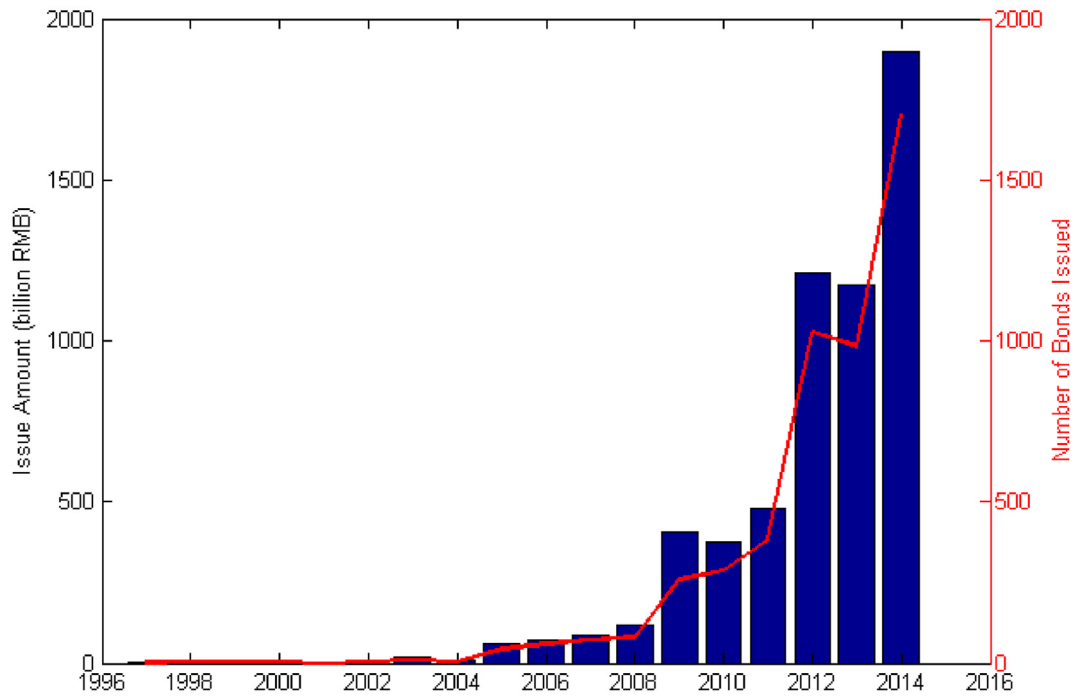
GDP LAND COST Total amount used to purchase land scaled by local

GDP RE TAX Ratio of real estate tax to the total tax.

RE PRICE Average selling price of buildings.

RE LOAN Amount of loans to real estate companies scaled by local GDP.

A. Issue Amount and Issue Numbers



B. Issue Amount by Tenor

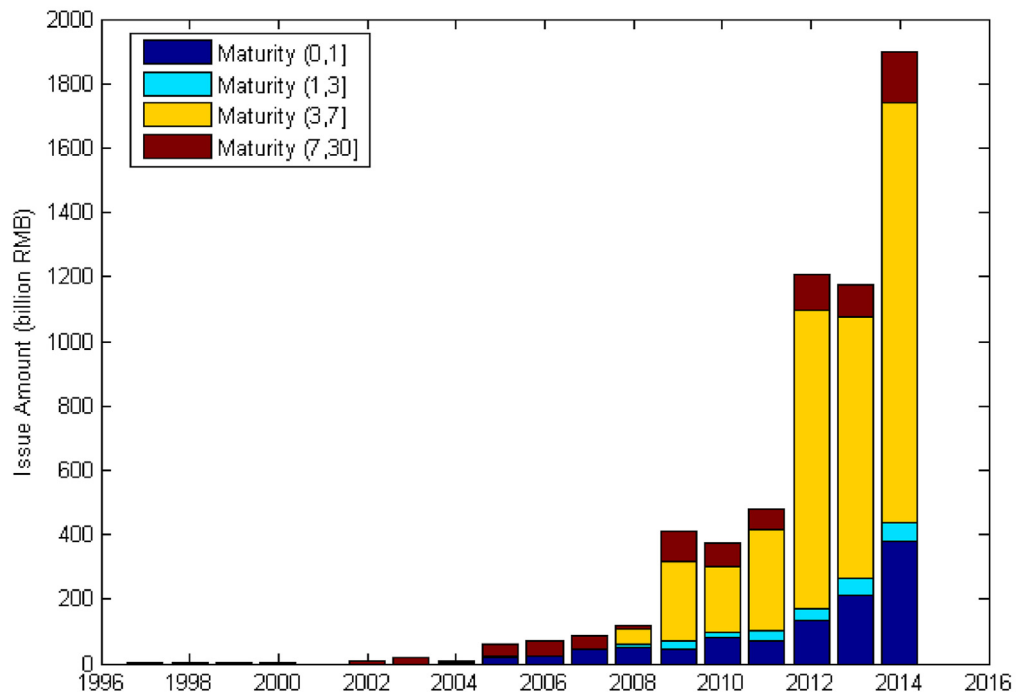


Fig. 3. Annual issuance of chengtou bonds.

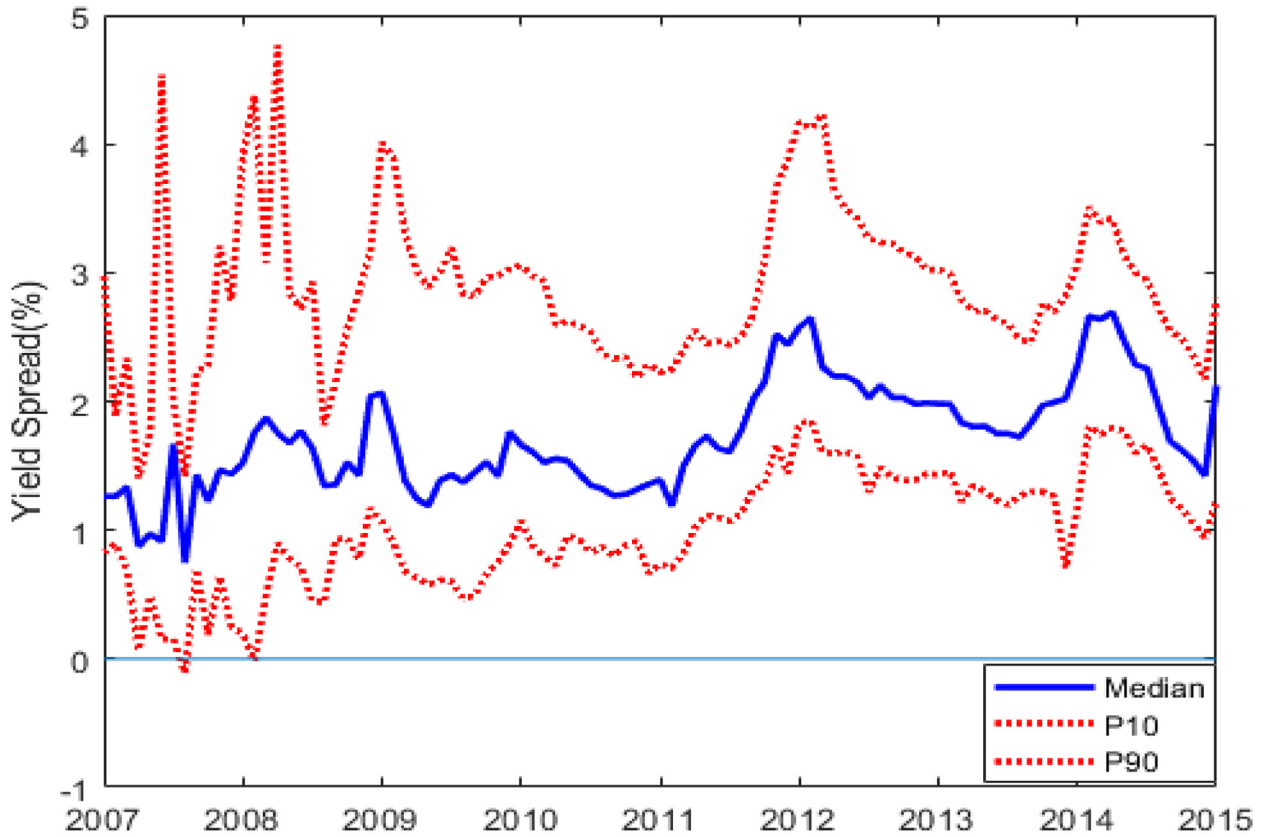


Fig. 4. Dispersion of chengtou bond yield spreads.

RE INVEST Investment in real estate development scaled by local GDP.

All data are downloaded from the National Bureau of Statistics and WIND. These variables are available for each local government at the annual frequency from 2006 to 2014. Table 2 reports the summary statistics of these variables. In particular, Panel C of Table 2 presents the correlation matrix of six real estate variables. The real estate value-added GDP synthesizes different dimensions of real estate information and captures the overall contribution to the local economy by the real estate sector, while the remaining five variables captures the information in one dimension of real estate, such as price, cost, tax, loans, and investment. They are positively related to each other, as expected, with the correlation values ranging from 0.16 to 0.88.

