The Great Wall of Debt: Real Estate, Political Risk, and Chinese Local Government Credit Spreads*

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Abstract

Chengtou bonds—urban construction and investment bonds, backed mostly by land sales, are the major financing source for Chinese local governments. We find that one standard deviation increase in local real estate GDP—the growth engine in economy—corresponds to about 8.6 percent decrease in Chengtou bond excess yields. Political risk, a novel measure based on the anti-corruption campaign in China, has a significant negative effect on Chengtou bond prices. However, conditional on high corruption level, real estate GDP actually elevates Chengtou bond yields; only low corruption provinces enjoy the low financing costs due to high real estate GDP.

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, and as of December 2014, there were RMB 4.95 trillion (USD 0.82 trillion) Chengtou bonds outstanding. The brisk increase in Chengtou liabilities 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 is one distinctive feature that makes it uniquely suited to investigating the effect of government guarantees, political risk, and distortions in market pricing induced by such effects. 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 addition, under China's fiscal and tax system, the central government takes final responsibility for the revenues and deficits of the local governments. Chengtou bonds, therefore, are backed directly by the local governments and indirectly by the central government—and so far there is no single default in Chengtou bond market.[1] This is a crucial feature that distinguishes them from municipal bonds in the United States.[2]

Given this unique feature, one may hypothesize that all Chengtou bonds have similar

[1] In absence of defaults and with attractive yields, Chengtou bonds become the most sought-after asset class among fund managers (China Funds Post, 2016; China Business Daily 2016).

[2] 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 may link to the real estate market and political risk, whereas agency bonds in the U.S. are nearly homogeneous.

yields, that is, issuing provinces have similar cost of financing. However, we show that despite the tacit endorsement by the central government, Chengtou bonds yields exhibit significant *economic* heterogeneity across provinces. In this paper we study the dispersion of Chengtou bond yields and examine what potential factors drive the cross-sectional variation of the local government financing costs. We show that the Chengtou bond market is a nexus to China's real estate market, political risk, and market distortions.

Our economic analyses hinge on another special feature of Chengtou bonds—their issuance mostly requires collateral, which often involves the land-use right. In contrast, the U.S. municipal debt does not have to be backed by physical collateral. Chengtou bonds are officially issued by local government financing vehicles (LGFVs), through which municipalities raise funds to supplement the direct transfers they receive from the central government. The municipality in turn transfers land-use rights, or existing assets such as highways or bridges, to the LGFV as capital injection. LGFVs issue Chengtou bonds using the land-use right and the alike as collateral.

The critical role of land-use right as bond collateral naturally links Chengtou bond market to the real estate market. In China, real estate has a vital influence on economic development, and the key components driving the real estate market are the supply of land and the rental price of land-use right, both of which are controlled by local governments. Therefore intuitively, the cross-section of Chengtou bond yields should reflect both local governments' financial strength and their willingness to provide backup cash flow. Given that land sales are likely the major income resource for local governments, the conditions in the local real estate market should in particular be related to Chengtou bond yields. However, it is unclear to which direction should real estate value affect local financing cost, that is, the Chengtou bond yields.

One hypothesis is that higher proportion of real estate value in the local GDP helps boost local government's future revenue, including various real estate related tax and land sales income, hence better cash flow to support LGFVs to pay back the interests and principals of Chengtou bonds. This is basically a "growth engine" story for real estate market, which

positively affects the Chengtou bond prices hence decreases bond yields. The opposite hypothesis is that 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 will dampen the local government's backing income stream, which *negatively* affects Chengtou bond prices hence increases bond yields.

Our empirical findings support the "growth engine" effect—overall, local real estate value 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 yields of approximately 0.17 percent. Given that the average Chengtou bond yield spread (in excess of corresponding central government bond yield) is 1.98 percent, the impact is about 8.6 percent which turns out to be a large economic effect. The results suggest that in China, provinces with higher proportion of real estate value in local GDP tends to have lower cost of financing. The concern on "ghost town" or overinvestment is not supported by our entire sample analysis.