Given the close relationship of local governments to the central government and the fact that Chengtou bonds are indirectly guaranteed by the central government, we also construct local government risk exposures as control variables. We choose the following national variables to calculate risk exposures, on the basis that they capture China's solvency risk, monetary policy, and financial market conditions. Among these national variables, credit default swap rates (*CDS*), foreign direct investment (*FDI*), and current account (*CA*) capture different aspects of solvency risk. The effective real exchange rate (*FX*) and the one-year time deposit interest rate (*RF*) serve as the proxies of monetary policies, with the latter the benchmark interest rate adopted in China. For China's financial market conditions, we take the Chinese stock market index (including all A-shares and B-shares) and calculate the value-weighted return (*RET*). These variables are collected from WIND, China's National Bureau of Statistics, and Global Financial Data, and are available at the monthly frequency from August 2007 to December 2014.

We estimate local government risk exposures by calculating the betas of province-level Chengtou bond yields with respect to national economic barometers in the following model:

$$\Delta Y_{jt} = \alpha_j + \beta_{j,F} \Delta F(k)_t + \varepsilon_{jt} \quad (2)$$

where ΔY_{jt} is the monthly change of province-level yield spreads, computed by averaging the yield spreads across all Chengtou bonds issued in local government j during month t . $\Delta F(k)_t$ is the change of national economic barometers from month $t - 1$ to month t . We run the regression (2) for each local government j using the full sample data from August 2007 to December 2014, a total of 89 monthly observations. The factor loadings, $\beta_{j,F(k)}$, measure the contemporaneous response of province-level yield spreads to the changes in national economic conditions.

We report summary statistics of the distribution of betas in Panel A of Table 2. The betas exhibit significant variation across local governments, with the largest dispersion between the 10th and 90th percentiles being 1.79 for betas on the Chinese stock market return

Table 2
Summary statistics of main variables.

Panel A: summary statistics						
Variable	Mean	Median	SD	P10	P90	
Bond Yield Spread (%)	1.98	1.90	0.81	1.11	2.98	
REAL ESTATE GDP (%)	3.98	3.66	1.45	2.49	6.23	
SERVICE GDP (%)	10.50	10.29	2.28	7.46	13.53	
RETAIL GDP (%)	8.32	7.99	2.38	5.68	11.72	
CONSTN GDP (%)	6.84	6.49	1.91	4.38	9.39	
TRANS GDP (%)	5.36	4.97	1.61	3.80	8.16	
FOODLGD GDP (%)	2.28	2.15	0.81	1.55	3.13	
GDP GROWTH(%)	11.92	12.11	2.52	8.49	15.00	
FISCAL GAP(%)	13.92	10.19	18.12	2.13	24.43	
GRAFT-TIGERS	2.18	2.19	0.31	1.88	2.40	
GRAFT-FLIES	29.81	28.00	17.35	12.00	50.00	
LAND COST (%)	1.85	1.38	1.36	0.72	3.71	
RE TAX (%)	2.75	2.69	0.60	2.07	3.56	
RE PRICE ('000/m ²)	4.88	4.05	3.13	2.27	8.74	
RE LOANS (%)	2.64	2.09	2.32	0.58	5.20	
RE INVEST(%)	15.70	14.15	6.41	9.18	24.38	
SIZE (log(Mil))	7.12	6.91	0.84	6.21	8.16	
MATURITY (year)	3.77	3.33	3.11	0.54	7.59	
SPREAD	0.23	0.00	0.76	0.00	0.59	
RATING	4.52	4.00	1.35	3.00	6.00	
TURNOVER (%)	33.80	11.00	82.25	0.06	79.59	
β_{CDS}	0.12	0.13	0.22	-0.08	0.33	
β_{FDI}	0.14	0.12	0.20	-0.08	0.34	
β_{CA}	-0.01	-0.02	0.04	-0.04	0.02	
β_{FX}	0.00	-0.01	0.03	-0.04	0.03	
β_{RF}	-0.27	-0.26	0.61	-0.70	0.24	
β_{RET}	0.11	0.18	0.63	-0.72	0.55	

Panel B: Correlation of real estate variables						
	RE GDP	LAND COST	RE TAX	RE PRICE	RE LOAN	RE INVEST
RE GDP	1.00					
LAND COST	0.52	1.00				
RE TAX	0.35	0.28	1.00			
RE PRICE	0.68	0.64	0.32	1.00		
RE LOAN	0.54	0.53	0.28	0.58	1.00	
RE INVEST	0.34	0.42	0.12	0.42	0.88	1.00

Panel C: Correlation of local government economic conditions										
RE GDP	RE GDP 1.00	SERVICE	RETAIL	CONSTN	TRANS	FOODLGD	GROWTH	FGAP	TIGERS	FLIES
SERVICE GDP	0.54	1.00								
RETAIL GDP	0.58	0.89	1.00							
CONSTN GDP	-0.35	-0.60	-0.53	1.00						
TRANS GDP	-0.20	-0.19	-0.20	-0.03	1.00					
FOODLGD GDP	0.11	0.09	-0.03	0.07	0.12	1.00				
GDP GROWTH	-0.22	-0.20	-0.21	0.04	0.19	0.12	1.00			
FISCAL GAP	-0.33	-0.52	-0.38	0.70	0.06	0.24	0.03	1.00		
GRAFT-TIGERS	-0.27	0.04	-0.02	-0.14	-0.01	-0.21	0.14	-0.16	1.00	
GRAFT-FLIES	0.10	-0.06	-0.07	-0.29	-0.05	0.16	-0.02	-0.32	-0.07	1.00

Variables are defined in Sections 4.3 and 4.4. The correlation matrix is calculated based on the full sample from August 2007 to December 2014.

(*RET*) and 1.17 for betas on the change in the one-year time deposit rate (ΔRF). In untabulated analysis, we sort local governments into three portfolios: Low, Medium, and High, based on the betas for each risk exposure. We find significant differences in the Chengtou bond yield spreads between the Low and High portfolios sorted by each and all risk exposures. For example, local governments with higher betas to China's solvency risk, CDS, tend to have higher Chengtou bond yields, with the difference between the High and Low portfolios being 0.24 percent. This is consistent with the close link between local and central government finances: as the central government becomes riskier, Chengtou bond yields in the local governments most exposed to the central government also increase. These univariate portfolio sorting results suggest that Chengtou bonds yields are sensitive to local government risk exposures to national solvency risk, monetary policy, and financial market conditions. We will include local government risk exposures, β s, as control variables in our main empirical tests.

4.4. “TIGERS” and “FLIES”—Political risk proxies

When China's new Politburo took power in November 2012, the Communist Party of China launched an anti-corruption campaign. President Xi Jinping has vowed to crack down on both “tigers” and “flies”—a reference to powerful leaders and low-level local officials—in his campaign against corruption.¹³ Up to the end of our sample, December 2014, China's Central Commission for Discipline Inspection (CCDI), the organization in charge of the anti-corruption drive, had investigated a significant number of officials from township-level “flies” to high-ranking “tigers.”

We measure province-level political risk through CCDI's graft investigations during November 2012 to December 2014. We manually compile a list of individual officials in graft investigations published on the CCDI website. There are a total of 753 officials named in the graft investigations, covering 30 provinces. We further collect information on the titles and rankings of corrupt officials, and categorize individuals into five categories.¹⁴ The final index number, denoted as *GRAFT-TIGERS*, is a weighted ranking of corrupt officials in each province, which gauges the qualitative severity of local political risk. A higher index number suggests more severe corruption for corresponding provinces, and thus greater political risk. We also use the number of officials listed in the graft cases in each province as an alternative proxy, denoted as *GRAFT-FLIES*, which gauges the quantitative severity of local political risk. The average corruption index number is 2.18 with a standard deviation of 0.31 across 30 provinces whose LGFVs issue Chengtou bonds. On average, there were 30 officials investigated for each province, with a standard deviation of 17, as shown in Panel A of Table 2. The number of officials named in the graft report varies across provinces: Tianjin and Guangxi, for example, each have four cases in our sample, whereas Shanxi has 49 cases, and Sichuan and Hubei have 50 and 51 cases, respectively.

It is worth noting that both political risk proxies are static evaluations for each province based on the aggregate graft investigation results from the beginning of the anti-corruption campaign to the end of our sample, that is, the proxies are not changing over time. The anti-corruption campaign is a series of progressive effort. Investigations proceed in steps and the graft probes are released gradually. The aggregate results are more accurate in terms of appraising the overall political risk in a particular province. Any time t graft probes only provide partial information; the probes not released at time t do not suggest that those related corruptions do not exist and the probes released later should also be counted into the appraisal. Moreover, even if the time- t graft probe announcement has any impact on the market, it reflects the *corpus delicti* which happened in the past few years. Therefore, we think it is more appropriate to capture political risk using the aggregate corruption investigation results, and then study its impact on the Chengtou bond yield spreads. For scrutiny, we conduct a placebo test in Section 6.2.1 and conduct an event study on the graft announcements in Section 6.2.2.

5. The explanatory power of credit and liquidity risk

We examine the explanatory power of conventional risk factors in the following specification:

$$Y_{ijt} = \alpha_0 + \eta_t + \gamma' Z_{ijt} + \varepsilon_{ijt}, \quad (3)$$

where Y_{ijt} is the yield spread of Chengtou bond i in local government j in month t , and η_t is the year-month fixed effect. Z_{ijt} is a vector of conventional risk factors including *BOND SIZE* defined as the logarithm of bond issuing amount, *MATURITY* defined as the remaining years to maturity, *SPREAD* defined as the bid-ask spread, *RATING* defined in numerical values with a higher number for higher credit quality, and *TURNOVER* defined as the trading volume scaled by bond outstanding amount. As a robustness check, we also consider firm-level characteristics including *FIRM SIZE* defined as the logarithm of total asset, *LEVERAGE* defined as the ratio of total liability to total asset, *FIRM LIQ* defined as the ratio of current assets to current liabilities, and *ROA* defined as the ratio of net income to total assets.

Our main findings are twofold. First, specifications (2) and (5) in Table 3 presents an unexpected positive relationship between bond trading liquidity and bond yield spreads, that is, bonds with high liquidity tend to have higher yield spreads. In particular, one standard deviation decrease in bond spread is related to 4.4 basis points increase in the yield spreads, and one standard deviation increase in bond turnover is related to 7.1 basis points increase in the yield spreads. In the fixed income literature, higher liquidity usually leads to lower yields as the greater liquidity should be more attractive to investors. Surprisingly, Chinese investors seem to favor high-yield Chengtou bonds and trade more correspondingly. We postulate that the positive relationship between trading liquidity and bond yields is due to the “reaching for yield” under the implicit government guarantee. As mentioned in Section 3, there does not exist a real default in the Chengtou bond market. Devoid of default risk, investors would prefer bonds with yields as high as possible, therefore the high-yield bonds become the most actively traded in the market.

Consistent with the “reaching for yield” hypothesis, we find that the turnover ratio is higher for lower-rating bonds, say 52.6% for bonds with AA rating and 46.8% for bonds with AA- rating, in contrast to 31.8% for bonds with AAA rating and 18.4% for bonds with AA+ rating. In specification (7), we introduce an interaction term between turnover and the indicator of high-quality bonds, the latter is a dummy variable which is equal to one if a bond is rated AAA, and zero otherwise. Specification (7) in Table 3 shows that while the coefficient on turnover remains significantly positive, the coefficient on the interaction term between turnover and the high-quality

¹³ Cited from the speech of Xi: “We must uphold the fighting of tigers and flies at the same time, resolutely investigating law-breaking cases of leading officials and also earnestly resolving the unhealthy tendencies and corruption problems which happen all around people,” according to the state news agency Xinhua on January 22, 2013.

¹⁴ The rankings have five levels, 5-governor, 4-vice governor, 3-mayor, 2-vice mayor, 1-township and below. Officials with higher ranking than governor, who are from the central government or the military, are not included in our sample.

Table 3
Explanatory power of conventional risk factors.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
<i>BOND SIZE</i>	-0.213***					-0.098**			0.047
<i>MATURITY</i>	(-6.38)	-0.009				(-2.29)			(1.27)
		(-0.67)				0.024**			0.025***
<i>SPREAD</i>						(2.33)			(2.80)
<i>RATING</i>			-0.044*			0.003			-0.044
			(-1.86)	-0.283***		(0.22)			(-1.52)
<i>TURNOVER</i>				(-17.61)	0.071***	-0.321***	0.153***		-0.195**
<i>TURNOVER*HQ FIRM SIZE</i>					(3.37)	(-13.84)			(-2.21)
						0.038**			0.032***
						(2.22)	(7.00)	0.042	(2.78)
							-0.276*** (-9.78)		0.075
<i>LEVERAGE</i>								(0.24)	(0.43)
								-0.000	-0.000
<i>FIRM LIQ</i>								(-0.05)	(-0.05)
								0.002	0.003
								(0.70)	(1.03)
<i>ROA</i>								0.016	0.018*
Constant	3.503***	2.035***	2.017***	3.246***	1.978***	2.632***	1.976***	(1.63)	(1.73)
	(16.76)	(27.37)	(30.24)	(35.07)	(30.45)	(13.58)	(30.06)	2.955***	3.100***
FIXED EFFECT	YM	YM	YM	YM	YM	YM	YM	YM, F	YM, F
CLUSTER	LG	LG	LG	LG	LG	LG	LG	LG	LG
Observation	20420	20420	20420	20420	20420	20420	20420	11928	11928
Adj. R2	0.144	0.120	0.121	0.264	0.125	0.274	0.143	0.380	0.393

This table presents the panel regression results of Chengtou bond yield spreads on conventional risk factors, as in regression (3). The explanatory variables include *BOND SIZE* defined as the logarithm of bond issuing amount, *MATURITY* defined as the remaining years to maturity, *SPREAD* defined as the bid-ask spread, *RATING* defined as numerical values with 6 for AAA, 5 for AA+, 4 for AA, 3 for AA-, 2 for A+, and 1 for A, and *TURNOVER* defined as the aggregate monthly trading volume scaled by bond outstanding amount. *HQ* is a dummy variable which is equal to one if a bond is rated AAA, and zero otherwise. As a robustness check, we also consider firm-level characteristics including *FIRM SIZE* defined as the logarithm of total asset, *LEVERAGE* defined as the ratio of total liability to total asset, *FIRM LIQ* defined as the ratio of current assets to current liabilities, and *ROA* defined as the ratio of net income to total assets. We standardize the explanatory variables in the cross section each month, thus the regression coefficients are directly comparable. Standard errors are clustered at the local government level and corresponding *t*-statistics are reported. *, **, and *** represent statistical significance at the 10%, 5%, and 1% confidence levels, respectively. The sample period is from August 2007 to December 2014.

indicator is negative. Thus, within the high credit quality category, bonds with high turnover ratios have lower yields, which is in line with the conventional findings in the fixed income literature.

Our second finding is that credit risk proxied by ratings remain statistically significant in all specifications, even after controlling for LGFV financial conditions. Specification (8) shows that none of the four LGFV risk characteristics have significant explanatory power after controlling for firm-level fixed effects. This result confirms the findings in Liu, Lyu, and Yu (2017a). Specification (9) further shows that controlling for firm risk characteristics, *RATING* and *TURNOVER* keep their significant power in explaining the cross-sectional variations of Chengtou bond yield spreads.

6. The explanatory power of implicit guarantee

In this section we provide empirical evidence that the capability and the uncertainty of offering the implicit government guarantee play an important role in explaining the cross-sectional variations of Chengtou bond yield spreads, even after controlling for conventional risk factors. In particular, the capability of offering the guarantee by local governments is most related to the real estate proportion in local GDP. Local government with higher real estate GDP tend to have lower financing cost. The uncertainty of offering the guarantee, captured by political risk measures based on China's anti-corruption campaign, tends to elevate the local government's financing cost. In addition, real estate GDP and political risk are closely negatively related, which results in a significant elevation of Chengtou bond yields from the interaction of real estate and political risk.

Following the risk analysis in Section 3, we examine the cross section of Chengtou bond yield spreads through the following panel regression:

$$Y_{ijt} = \alpha_0 + \eta_t + \xi' \mathbf{m}_{j,t|t} + \lambda' \mathbf{f}_j + \beta' \mathbf{m}_{j,t|t} \times \mathbf{f}_j + \gamma' \mathbf{Z}_{ijt} + \varepsilon_{ijt}, \tag{4}$$

where Y_{ijt} is the yield spread of Chengtou bond i in local government j in month t , $\mathbf{m}_{j,t|t}$ is a vector of proxies for local government j 's economic conditions which are available up to month t (denoted as $[t]$),¹⁵ and \mathbf{f}_j is a vector of two proxies of political risk in local

¹⁵ The province economical barometers are available at the annual frequency. In regressions, we use the previous annual value for all months in the current year.

government j , *GRAFT-TIGERS* and *GRAFT-FLIES* based on the graft probes. Th political risk measures are fixed for each province based on the entire investigation results by the CCDI during November 2012 to December 2014. \mathbf{Z}_{ijt} is a vector of control variables including bond characteristics and local government's risk exposures to the central government. The primary parameters of our interest are $\{\xi, \lambda, \beta\}$.

In the panel regression, we include the year-month fixed effect, η_t , which captures any unobservable (bond-invariant) factors that can influence Chengtou bond yields not spanned by our explanatory variables. We do not need to include the local government fixed effect because both local government risk exposures and political risk proxies are calculated for each local government using the whole sample data, thus serving the role of fixed effect. In all regressions, we cluster standard errors at the local government level. Given that Chengtou bond yield spreads disperse to a much larger degree within a local government, this setup significantly raises the bar for statistical significance. We also standardize the explanatory variables in the cross section each month, except local government risk exposures. In this way, the estimated coefficients in the regression can be interpreted as the effect of one standard deviation move in the cross section, so the economic scale is also comparable across explanatory variables.

6.1. The capability of offering the guarantee

Local government economic conditions captures the capability of local governments to offer the guarantee, and hence have potential power to explain the cross-section of Chengtou bond yield spreads. Table 4 presents the results.

Specifications (1) through (6) report the coefficients of the univariate regression taking just one GDP component at a time. The coefficient on *REAL ESTATE GDP* is -0.09 with a t -statistic of -3.55 , implying that if a given local government moves by one standard deviation in the cross section, the yield spreads of Chengtou bonds issued in that government would decrease by 9 bps. Given that the average Chengtou bond yield spreads is 1.98 percent, the impact is about 5 percent decrease which turns out to be a large economic effect. In the univariate regressions, other GDP components also have significant explanatory power, though at a smaller magnitude or having less statistical significance. For example, the coefficient for *SERVICE GDP* is -0.05 with a t -statistic of -2.02 , and the coefficients for *RETAIL GDP* is -0.04 with a t -statistic of -1.76 . When combining various GDP components together in the multivariate regression, as shown in specification (7), the real estate sector remains significant whereas the retail sector and the transportation sector have marginal significance. It is worth nothing that the coefficient for the retail sector switches the sign from negative in the univariate regression to positive in the multivariate regression; also, the coefficient for the transportation sector is not significant in the univariate regression, though has 10% significance in the multivariate regression. These findings suggest that the real estate sector is the most important component in local GDP that drives Chengtou bond yields.