The critical dependence of Chengtou bond issuance on land-use right as collateral also potentially leads to its close relationship with political risk, especially corruption. Chengtou bonds, although issued by a special purpose vehicle—LGFV, its yields are reflecting the local government's backing income stream and their willingness to 'bail-out', which could be heavily affected by local political risk. To study the influence of political risk, we create a novel measure by utilizing a manually collected dataset based on China's anti-corruption campaign, including a sample of 753 officials from 30 provinces in graft probes. Among the 753 graft probes, we find more than half of the officials had "undesirable working practices" related to the real estate sector.

[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.

One classical "value destruction" hypothesis is that provinces with higher political risk is unlikely to have stable future revenue income and hence should have higher cost of financing. That means, if a province has more officials involved in graft probes, these legal investigations could hinder local economic development and thus increase financing cost. An alternative "greasing the wheels" hypothesis is that those provinces with more officials involved in graft probes, especially high-ranking officials, are typically the provinces with good economic development and aggressive political leaders. In other words corruption and growth go hand-in-hand,[4] hence more corruption would imply lower Chengtou bound yields, as the local governments have better income stream and strong motivation to back up LGFVs.

Confirming the "value destruction" hypothesis, we show a statistically significant and economically meaningful *positive* relationship between risk-adjusted Chengtou bond yields and two political risk measures: the rank-weighted average index and the total number of graft cases which we call *GRAFT–TIGERS* and *GRAFT–FLIES*, respectively.[5] A one standard deviation move by a province in the cross-section from less to more corrupt increases excess Chengtou bond yields by 0.15 percent under the *GRAFT–TIGERS* measure, and 0.05 percent (though insignificant) under the *GRAFT–FLIES* measure. The results suggest that graft probes on high-ranking officials likely increase the uncertainty of the local government for providing backing income stream for LGFVs hence increase corresponding Chengtou bond yields. Our empirical results do not support the "greasing the wheels" hypothesis—government corruption and economic growth go hand-in-hand.

Ultimately, the two factors that drive the cross-section of Chengtou bond yields—real estate and political risk—are not independent of each other. In China, real estate is a hotbed for the misuse of power and malpractice, as the anti-corruption cases indicate. We therefore pay particular attention to the interaction between real estate and political risk proxies in determining the local governments' financing cost.

[4]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 evidened in emerging-market countries.

[5]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 late 2012.

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 corrupted) provinces, real estate value is positively related to sustainable backing income stream. Alternatively speaking, provinces with both higher political risk and higher proportion of real estate value to local GDP will not benefit from local real estate revenue, since such revenue may not be durable and likely is impaired by political risk.

One implication of this interaction effect is that, although real estate overall has a "growth engine" effect on Chengtou bond yields nationwide, for high political risk provinces real estate seemingly has a "ghost town" effect—elevating local government financing cost. This result is likely driven by a significant and robust negative impact of political risk on real estate, which impairs the collateral value of Chengtou bonds. Therefore, the nonlinear interaction effect on Chengtou bond yields likely represents the net balance between the direct positive effect from real estate and the indirect negative effect from political risk.

Literature

Given China's important role in the world economy, especially since it overtook Japan as world's second largest economy, there have been fast growing studies on China's economy and financial systems, such as Brunnermeier, Sockin, and Xiong (2016), Jiang (2015), Song, Storesletten, and Zilibotti (2011), Brandt and Zhu (1995, 2000). 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.

There are few academic papers studying Chengtou bonds. Lu and Sun (2013) describe the function of LGFVs and discuss their role in China's credit expansion. Our paper is

related to Wang and Yu (2014), who use a small sample of Chengtou bonds to study how the firm characteristics of LGFVs as bond issuers 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.

Our paper offers a fresh perspective to the booming literature on China's real estate market. 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, Gu, Xiong, and Zhou (2015) and Wu, Gyourko, and Deng (2015) 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. We further demonstrate the importance of real estate sector on local government financing cost.

Our paper also contributes to the present 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 opacity of the political system, in China. In the political risk literature, many academic studies use Chinese markets and socioeconomic circumstances to study the economics of corruption and political interference (see, among many others, Griffin, Liu, and Shu, 2016, Lin, Morck, Yeung, and Zhao, 2016, Fisman and Wang, 2015). 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.