We examine the conventional economic strength measures in specification (8). Both the coefficient of *GDP GROWTH* and that of *FISCAL GAP* are positive but not significant. A priori we might expect that local governments with higher growth may enjoy lower cost of financing, that is, lower Chengtou bond yield spreads. The positive coefficients thus seem counter-intuitive. One possible reason for the positive relationship is that local governments with higher GDP growth also exhibit higher volatility of growth. When dividing the local governments into high, middle, and low terciles, governments in the high tercile of GDP growth have a higher mean of 19.08 percent and also a higher standard deviation of 7.34 percent, while governments in the low tercile have a lower mean of 13.93 percent and also a lower standard deviation of 5.73 percent.

Specification (9) offers the kitchen-sink test on all proxies of local government economic conditions. Real estate GDP maintains its significant pricing power. In addition, the magnitude of the coefficient remains almost the same, -0.10 percent compared to -0.09 percent in specification (1), indicating a robust explanatory power. It is worth noting that the significance of real estate GDP holds after controlling for local government risk exposures and conventional risk factors on credit and liquidity risk.

In sum, all regression specifications favor real estate GDP. The strong results indicate that the real estate sector plays an essential role in boosting the local government's revenue and hence help reduce the local government financing costs. That is, Chengtou bonds issued in the local governments with higher real estate GDP tend to have lower yield spreads.

Real estate GDP is a measure that synthesizes different dimensions of real estate information and captures the overall contribution to the local economy. We further examine each of such dimensions including *LAND COST*, the total amount used to purchase land scaled by local GDP, *RE TAX*, the ratio of tax on the real estate sector to the total tax, *RE PRICE*, the average selling price of buildings, *RE LOAN*, the amount of loans to real estate companies scaled by local GDP, and *RE INVEST*, the investment in real estate development scaled by local GDP.

As shown in Panel B of Table 2, these real estate variables are positively related to each other, with the average correlation coefficient of 0.51 ranging from 0.12 to 0.88. In particular, *RE GDP* is highly correlated with *RE PRICE* and *RE LOAN*, with the correlation coefficient of 0.68 and 0.54, respectively. Not surprisingly, when substituting *REAL ESTATE GDP* with these alternative proxies, most of them also have a significant and negative coefficient in explaining the cross-section of Chengtou bond yield spreads. Table 5 shows that one standard deviation increase in *RE PRICE* leads to 9 bps decrease in Chengtou bond yield spreads, and the coefficient is -0.09 (t -stat = -3.47) for *RE LOAN*, and -0.06 (t -stat = -1.92) for *RE TAX*. Evidently, different parts of real estate information have different degree of explanatory power; but overall, real estate is clearly an important factor in explaining the cross-section of Chengtou bond yield spreads.

6.2. The uncertainty of offering the guarantee

In this section, we examine whether political risk can explain the cross-section of Chengtou bond yield spreads. We use the two proxies for political risk: the number of officials in a local government involved in graft probes, *GRAFT-FLIES*, and the rank-weighted index, *GRAFT-TIGERS*, which we construct in Section 4.4. As hypothesized in the introduction, local government with higher political

Table 4
Chengtou bond yield spreads and local government economic conditions.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
<i>REAL ESTATE GDP</i>	-0.09*** (-3.55)						-0.10*** (-2.59)		-0.10*** (-2.40)
<i>SERVICE GDP</i>		-0.05* (-2.02)					-0.04 (-0.92)		-0.04 (-0.94)
<i>RETAIL GDP</i>			-0.04* (-1.76)				0.09* (1.95)		0.09* (1.89)
<i>CONSTN GDP</i>				0.08*** (3.04)			0.05 (1.21)		0.05 (1.09)
<i>TRANS GDP</i>					-0.03 (-1.37)		-0.05* (-1.79)		-0.05* (-1.81)
<i>FOODLOD GDP</i>						0.04* (1.88)	-0.03 (-0.79)		-0.03 (-0.77)
<i>GDP GROWTH</i>								0.03 (1.01)	0.01 (0.22)
<i>FISCAL GAP</i>								0.04 (1.52)	-0.01 (-0.30)
β_{CDS}	0.26** (2.67)	0.18** (2.20)	0.20** (2.46)	0.15 (1.69)	0.23** (2.32)	0.25** (2.68)	0.24** (2.30)	0.21** (2.65)	0.23** (2.13)
β_{FDI}	-0.05 (-0.27)	-0.04 (-0.38)	-0.06 (-0.46)	0.16 (1.15)	-0.03 (-0.22)	-0.09 (-0.66)	0.18 (0.77)	0.08 (0.56)	0.17 (0.67)
β_{CA}	0.58 (0.70)	0.59 (0.85)	0.75 (1.04)	-0.08 (-0.12)	0.59 (0.76)	1.35 (1.60)	-0.87 (-0.79)	0.31 (0.44)	-0.87 (-0.75)
β_{FX}	-3.83*** (-3.33)	-2.91*** (-3.26)	-3.09*** (-3.58)	-1.35 (-1.16)	-2.93*** (-3.02)	-3.36*** (-3.87)	-2.18 (-1.39)	-2.55*** (-2.86)	-2.02 (-1.28)
β_{RF}	-0.03 (-0.64)	-0.02 (-0.29)	-0.00 (-0.07)	-0.03 (-0.63)	-0.00 (-0.04)	0.04 (0.66)	-0.10 (-1.45)	-0.01 (-0.20)	-0.10 (-1.40)
β_{RET}	-0.11*** (-3.13)	-0.04 (-0.90)	-0.05 (-1.17)	-0.01 (-0.29)	-0.05 (-1.29)	-0.08** (-2.15)	-0.05 (-0.79)	-0.08* (-2.04)	-0.05 (-0.71)
<i>BOND SIZE</i>	0.04 (1.08)	0.04 (1.18)	0.04 (1.17)	0.04 (1.16)	0.03 (1.08)	0.04 (1.12)	0.03 (0.99)	0.03 (1.06)	0.03 (0.93)
<i>MATURITY</i>	0.09*** (3.16)	0.09*** (3.32)	0.09*** (3.36)	0.09*** (3.34)	0.09*** (3.91)	0.09*** (3.56)	0.10*** (3.68)	0.09*** (3.53)	0.10*** (3.75)
<i>SPREAD</i>	0.00 (0.25)	0.00 (0.11)	0.00 (0.11)	0.00 (0.04)	0.00 (0.04)	0.00 (0.03)	0.00 (0.16)	0.00 (0.11)	0.00 (0.15)
<i>RATING</i>	-0.33*** (-9.72)	-0.34*** (-11.51)	-0.34*** (-11.66)	-0.33*** (-10.90)	-0.35*** (-12.87)	-0.34*** (-12.22)	-0.33*** (-9.90)	-0.33*** (-11.25)	-0.33*** (-9.86)
<i>TURNOVER</i>	0.04** (2.41)	0.04** (2.60)	0.03** (2.58)	0.03** (2.51)	0.04** (2.60)	0.03** (2.51)	0.04** (2.47)	0.03** (2.42)	0.04** (2.44)
Constant	1.94*** (38.38)	1.96*** (52.60)	1.97*** (50.60)	1.93*** (47.82)	1.96*** (45.04)	1.99*** (43.10)	1.87*** (28.03)	1.94*** (49.11)	1.87*** (27.15)
<i>FIXED EFFECT</i>	YM	YM	YM	YM	YM	YM	YM	YM	YM
<i>CLUSTER</i>	LG	LG	LG	LG	LG	LG	LG	LG	LG
Observations	17524	20342	20342	20342	20342	20357	17524	20295	17477
Adj. R2	0.374	0.378	0.377	0.382	0.377	0.377	0.379	0.379	0.378

This table presents the panel regression results of chengtou bond yield spreads on local government economic conditions, as in regression (4). As proxies for the capability of offering government guarantee, local government economic conditions include the real estate value-added GDP, the service value-added GDP, the retail value-added GDP, the construction value-added GDP, the transportation value-added GDP, the food and lodging value-added GDP, as well as the local real GDP growth and fiscal gap between revenues and deficits, all scaled by the local GDP. We also consider local government risk exposures to the central government including the exposure to China's sovereign credit default swap (*CDS*), foreign direct investment (*FDI*), current account (*CA*), effective exchange rate (*FX*), risk-free interest rate (*RF*), and the stock market return (*RET*). Control variables are conventional risk factors such as bond rating, bond trading liquidity proxied by the bid-ask spread and monthly turnover ratio, size, and maturity. Monthly yield spreads are calculated as the average over daily observations. Standard errors are clustered at the local government level and corresponding *t*-statistics are reported. *, **, and *** represent statistical significance at the 10%, 5%, and 1% confidence levels, respectively. The sample period is from August 2007 to December 2014.

risk could have either higher or lower cost of financing. If a local government has more officials especially senior ones involved in graft probes, these legal investigations as uncertainty shocks could hinder local economic development and thus increase financing cost. Alternatively, local governments with more officials involved in graft probes, especially high-ranking officials, are typically those with good economic development and aggressive political leaders, hence they should have lower financing cost since corruption greases the wheels of economic growth.