[6]Butler, Fauver, and Mortal (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.

Lastly, our paper also relates to the literature about market distortion under government guarantee. In other markets where policymakers have set or have an undue influence on, prices often involve a limited number of securities: foreign exchange pegs at one extreme, for example, involve only one price—the exchange rate (cf. Husain, Mody, and Rogoff, 2005). Other markets with a large cross-section of securities with government guarantees have such guarantees suddenly imposed, and the guarantee does not extend to all securities within that asset class. For example, only certain bonds issued by financial institutions were suddenly guaranteed by governments during the financial crisis (see Levy and Schich, 2010). In this paper, Chengtou bond market provides an atypical environment to study the impact of guarantee, since thousands of bonds have been under the same implicit guarantee from the beginning of their issuance in the past two decades. Such continuity allows us to examine alternative channels of market distortion such as real estate and political risk.

The rest of this paper is organized as follows. Section 2 provides institutional background on local government finances, the Chengtou bond market, China's real estate market and corruption. In Section 3, we describe data, construct Chengtou bond excess yields, and construct the political risk proxies. Section 4 sets up the empirical specification and Section 5 tests our hypotheses and presents the main findings. We conclude in Section 6 with a discussion on relevant policies.

2 Institutional Background

In this section, we review institutional background on China's local government finances, the Chengtou bond market, real estate market and corruption, which serve as the key to understanding the local government debt problem in China and its economic relationship with real estate and political risk.

2.1 Local Government Finances

The history of local government debt in China can be traced back to 1978 when the economic reform began. The decision-making power of the central government has been gradually delegated to regional governments, and economic growth motives have been driving local governments to look for additional funding sources. The situation has been exacerbated since the early 1990s, when national budget reforms channeled more tax revenue to the central government, and the local spending responsibility remained roughly the same. The mismatch is normally balanced by central government transfer or extra revenue 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 package of RMB 4 trillion, among which only RMB 1.18 trillion is provided by the central government and the rest needs to be shouldered by the local governments (Lu and Sun 2013).

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

To meet the growing financing challenge while circumventing regulations, Chinese local governments have created a special purpose vehicle. Local government financing vehicles (LGFVs) thus act as the principal financing agents for local governments. LGFVs are corporations that can obtain 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

[7] When approved by the State Council, "pseudo municipal bond" issuance is via the Ministry of Finance on behalf of the local governments. With an explicit guarantee from the central government, these "local government bonds" are quasi-treasuries and indeed behave like treasuries (Wang and Yu, 2014).

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 construction, infrastructure, social services, and environmental protection.

The history of Chengtou bond market started with Pudong development bond, a first of such bonds, issued in Shanghai in 1997 with a value of RMB 500 million. Both the number of bonds issued and the issue amounts were negligible before 2005 but since the fiscal stimulus in late 2008, Chengtou bond market has expanded dramatically, as shown in Table 1 and Figure 1. 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 year. In 2014, the number of new Chengtou bond issuance reached 1,704, with a total amount outstanding of RMB 4.95 trillion (USD 0.82 trillion). 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 amount issuance are Jiangsu, Zhejiang, Beijing, Shanghai, and Guangdong. These provinces represent 40 percent of the total RMB 5.92 trillion 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 amounts of bonds by maturity in Figure A.1, 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 bonds issued mainly have a maturity of three to seven years, accounting for 66 percent as of 2014.

The primary holders of Chengtou bonds are, according to China Central Depository & Clearing Co., commercial banks (31.0 percent) (through its trust), funds (24.8 percent), and insurance companies (21.4 percent). China's shadow banks—trust, securitization, insurance companies, and all kinds of funds—hold large amounts of Chengtou bonds and are increasingly exposed to local government credit risk (see Wu and He, 2014). Thus, local government debt may represent a source of systemic risk to China. 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, 2014, Gospodinov et al., 2014).