Table 6 confirms the "value destruction" hypothesis. Specifications (1) shows a statistically significant and economically meaningful positive relationship between Chengtou bond yield spreads and *GRAFT-TIGERS*. A one standard deviation move by a local government in the cross section from less to more political risk increases Chengtou bond yield spreads by 9 bps under the *GRAFT-TIGERS* measure. The results suggest that graft probes on high-ranking officials likely increase the uncertainty of the local government to provide the guarantee for LGFVs hence increase corresponding Chengtou bond yield spreads. In specification (2), the coefficient on *GRAFT-FLIES* is

Table 5
Robust check: Alternative real estate barometers.

	(1)	(2)	(3)	(4)	(5)
<i>LAND COST</i>	-0.04 (-1.05)				
<i>RE TAX</i>		-0.06* (-1.92)			
<i>RE PRICE</i>			-0.09*** (-4.19)		
<i>RE LOAN</i>				-0.09*** (-3.47)	
<i>RE INVEST</i>					-0.00 (-0.01)
β_{CDS}	0.28*** (3.19)	0.30*** (3.89)	0.22*** (3.23)	0.29*** (3.58)	0.23** (2.52)
β_{FDI}	-0.10 (-0.60)	-0.04 (-0.28)	0.01 (0.10)	-0.12 (-0.61)	-0.06 (-0.38)
β_{CA}	0.77 (0.99)	0.92 (1.21)	0.24 (0.34)	0.92 (1.27)	0.77 (0.89)
β_{FX}	-3.96*** (-3.32)	-4.02*** (-4.33)	-2.45** (-2.47)	-4.27*** (-3.97)	-3.22*** (-3.20)
β_{RF}	-0.00 (-0.03)	-0.00 (-0.04)	-0.03 (-0.65)	-0.01 (-0.26)	0.01 (0.16)
β_{RET}	-0.10** (-2.17)	-0.10** (-2.21)	-0.04 (-1.01)	-0.07** (-2.18)	-0.08 (-1.66)
<i>BOND SIZE</i>	0.04 (1.15)	0.04 (1.05)	0.04 (1.30)	0.04 (1.33)	0.04 (1.16)
<i>MATURITY</i>	0.09*** (3.60)	0.09*** (3.22)	0.08*** (3.09)	0.08*** (3.09)	0.09*** (3.65)
<i>SPREAD</i>	-0.00 (-0.06)	-0.00 (-0.25)	-0.00 (-0.13)	-0.00 (0.03)	0.00 (0.07)
<i>RATING</i>	-0.34*** (-11.52)	-0.34*** (-10.84)	-0.33*** (-10.44)	-0.33*** (-10.38)	-0.35*** (-12.55)
<i>TURNOVER</i>	0.04** (2.63)	0.03** (2.27)	0.03** (2.46)	0.03** (2.59)	0.04** (2.64)
Constant	1.97*** (40.14)	1.95*** (41.45)	1.94*** (45.23)	1.97*** (37.67)	1.97*** (42.81)
FIXED EFFECT	YM	YM	YM	YM	YM
CLUSTER	LG	LG	LG	LG	LG
Observations	20342	18234	20342	20342	20342
Adjusted R2	0.374	0.368	0.382	0.381	0.372

This table presents the panel regression results of Chengtou bond yield spreads on the real estate barometers measured in various dimensions. In addition to real estate GDP examined in Table 4, alternative real estate barometers include the total amount used to purchase land as a ratio of local GDP (*LAND COST*), the tax on real estate as a ratio of total tax (*RE TAX*), the average selling price of buildings (*RE PRICE*), the amount of loans to real estate companies scaled by local GDP (*RE LOAN*), the investment in real estate development scaled by local GDP (*RE INVEST*). We also consider local government risk exposures to the central government including the exposure to China's sovereign credit default swap (*CDS*), foreign direct investment (*FDI*), current account (*CA*), effective exchange rate (*FX*), risk-free interest rate (*RF*), and the stock market return (*RET*). Control variables are conventional risk factors such as bond rating, bond trading liquidity proxied by the bid-ask spread and monthly turnover ratio, size, and maturity. Monthly yield spreads are calculated as the average over daily observations. Standard errors are clustered at the local government level and corresponding *t*-statistics are reported. *, **, and *** represent statistical significance at the 10%, 5%, and 1% confidence levels, respectively. The sample period is from August 2007 to December 2014.

positive but insignificant. Specification (3) considers two proxies jointly. Though two proxies are negatively related with a correlation of -0.07 as shown in Panel C of Table 2, the multivariate regression results remain almost the same as the univariate regressions: *GRAFT-TIGERS* has a positive and significant coefficient of 0.09 (t -stat = 4.04), while *GRAFT-FLIES* has a positive but insignificant coefficient of 0.01 (t -stat = 0.43), after controlling for conventional risk factors and risk exposures to the central government.

6.2.1. Placebo test

There are different interpretations on the anti-corruption campaign. For example, one opinion claims that officials investigated in the campaign are selective due to political power wrestling. Insofar as the case, the two proxies may not be able to capture the local political risk. To alleviate the concern, we conduct a placebo test by randomly assigning the values of each proxy across local governments. Table 7 reports the results. In the placebo test, neither *GRAFT-TIGERS* nor *GRAFT-FLIES* have any explanatory power on Chengtou bond yield spreads.

6.2.2. Event study: anti-corruption announcement

Another concern on the political risk proxies is that they are static evaluations for each local government based on the aggregate graft investigation results. We thus further examine the impact of the real-time anti-corruption announcement on Chengtou bond pricing. There are a total of 753 officials named in the graft investigations. Many announcements took place on the same day or in adjacent periods. We examine two types of events: (1) the first corruption event in each province; and (2) TIGER events in each province. For an

Table 6
Chengtou bond yield spreads and political risk.

	(1)	(2)	(3)
<i>GRAFT-TIGERS</i>	0.09*** (3.71)		0.09*** (4.04)
<i>GRAFT-FLIES</i>		0.03 (0.87)	0.01 (0.43)
β_{CDS}	0.23*** (3.53)	0.20* (1.81)	0.22*** (2.83)
β_{FDI}	-0.22* (-2.01)	-0.14 (-0.75)	-0.26 (-1.58)
β_{CA}	0.75 (1.25)	0.90 (1.06)	0.82 (1.32)
β_{FX}	-3.30*** (-4.24)	-3.71*** (-3.46)	-3.53*** (-4.43)
β_{RF}	-0.01 (-0.13)	-0.01 (-0.10)	-0.01 (-0.26)
β_{RET}	-0.14*** (-3.79)	-0.06 (-1.06)	-0.13** (-2.69)
<i>BOND SIZE</i>	0.03 (1.03)	0.04 (1.19)	0.03 (1.06)
<i>MATURITY</i>	0.09*** (3.58)	0.09*** (3.60)	0.09*** (3.57)
<i>SPREAD</i>	0.00 (0.01)	0.00 (0.04)	-0.00 (-0.00)
<i>RATING</i>	-0.34*** (-12.35)	-0.35*** (-12.20)	-0.34*** (-12.25)
<i>TURNOVER</i>	0.03** (2.68)	0.04** (2.63)	0.03** (2.67)
Constant	2.00*** (64.79)	1.98*** (41.46)	2.00*** (63.09)
FIXED EFFECT	YM	YM	YM
CLUSTER	LG	LG	LG
Observations	20342	20342	20342
Adj. R2	0.381	0.373	0.381

This table presents the panel regression results of Chengtou bond yield spreads on political risk of local governments, β_j , as in regression (4). As proxies for the uncertainty of offering government guarantee, political risk are measured by *GRAFT-TIGERS* which is the rank-weighted index according to the graft probes by the CCDI in each province, and *GRAFT-FLIES* which is the number of officials listed in graft cases in each province. Both measures are fixed for each province based on the aggregate investigation results from November 2012 to December 2014. We also consider local government risk exposures to the central government including the exposure to China's sovereign credit default swap (*CDS*), foreign direct investment (*FDI*), current account (*CA*), effective exchange rate (*FX*), risk-free interest rate (*RF*), and the stock market return (*RET*). Control variables are conventional risk factors such as bond rating, bond trading liquidity proxied by the bid-ask spread and monthly turnover ratio, size, and maturity. Monthly yield spreads are calculated as the average over daily observations. Standard errors are clustered at the local government level and corresponding *t*-statistics are reported. *, **, and *** represent statistical significance at the 10%, 5%, and 1% confidence levels, respectively. The sample period is from August 2007 to December 2014.

event to be identified as a TIGER event, the official in the graft report should have a ranking higher than 3 (that is, vice governor or governor of a province), and the event should be at least three months away from a previous event of the same province to avoid the overlapping of information.

To estimate the abnormal yield spread (conventionally called abnormal return, AR, in the event study literature), we first regress the province-level Chengtou bond yield spreads to the national average yield spread, in the spirit of CAPM in asset pricing studies. The estimation window is the period before the anti-corruption campaign, from August 2007 to October 2012. After identifying each event, we calculate the abnormal yield spread as the difference between realized province yield spreads and that predicted, where the prediction is based on the realized national yield spread and the estimated regression coefficients in the pre-event window. Table 8 reports the abnormal yield spreads for the event day, AR(0), and the days before and after the event, AR(-1) and AR(1). For both types of events in general, the abnormal yield spreads tend to be negative but insignificant around event days; only the announcements of TIGER events have significant impact on the Chengtou bond market. The results indicate that provinces with the most severe political risk are inclined to respond positively on the announcement days, and their average yield spreads are lower than the predicted. In other words, provinces with the most severe political risk benefit from the announcement to have a reduced financing costs. The cumulative effect over event days [0,1], or [-1,1], is even stronger for TIGER events in provinces with the most severe political risk, but remains muted for other events or for the same events in other provinces. By isolating the changes in other market conditions, the event study of anti-corruption announcements provides further evidence that political risk plays an important role in the Chengtou bond market, which is consistent with our earlier cross-sectional analysis.

6.3. The interaction of real estate and political risk

So far we have shown that real estate GDP and political risk have strong explanatory power in the cross-section of Chengtou bond yield spreads, after controlling for bond characteristics and province risk exposures. Real estate and political risk, however, are not

Table 7
Chengtou bond yield spreads and political risk: Placebo test.

	(1)	(2)	(3)
<i>GRAFT-TIGERS</i>	-0.26 (-0.56)		-0.28 (-0.59)
<i>GRAFT-FLIES</i>		-0.16 (-0.36)	-0.18 (-0.41)
β_{CDS}	0.22** (2.31)	0.22** (2.31)	0.22** (2.32)
β_{FDI}	-0.05 (-0.36)	-0.05 (-0.36)	-0.05 (-0.36)
β_{CA}	0.74 (0.90)	0.74 (0.91)	0.74 (0.90)
β_{FX}	-3.14*** (-3.25)	-3.14*** (-3.25)	-3.14*** (-3.25)
β_{RF}	0.01 (0.12)	0.01 (0.12)	0.01 (0.12)
β_{RET}	-0.08* (-1.82)	-0.08* (-1.82)	-0.08* (-1.82)
<i>BOND SIZE</i>	0.04 (1.09)	0.04 (1.09)	0.04 (1.09)
<i>MATURITY</i>	0.09*** (3.65)	0.09*** (3.65)	0.09*** (3.65)
<i>SPREAD</i>	0.00 (0.06)	0.00 (0.06)	0.00 (0.06)
<i>RATING</i>	-0.35*** (-12.72)	-0.35*** (-12.72)	-0.35*** (-12.72)
<i>TURNOVER</i>	0.04** (2.64)	0.04** (2.64)	0.04** (2.64)
Constant	1.97*** (42.70)	1.97*** (42.68)	1.97*** (42.69)
FIXED EFFECT	YM	YM	YM
CLUSTER	LG	LG	LG
Observations	20342	20342	20342
Adj. R2	0.372	0.372	0.372

This table presents the panel regression results of chengtou bond excess yields on the political risk of local governments, f_j , as in formula (??). We use two proxies for political risk: *GRAFT-TIGERS* which is the rank-weighted index according to the graft probes by the CCDI in each province, and *GRAFT-FLIES* which is the number of officials listed in graft cases in each province. Both measures are fixed for each province based on the aggregate investigation results from November 2012 to December 2014. We average daily bond yields over each month to obtain monthly frequency values. Control variable include bond characteristics such as bond size, maturity, bond trading liquidity proxied by the bid-ask spread, as well as the province-level risk exposures to the central government, including the exposure to China's sovereign credit default swap (*CDS*), foreign direct investment (*FDI*), current account (*CA*), effective exchange rate (*FX*), risk-free interest rate (*RF*), and the stock market return (*RET*). Standard errors are clustered at the province level and corresponding *t*-statistics are reported. *, **, and *** represent statistical significance at the 10%, 5%, and 1% confidence levels, respectively. The sample period is from August 2007 to December 2014.

Table 8
Event study on corruption announcement.

Event	AR(-1)	AR(0)	AR(1)	CAR[0,1]	CAR[-1,1]
A: First corruption in each province	0.168	-0.204	-0.066	-0.245	-0.085
B: Tiger graft in each province	-0.187	0.027	-0.100	-0.061	-0.221
in Top 5 provinces with highest corruption index	-0.392***	-0.265***	-0.312**	-0.558***	-0.861***
in Bottom 5 provinces with lowest corruption index	-0.230	0.09	-0.170	-0.04	-0.253
in Top 5 provinces with largest corruption cases	0.143	-0.139	0.174	0.019	0.141
in Bottom 5 provinces with smallest corruption cases	-0.241	-0.206	-0.119	-0.305	-0.497

This table presents the event study result on two types of corruption announcements: A. the first corruption in each province, and B. TIGER events in each province. An event is identified as a TIGER event if the official in graft report has a ranking higher than 3 and the event is at least three months from the previous event of the same province to avoid the overlapping of information. The estimation window is the sample period before anti-corruption campaign, from August 2007 to October 2012. The abnormal yield spread (AR) is calculated as the difference of realized province excess yield and the predicted one, where the prediction is based on the realized national excess yield and the regression coefficients in the estimation window.

orthogonal to each other. In China, real estate is in particular a hotbed for corruption. To develop a real estate project, one needs to acquire land and obtain various certificates and permits from government agencies. In this process, local government officials play assorted roles as land suppliers, project supervisors, and quality evaluators.¹⁶ Indeed, land transfer and construction were ranked by the

¹⁶ According to a government-run newspaper, the completion of a real estate project on average needs approvals from 166 government agencies, involving about 180 officials. See the article "Corruption nourished by complicated land deals," as of January 23, 2013, China Daily.

State Council as the top two sectors where bribery is most prevalent in business transactions.¹⁷ Cai et al. (2013) offer micro evidence of corruption in land leasehold sales. In the anti-corruption campaign, half of officials under investigation have close connections with real estate developers. Table A.3 in the appendix lists some examples, one of which is Ni Fake, once the deputy governor of Anhui Province, was in charge of land resources when in office. Since 2008, he helped nine real estate companies illegally acquire land in return for gifts.

We formally examine the relationship of real estate and political risk in Table A.4 of the appendix. The dependent variable is *REAL ESTATE GDP* for each local government per year, and the explanatory variables are political risk proxies, *GRAFT-TIGERS* and *GRAFT-FLIES*. Both proxies are negatively and significantly related to *REAL ESTATE GDP*, as shown in the univariate regression, specifications.

(1) and (2), and in the multivariate regression, specification (3). The magnitude is particularly large for the *GRAFT-TIGER* measure, -1.50 (t -stat = -4.08), compared to -0.02 (t -stat = -3.01) for the *GRAFT-FLIES* measure, indicating that local governments with more higher-ranking officials in graft probes tend to have lower proportion of real estate value in the local GDP. The results remain the same, as shown in specification (4), after controlling for local government risk exposures.

Given the above discussion, we include the interaction of real estate and political risk in the research design. Table 9 shows that after adding interaction terms, *REAL ESTATE GDP* remains its significant explanatory power with a robust coefficient ranging from -0.09 to -0.10 . So does *GRAFT-TIGERS*, except with smaller explanatory power. It is worth noting that the interaction term *RE GDP * FLIES* also has a significant estimated coefficient, 0.06 , with a t -statistic value of 3.46 . This conditional finding is important, as it indicates that local governments with higher real estate GDP become to have higher financing cost, i.e., higher Chengtou bond yields, if they have more officials investigated in graft probes hence have more political risk. Alternatively speaking, only in relatively healthy (less political risk) governments, real estate GDP is positively related to local government's sustainable capability of offering the guarantee, thus these local governments can enjoy low financing costs incurred by real-estate-driven high growth.

7. Conclusion

Chengtou bonds play a major role in local government financing. Different from conventional bond pricing, Chengtou bond yield spreads are driven not only by conventional risk factors such as credit risk and liquidity risk, but also by novel risk factors related to the local government guarantee. This paper construct unique measures to capture the capability and the uncertainty of local governments to offer the guarantee—the real estate GDP proportion in a local government and political risk proxied by the recent anti-corruption investigation campaign in China.

We find that the proportion of real estate revenue in the local GDP overall boost the local economies and hence reduce the cost of financing measured by the Chengtou bond yield spreads—confirming the “growth engine” hypothesis. Also, the rank weighted index of senior official being invested acts as a measure of political risk elevates the cost of Chengtou bond financing—confirming the “value destruction” hypothesis. However, conditional on political risk, real estate GDP dampens local governments financing cost; only healthy local government with little political risk can benefit the low financing cost incurred by real-estate-driven growth. Since the anti-corruption campaign started in late 2012, there have been fierce debates about whether the campaign has caused positive or negative economic impacts. Our empirical evidence, based on the investors reaction from the Chengtou bond market, suggests that the anti-corruption campaign may have a positive economic value—the funding costs differentiate significantly and meaningfully among more and less corrupt provinces, which leads to more efficient capital allocation in China.

Conflict of interest

The authors declare that there is no conflict of interest.