Figure 2 shows the relationships of important institutions involved in local government finances in China. Local governments incorporate LGFVs by injecting capital through budget revenue—usually by transferring land-use rights and existing assets such as highways and bridges. LGFVs then finance the rest through bank loans or through raising funding from equity and bond markets. The borrowing of LGFVs is often collateralized by land and is based on implicit or explicit local government guarantees. Evidently, LGFVs have close business connections with both commercial banks and the shadow banking system, as well as the real estate sector. Many financial institutions and financing sources are thus connected through issuing, holding, or collateralizing Chengtou bonds.

There are other sources of local government finances in addition to those associated with Chengtou bonds, including direct transfer from the central government, loans, and pseudo-municipal bond issues (through the central government). Except for Chengtou bonds, none of these have market prices.[8] In so far as Chengtou bonds reflect risk that is shared by other types of local government financing, the relatively transparent Chengtou bond market provides a window through which we can appraise the local governments financing cost in general. In particular, the relationships we uncover between Chengtou bond yields and real estate variables, political risk, are of interest to the broad policy debate on Chinese local government finances.

2.2 Real Estate and Corruption

Given the relationships involved in local government finances, the real estate sector plays a central role. Rapidly decreasing real estate values may be a trigger for a systemic event as LGFV collateral consists of property, land-use rights, and other real estate related assets. In normal times, real estate values increase and LGFVs are able to rollover debts without

[8]Directly issued pseudo-municipal bonds are sold over-the-counter, and there are no public figures on their original issuance or secondary-market transactions, except for nationwide total issuance information that is published by the central government.

increasing their cost of financing. In stress times of low real estate values, debt holders may demand more collateral, which increases financing costs and generates a significant rollover risk for LGFVs. One way to meet the shortfall is to sell land, but the fire-sale in an illiquid market would create a vicious circle. Indeed, revenue from the sales of land-use rights constitutes a principal source of local government revenue. In the United States, decreasing real estate values played a major role in many bankruptcies of over-leveraged banks in the 1980s and 1990s (see Case, 2000) and the subprime mortgage crisis of 2007 (see Brunnermeier, 2009). In our empirical work, we will investigate how real estate values influence local governments backing income stream hence affect further Chengtou bond yields.

The real estate market has also become a hotbed of corruption. The development of a real estate project can be roughly divided into four steps: (i) acquiring land for construction, ii) applying and obtaining all necessary certificates and permits from various government agencies, iii) construction, and iv) sales. In this process, the local government officials play assorted roles as land suppliers, project supervisors, and quality evaluators. The completion of a real estate project on average needs approvals from 166 government departments, involving about 180 officials.[9] Such complicated administration procedures can nourish corruption. Indeed, land transfer and construction were ranked by the State Council as the top two sectors where bribery is most prevalent in business transactions.[10] Cai, Henderson, and Zhang (2013) offer micro evidence of corruption in land leasehold sales.

Since the new Politburo assumed power in the late 2012, President Xi Jinping's administration announced a set of major policy reforms explicitly designed to tackle corruption, the well-known anti-corruption campaign. In the following years, the Central Commission for Discipline Inspection (CCDI), the organization in charge of the anti-corruption drive, has investigated a significant number of officials. Most officials under investigation for corruption have close connections with real estate developers. Table A.1 lists the examples of local authorities that have been investigated who were involved in real estate related corruption. These investigative actions on local government officials may as

[9] See the article "Corruption nourished by complicated land deals," as of January 23, 2013, China Daily.
[10] http://news.xinhuanet.com/politics/2006-12/25/content_5528527.htm

well affect the possibility of local government bail-out hence affect Chengtou bond yields.

3 Data

Our data on Chengtou bond issuance and transactions comes from Wind Information Co. (WIND), which provides information on Chinese financial markets.

After issuance, 68 percent of chengtou bonds trade in the interbank bond market and another 30 percent trade in the Shanghai and Shenzhen stock exchange markets. For each bond transaction at day t, we observe its open price, close price, the highest and lowest price, the mid price, trading volume, and yield to maturity. 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.