Appendix A. Calculate the Chengtou Bond Yield Spread

We first compute the zero-coupon rates of Chinese government bonds as follows. We take daily transaction records from WIND on Chinese central government bonds at time t satisfying the following criteria: (1) there are at least 20 bond transactions, (2) the time-to-maturity of these bonds spans at least 10 years, and (3) we exclude bonds with a remaining maturity of less than one month. We fit the zero-bond yield curve following Svensson (1994), assuming the following functional form for the instantaneous forward rate, f^t ¹⁸

$$f(s, \theta) = \beta_0 + \beta_1 \exp\left(-\frac{s}{T_1}\right) + \beta_2 \frac{s}{T_1} \exp\left(-\frac{s}{T_1}\right) + \beta_3 \frac{s}{T_2} \exp\left(-\frac{s}{T_2}\right), \quad (\text{A.1})$$

where s denotes the time to maturity and $\theta = (\beta_0, \beta_1, \beta_2, \beta_3, \tau_1, \tau_2)$ are the model parameters to be estimated. The forward curve in equation (A.1) is understood to apply at time t . Using the parameterized forward curve, we derive the corresponding zero-coupon central government bond yield curve at time t over different maturities s , $\{r_s(t)\}$.

To find the matching central government bond yield for Chengtou bond i , $y^{CGB}(t)$, we hold fixed bond i 's characteristics—coupon

¹⁷ http://news.xinhuanet.com/politics/2006-12/25/content_5528527.htm.

¹⁸ We have also tried to fit the yield curve following Nelson and Siegel (1987), but we prefer the method in Svensson (1994) since it produces smaller fitting errors than the Nelson and Siegel (1987) procedure.

Table 9
Chengtou Bond Yield Spreads and Real Estate, Political Risk, and their Interaction.

	(1)	(2)	(3)	(4)
REAL ESTATE GDP	-0.10*** (-3.07)	-0.10*** (-2.81)	-0.09*** (-3.05)	-0.10*** (-3.05)
GRAFT-TIGERS	0.10*** (3.04)	0.10*** (3.01)		0.07** (2.33)
GRAFT-FLIES	-0.00 (-0.12)		0.00 (0.06)	0.02 (0.47)
RE GDP*TIGERS		0.00 (0.08)		-0.02 (-0.95)
RE GDP*FLIES			0.07*** (5.08)	0.06*** (3.46)
SERVICE GDP	-0.00 (-0.05)	0.00 (0.02)	-0.01 (-0.13)	0.01 (0.15)
RETAIL GDP	0.09* (2.03)	0.09* (1.89)	0.06 (1.22)	0.07 (1.54)
CONSTN GDP	0.04 (0.99)	0.04 (0.98)	0.07 (1.49)	0.05 (1.22)
TRANS GDP	-0.03 (-1.12)	-0.03 (-1.11)	-0.07*** (-2.80)	-0.05* (-2.00)
FOODLOD GDP	-0.04 (-1.23)	-0.05 (-1.35)	-0.02 (-0.49)	-0.03 (-0.89)
β_{CDS}	0.28** (2.38)	0.28** (2.73)	0.27** (2.50)	0.29*** (2.77)
β_{FDI}	-0.00 (-0.00)	-0.01 (-0.05)	0.36 (1.49)	0.11 (0.45)
β_{CA}	-1.01 (-0.99)	-1.02 (-0.97)	-1.43 (-1.25)	-1.30 (-1.31)
β_{FX}	-2.80* (-1.73)	-2.88* (-1.84)	-0.97 (-0.58)	-2.14 (-1.39)
β_{RF}	-0.10 (-1.42)	-0.11* (-1.70)	-0.11 (-1.53)	-0.12* (-1.72)
β_{RET}	-0.17*** (-2.82)	-0.17*** (-2.84)	-0.06 (-0.98)	-0.15*** (-2.37)
BOND SIZE	0.02 (0.80)	0.02 (0.80)	0.03 (1.04)	0.03 (0.93)
MATURITY	0.10*** (3.94)	0.10*** (3.95)	0.10*** (3.89)	0.10*** (4.04)
SPREAD	0.00 (0.13)	0.00 (0.12)	0.00 (0.08)	0.00 (0.11)
RATING	-0.33*** (-10.18)	-0.33*** (-10.10)	-0.32*** (-9.74)	-0.32*** (-9.87)
TURNOVER	0.04** (2.54)	0.04** (2.59)	0.04** (2.39)	0.04** (2.49)
Constant	1.89*** (34.01)	1.90*** (34.65)	1.86*** (30.09)	1.88*** (35.43)
FIXED EFFECT	YM	YM	YM	YM
CLUSTER	LG	LG	LG	LG
Observations	17524 41	17524	17524	17524
Adj. R2	0.380	0.380	0.380	0.38

This table presents the panel regression results of Chengtou bond yield spreads on the local real estate GDP, local political risk, and their interactions, as in formula (4). We also consider local government risk exposures to the central government including the exposure to China's sovereign credit default swap (CDS), foreign direct investment (FDI), current account (CA), effective exchange rate (FX), risk-free interest rate (RF), and the stock market return (RET). Control variables are conventional risk factors such as bond rating, bond trading liquidity proxied by the bid-ask spread and monthly turnover ratio, size, and maturity. Monthly yield spreads are calculated as the average over daily observations. Standard errors are clustered at the local government level and corresponding *t*-statistics are reported.

*, **, and *** represent statistical significance at the 10%, 5%, and 1% confidence levels, respectively. The sample period is from August 2007 to December 2014.

type, coupon rate, coupon frequency, and maturity date—at the time of trade and discount each cash flow using the central government bond zero-coupon rates $\{r_s(t)\}$:

$$P_i^{CGB} = \sum_{s=1}^T \frac{C_i^{CTB}}{(1+r_s(t))^s} + \frac{100}{(1+r_T(t))^T}, \quad (\text{A.2})$$

for maturity T , and coupon C^{CTB} . With the implied government bond price P^{CGB} , we calculate the corresponding yield, y^{CGB} , which we define as the matching central government bond yield for Chengtou bond i . Equation (A.2) effectively prices bond i as a Chinese central government bond because it uses that series of discount rates (see Duffie and Singleton, 1999), and is thus more accurate than just matching on duration or maturity because it controls for all the cash flow effects unique to each Chengtou bond.

We define the Chengtuo bond yield spread as the difference between the Chengtuo bond yield, $y^{CTB}(t)$, and the (synthetic) matching central government bond yield, $y^{CGB}(t)$:

$$Y_{ij}(t) = y^{CT}(t) - y^{CGB}(t), \quad (\text{A.3})$$

where $y^{CTB}(t)$ is the yield for Chengtuo bond i in province j at time t , which we calculate based on the transaction price at time t and bond characteristics such as coupon rate, interest payment frequency, and maturity; $y^{CGB}(t)$ is the matching central government bond yield at time t , which has the same cash flow characteristics as Chengtuo bond i .

Table A.1. Comparison of Municipal Bonds and Chengtuo Bonds

USA: Muni China: CTB.

- Municipal Bond - Corporate Bond.
- Central gov't bears no responsibility - Central gov't has implicit guarantee.
- Primary investors are households (50%) - Primary investors are China's shadow banking (80%)
- Have little systemic risk - Affects financial stability.
- More transparent - More opaque.
- Debts do not have to be - Collaterals are often required:
backed by physical collaterals the land-use rights and assets such as bridges, highways, etc.
- Tax-exempt - Non tax-exempt.

Table A.2: Financial Report of the Shanghai Municipal Government (RMB billion)

Revenue			Expenditure	
1. General Budget	458.6	492.3	Total	
Total				
Taxes	421.9	80.1	Community Development	
Business Tax	100.2	69.6	Education	
VAT	96.9	49.8	Social Safety Net	
Corporate Income Tax	94.3	46.8	Resources Exploration	
Individual Income Tax	40.9	26.5	Health	
Other Taxes	89.7	26.2	R&D	
		25.1	Public Security	
Non-tax Revenues	36.7	168.2	Others	
2. Government Funds Total	253.3	230.3	Total	
Land Related	219.7	199.4	Land Related	
Others	33.6	30.8	Others	
3. Social Security Fund Total	251.2	213.6	Total	
Pension	160.1	142.4	Pension	
Medical	66.2	48.0	Medical	
Unemployment	8.9	8.4	Unemployment	
Others	15.9	14.8	Others	
4. State-Owned Capital Management				
Total	4.6	6.1	Total	
Profits	3.2	1.6	Commercial & Services Industries	
o/w Machinery Industry	1.9	1.3	Community Development	
o/w Financial Investment	0.6	1.2	R&D	
o/w Electricity industry	0.2	1.0	Transportation	
Dividends	1.3	0.8	Cultural & Sports	
Divestiture	0.1	0.2	Others	

Source: The Shanghai Municipal Finance Bureau.