To get a sense of Chengtou bond market liquidity, we calculate the trading frequency as the number of traded bonds divided by the total number of outstanding bonds in each month. The monthly trading frequency is below 30 percent before 2006, jumps to 65 percent in 2007, remains stable between 60 to 70 percent after August 2007. Given our object of interest is the cross section of Chengtou bonds, we choose our final sample to cover the relatively liquid period from August 2007 to December 2014.

We end the sample period in December 2014 to ensure a clean analysis. Since 2015, China's Ministry of Finance initiated a provincial bond swap plan for local government debts over the next five years, in order to develop a "standard" municipal bond market and, as part of a broader plan, to reform the local government financing.

3.1 Chengtou Bond Excess Yields

Chengtou bond excess yields, as the measure of local government financing cost, is the cornerstone of our analysis. We first introduce the method to calculate Chengtou bond excess yields.

A well-known fact about fixed income is that all yields are highly correlated with the

level of sovereign bond yields, or the "level" factor (see Knez, Litterman, and Scheinkman, 1994). We construct Chengtou bond yields in excess of matching central government bond yields to isolate the yield spreads in the Chengtou bond market. We need to control at least for duration because of the very different maturities at issue (see Figure A.1), but our matching procedure also takes into account convexity and other effects, because we control for the entire cash flow of the Chengtou bond.

We define the excess yield as the difference between the Chengtou bond yield and the (synthetic) matching central government bond yield:

$$Y_{ij}(t) = y_{ij}^{CTB}(t) - y_i^{CGB}(t), \tag{1}$$

where $y_{ij}^{CTB}(t)$ is the yield for Chengtou bond i in province j at time t, which we calculate based on bond characteristics and the transaction price at time t; $y_i^{CGB}(t)$ is the matching central government bond yield at time t, which has the same cash flow characteristics as Chengtou bond i.

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:[11]

$$f(s,\theta) = \beta_0 + \beta_1 \exp\left(-\frac{s}{\tau_1}\right) + \beta_2 \frac{s}{\tau_1} \exp\left(-\frac{s}{\tau_1}\right) + \beta_3 \frac{s}{\tau_2} \exp\left(-\frac{s}{\tau_2}\right), \tag{2}$$

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 (2) 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, $y_i^{CGB}(t)$,

[11] The Svensson (1994) model produces smaller fitting errors than the Nelson and Siegel (1987) procedure.

we hold fixed bond i's characteristics—coupon 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 $\{r_s(t)\}$:

$$P_i^{CGB} = \sum_{s=1}^{T} \frac{C_i^{CTB}}{(1 + r_s(t))^s} + \frac{100}{(1 + r_T(t))^T}, \tag{3}$$

for maturity T, and coupon C_i^{CTB}. With the implied government bond price P_i^{CGB}, we calculate the corresponding yield, y_i^{CGB}, which we define as the matching central government bond yield for Chengtou bond i. Equation (3) 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 calculate the Chengtou bond excess yields at the daily frequency, and then aggregate to the monthly frequency and/or province level depending on the research design, which we detail below. In our final sample, there are 20,357 bond-month observations from August 2007 to December 2014.

3.2 Provincial Economic Conditions

We consider province economic barometers that potentially affect the local government's likelihood in providing backing income.[12] In particular, we collect the various components of local GDP, for example, the real estate value contributing to the local GDP. We also collect traditional measures such as the growth rate of local GDP, the fiscal surplus and deficit scaled by local GDP. In addition, we consider alternative measures in the local real estate market, such as the land cost, the real estate price, the loans to the real estate sector, the

[12]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 two reasons. First, due to China's administration system, a potential 'bail-out' even if it is at city or county level will need to be proved and instructed by provincial officials. It is the local province governments that shoulder the responsibility of bail-out. Second, the data for city or county level economic conditions are in poor quality in terms of coverage and accuracy.

tax on real estate, and the local real estate related investment.

Real Estate GDP	Ratio of real estate value-added GDP to total GDP
Service GDP	Ratio of service value-added GDP to total GDP
Retail GDP	Ratio of wholesale and retail value-added GDP to total GDP
Hotel GDP	Ratio of hotel industry value-added GDP to total GDP
GDP Growth	Log difference of real GDP
Fiscal Surplus	Difference of revenue and expenditure, scaled by local GDP
Land Cost	Total amount used to purchase land as a ratio of local GDP
Real Estate Tax	Ratio of real estate tax to the total tax
Real Estate Price	Average selling price of buildings
Real Estate Loans	Amount of loans to real estate companies scaled by local GDP
Real Estate 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 province at the annual frequency from 2005 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. Each of the six variables captures the information in one dimension of real estate, such as price, cost, tax, loans, investment. They are all positively related to each other, with the correlation values ranging from 0.17 to 0.70. Among them, the real estate value scaled by the local GDP is the variable which synthesizes different dimensions of real estate information, and also the main variable we study in the empirical tests.

3.3 "TIGERS" and "FLIES"—Political Risk Proxies

Corruption in China seems to be endemic. The Carnegie Endowment estimates that the cost of corruption in China in 2003 was USD 86 billion, or 3 percent of GDP, and in 2013 this increased to 13 percent of GDP.[13] When China's new Politburo took power in November

[13]See www.carnegieendowment.org/files/pb55_pei_china_corruption_final.pdf.

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.[14] 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 seven rankings. 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.[15] 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 2.08 with a standard deviation of 0.33 across 30 provinces whose LGFVs issue Chengtou bonds. On average, there were 19.61 officials investigated for each province, with a standard deviation of 12.85, 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.

Both political risk measures are static evaluations for each province based on the aggregate graft investigation results from the beginning of the anti-corruption campaign

[14]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.

[15]The rankings have five degree, 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.

to the end of our sample. That means, these measures 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, that is those probes released later should also be counted into the accurate 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. In sum, we think it is more appropriate to capture provincial political risk using the aggregate corruption investigation results, and then study its impact on the cross-section of Chengtou bond yield spreads. For scrutiny, we also conduct the event study on the graft announcement in Section 5.2.1.

3.4 Nationwide Economic Barometers

To isolate the impact of real estate and political risk on Chengtou bond yields, we need to control for province-level risk exposure to the central government or national economic conditions. This is particularly relevant in China, since the central government backs the finances of the local governments, which in turn guarantee LGFVs issuing the Chengtou bonds. We select the following national variables to calculate province risk exposures, on the basis that they capture China's solvency risk, monetary policy, and financial market conditions. These variables are collected from WIND, China's National Bureau of Statistics, and Global Financial Data, and are available at the monthly frequency from January 2005 to December 2014.

CDS	Chinese credit default swap rate
FDI	Foreign direct investment in China
CA	Log of the current account
FX	Effective real exchange rate
RF	One-year time deposit interest rate
RET	Chinese stock market return (including all A-shares and B-shares)

Credit default swap rates (CDS), foreign direct investment (FDI), and current account (CA) all capture different aspects of solvency risk. We use the effective real exchange rate (FX) and the one-year time deposit interest rate (RF) for monetary policy proxies. The latter is 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). Section 4.3.2 will explain how we use these national economic barometers to construct province risk exposures.

4 Heterogeneity and Empirical Design

Chengtou bonds are implicitly guaranteed by local governments. Given the fact that there does not exist a single default of Chengtou bond, conventional determinants such as the probability of default do not work for Chengtou bond yields. Rather, it is local governments' backing income stream that plays the major role in explaining the cross-section of Chengtou bond yields. Meanwhile, under China's current fiscal and tax system, the central government is indirectly responsible for all local governments revenues and deficits, though there are uncertainties on whether or not the central government will lend a hand to a particular local government, and also uncertainties on to what degree the central government will bail out. Thus to test the explanatory power of factors related to local government's backing income stream, we need to particularly consider the control of province-level risk exposure to the central government. In this section, we first examine the cross-sectional variation in Chengtou bond yields, then specify the empirical design, and introduce the control variables

which are integral for our study.