Table A.3: Examples of High-Rank Local Officials involved in Real Estate Corruption

Name	Province	Rank	Date Investigated	Real Estate Corruption
NiFake	Anhui	Vice Governor	Jun2013	Illegal land transaction
ZhouZhenhong	Guangdong	Vice Governor	Feb2013	Related to his relatives' speculation in RE market
WanQingliang	Guangdong	Vice Governor	Jun2014	Illegally changing the volume ratio and taking bribes
LiDaqiu	Guangxi)	Vice Governor	Jul2013	Illegal land transaction
LiaoShaohua	Guizhou	Vice Governor	Jan2013	Bank loans, taking bribes and seeking interests for RE developers
GuoYouming	Hubei	Vice Governor	Nov2013	Related to some RE projects in Yichang City and Sanxia project
ChenBohuai	Hubei	Vice Governor	Nov2013	Illegal land transaction
JiJianye	Jiangsu	Vice Governor	Jan2013	Related to Wuzhong RE Company's bribe

(continued on next page)

(continued)

Name	Province	Rank	Date Investigated	Real Estate Corruption
ChenAnzhong	Jiangxi	Vice Governor	Dec2013	Taking bribes and seeking interests for RE developers
YaoMugen	Jiangxi	Vice Governor	Mar2014	Taking bribes and seeking interests for RE developers
ZhaoShaolin	Jiangxi	Vice Governor	Aug2015	Helping his son to make illegal profit in RE market
ChenTiexin	Liaoning	Vice Governor	Jul2014	Taking bribes and seeking interests for RE developers
HuangSheng	Shandong	Vice Governor	May2013	Related to several RE developers' bribe
JinDaoming	Shanxi	Vice Governor	Fed2014	Related to speculations in RE market
ShenWeichen	Shanxi	Vice Governor	Apr2014	Taking bribes and seeking interests for RE developers
LiChun Cheng	Sichuan	Vice Governor	Dec2012	Illegal land transaction
LiChongxi	Sichuan	Governor	Dec2013	Taking bribes and seeking interests for RE developers
Yanggang	Xinjiang	Vice Governor	Dec2013	Taking bribes and seeking interests for RE developers
ZhangTianxin	Yunnan	Vice Governor	Jul2014	Illegal land transaction
BaiEnpei	Yunnan	Governor	Aug2014	Taking bribes and seeking interests for RE developers

Table A.4: The Relationship of Real Estate GDP and Political Risk

	(1)	(2)	(3)	(4)	(5)	(6)
<i>GRAFT-TIGERS</i>	-0.44*** (-3.50)		-0.46*** (-5.15)	-0.55*** (-3.09)		-0.45*** (-3.12)
<i>GRAFT-FLIES</i>		-0.31 (-1.64)	-0.33** (-2.57)		-0.64*** (-3.06)	-0.52*** (-3.98)
β_{CDS}				-0.05 (-0.07)	0.64 (0.64)	0.51 (0.67)
β_{FDI}				0.74 (0.65)	1.87 (1.45)	2.23* (1.90)
β_{CA}				-2.59 (-0.46)	-7.68 (-1.30)	-6.31 (-1.14)
β_{FX}				-0.37 (-0.04)	11.74 (1.19)	9.41 (1.01)
β_{RF}				-0.32 (-1.02)	-0.09 (-0.26)	-0.04 (-0.17)
β_{RET}				0.30 (1.17)	-0.59* (-2.03)	-0.23 (-1.09)
Constant	0.01 (0.04)	-0.00 (-0.02)	0.00 (0.02)	-0.24 (-0.92)	-0.41 (-1.31)	-0.44* (-1.83)
Observations	17524	17524	17524	17524	17524	17524
Adj. R2	0.208	0.095	0.321	0.259	0.257	0.383

This table examines the relationship of real estate and political risk. The dependent variable is the real estate value scaled by local GDP, *REAL ESTATE GDP*. The independent variables are two proxies of political risk: *GRAFT-TIGERS* which is the weighted-average index by the ranking of officials investigated by the CCDI in each province, and *GRAFT-FLIES* which is the number of officials listed in graft cases in each province. Regression is run using the province-year panel during 2007–2014. We also include province risk exposures to China's sovereign credit default swap (*CDS*), foreign direct investment (*FDI*), current account (*CA*), effective exchange rate (*FX*), risk-free interest rate (*RF*), and the stock market return (*RET*), as control variables. *t*-statistics are reported in brackets. *, **, and *** represent statistical significance at the 10%, 5%, and 1% confidence levels, respectively. LHS = *REAL ESTATE GDP*.

References

- Ang, A., Bhansali, V., Xing, Y., 2015. The muni bond spread: credit, liquidity, and tax. Working paper. Columbia University.
- Ang, A., Longstaff, F., 2013. Systemic sovereign credit risk: lessons from the U.S. And Europe. *J. Monetary Econ.* 60 (5), 493–510.
- Bai, J., Wu, L., 2016. Anchoring corporate credit spreads to firm fundamentals. *J. Financ. Quant. Anal.* 51 (5), 1521–1543.
- Brandt, L., Zhu, X., 1995. The Development of Non-bank Financial Institutions in China Unpublished Manuscript. University, Toronto.
- Brandt, L., Zhu, X., 2000. Redistribution in a decentralized economy: growth and inflation in China under reform. *J. Polit. Econ.* 108 (2), 422–439.
- Butler, A.W., Fauver, L., Mortal, S., 2009. Corruption, political connections, and municipal finance. *Rev. Financ. Stud.* 22, 2873–2905.
- Cai, H., Henderson, J.V., Zhang, Q., 2013. China's land market auctions: evidence of corruption? *Rand J. Econ.* 44 (3), 488–521.
- Chen, K., Ren, J., Zha, T., 2018. The Nexus of Monetary Policy and Shadow Banking in China. *American Economic Review*, forthcoming.
- Chen, K., Wen, Y., 2017. The great housing boom of China. *Am. Econ. J. Macroecon.* 9 (2), 73–114.
- Chen, Z., He, Z., Liu, C., 2017. The financing of local government in China: stimulus loan Wanes and shadow banking Waxes. Working Paper. Tsinghua University.
- Collin-Dufresne, P., Goldstein, R.S., Martin, J.S., 2001. The determinants of credit spread changes. *J. Finance* 56 (6), 2177–2207.
- Cong, L., Gao, H., Ponticelli, J., Yang, X., 2017. Credit allocation under economic stimulus: evidence from China. Working Paper. The University of Chicago.
- Corwin, S.A., Schultz, P., 2012. A simple way to estimate bid-ask spreads from daily high and low prices. *J. Finance* 67, 719–760.
- Duffie, D., Singleton, K.J., 1999. Modeling term structures of defaultable bonds. *Rev. Financ. Stud.* 12 (4), 687–720.
- Fang, H., Gu, Q., Xiong, W., Zhou, L.-A., 2015. Demystifying the Chinese housing boom. *NBER Macroecon. Annu.* 30 (1), 105–166.
- Fisman, R., Wang, Y., 2015. The mortality cost of political connections. *Rev. Econ. Stud.* 82 (4), 1346–1382.
- Gospodinov, N., Robertson, B., Tkac, P., 2014. Do municipal bonds pose a systemic risk? Evidence from the detroit bankruptcy. Working paper. The Federal Reserve Bank of Atlanta.

- Griffin, J., Liu, C., Shu, T., 2016. Is the Chinese Anti-corruption Campaign Effective. Working paper. University of Texas at Austin.
- Houweling, P., Mentink, A., Vorst, T., 2005. Comparing possible proxies of corporate bond liquidity. *J. Bank. Finance* 29, 1331–1358.
- Hsieh, C.-T., Song, Z., 2015. Grasp the large, let go of the small: the transformation of the state sector in China. In: *Brookings Papers on Economic Activity*, pp. 295–346.
- Jiang, W., 2015. The future of China's shadow banking system. White paper. Columbia University.
- Li, H., Zhou, L.-A., 2005. Political turnover and economic performance: the incentive role of personnel control in China. *J. Publ. Econ.* 89, 1743–1762.
- Lin, C., Morck, R., Yeung, B., Zhao, X., 2016. Anti-Corruption Reforms and Shareholder Valuations: Event Study Evidence from China Working Paper. <http://www.nber.org/papers/w22001>.
- Liu, L.X., Lyu, Y., Yu, F., 2017a. Implicit Government Guarantee and the Pricing of Chinese LGFV Debt. Working Paper. Claremont McKenna College.
- Liu, L.X., Shu, H., Wei, K.J., 2017b. The impacts of political uncertainty on asset prices: evidence from the Bo scandal in China. *J. Financ. Econ.* 125, 286–310.
- Lu, Y., Sun, T., 2013. Local government financing platforms in China: A fortune or misfortune? IMF working paper.
- Mauro, P., 1995. Corruption and growth. *Q. J. Econ.* 110 (3), 681–712.
- Nelson, C.R., Siegel, A.F., 1987. Parsimonious modeling of yield curves. *J. Bus.* 60, 473–489.
- Schwert, M., 2017. Municipal bond liquidity and default risk. *J. Finance* 72 (4), 1683–1722.
- Svensson, L.E., 1994. Estimating and Interpreting Forward Interest Rates: Sweden 1992-1994. NBER Working Paper 4871.
- Wang, J., Wu, C., Zhang, F.X., 2008. Liquidity, default, taxes, and yields on municipal bonds. *J. Bank. Finance* 32 (6), 1133–1149.
- Wei, S.-J., 1999. Corruption in Economic Development: Beneficial Grease, Minor Annoyance, or Major Obstacle. World Bank policy research working paper No. 2048.
- Wu, J., Gyourko, J., Deng, Y., 2015. Evaluating the Risk of Chinese Housing Markets: what We Know and what We Need to Know. Working Paper. National University of Singapore.
- Xu, G., Wang, Y., 2013. Though there may be difficulties, we must continue on the path - The deep study of Chengtou bonds. *Financial Development Review* 3, 70–97. <http://www.doi.org/10.19895/j.cnki.fdr.2013.03.004>.