4.1 Heterogeneity of Chengtou Bond Excess Yields

Figure 3 plots the dispersion of issue yields in the primary market in Panel A and Chengtou bond excess yields in the secondary market in Panel B. We mark the median value along with the 10th and 90th percentiles from 2007 to 2014. Evidently, there is large heterogeneity in both issue yields and excess yields. In the primary market, the average range between the 10th and 90th percentiles is 2.95 percent with a standard deviation of 0.95 percent. In the secondary market, the corresponding range is 1.84 percent with a standard deviation of 0.87 percent. Figure 3 further shows that the dispersion of Chengtou bond excess yields changes over time, and tends to increase when the median excess yield is high. This suggests that the market more finely distinguishes underlying risks of Chengtou bonds across provinces when overall market conditions deteriorate.

Overall, Chengtou bonds earn a premium of 1.98 percent, on average, over matching central government bond yields. We also report the distribution of Chengtou bond excess yields in Table 3 for subsamples which divide all bonds into three portfolios according to province characteristics such as: 1) *GEOGRAPHY*, the coastal area, the middle area, and the western area; 2) *FISCAL SURPLUS*, the local fiscal surplus (or deficit if the value is negative) to GDP ratio; 3) *GDP GROWTH*, the local real GDP growth rate; 4) *REAL ESTATE PRICE*, the average price per squared meters during 2008 to 2014 for main cities in each province; 5) *GRAFT–TIGERS*, the rank-weighted index of officials in the graft probes; and 6) *GRAFT–FLIES*, the number of officials in the graft probes in each province. Summarizing the results in Table 3, we find that there are predictable variations in excess yields across provinces: provinces having lower Chengtou excess yields, i.e., lower cost of financing, tend to be those located along the coast, those provinces with smaller fiscal surplus, smaller GDP growth, higher housing prices, and those with more political risk under both proxies.

In summary, we find evidence supporting a large cross-sectional heterogeneity in

Chengtou bond excess yields, regardless of issuing provinces. The financial market seems to perceive that all Chengtou bonds are not equal. We now describe potential factors which may determine the cross-sectional variation of Chengtou bond yields.

4.2 Regression Specification

Following the research hypotheses laid out in the introduction, we examine the cross section of Chengtou bond excess yields through the following panel regression:

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

where Y_{ijt} is the excess yield of Chengtou bond i in province j in month t, which reflects the cost of financing for local government j. $\mathbf{m}_{j,[t]}$ is a vector of macroeconomic variables for province j which is available up to month t (denoted as $[t]$),[16] characterizing the local economic conditions that potentially influence local governments' backing income stream, $\mathbf{f}_j$ is a vector of two proxies of political risk in province 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 province risk exposures to national economic barometers, which we elaborate in the next subsection. The primary parameters of interest are $\{\xi, \lambda, \beta\}$.

In the panel regression, we include the monthly fixed effect, η_t, which captures any unobservable (bond-invariant) factors that can influence Chengtou bond yields not spanned by provincial factors or province risk exposures. In all regressions, we cluster standard errors at the province level instead of at the bond level. Given that Chengtou bond yields disperse to a larger degree within a province, this setup raises the bar for statistical significance. We also standardize the explanatory variables in the cross section each month. In this way, the estimated coefficients in the regression can be interpreted as the effect of one standard

[16] 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.

deviation move in the cross section, so the economic scale is also comparable across variables.

4.3 Control Variables

We consider two types of control variables: bond characteristics and province risk exposures to national economic barometers. Both sets of variables may have a potential influence on Chengtou bond excess yields.

4.3.1 Bond Characteristics

In the fixed income literature, bond yields are mainly related to bond credit rating, bond trading liquidity and bond characteristics such as bond size and the remaining time to maturity. We use the bid-ask spread as liquidity proxy, *LIQUIDITY* which is calculated based on the daily highest and lowest prices following Corwin and Schultz (2012).[17] We also consider *SIZE* which is the logarithm of bond outstanding amount, and *MATURITY* which is the remaining years to maturity, as the control variables. Yet we decide not to use Chengtou bond rating since bond ratings in China are highly inflated and homogeneous. Chengtou bonds in our sample are rated from A to AAA,[18] Except for non-rated bonds (16 percent of the total issuance), 18 percent of bonds have a rating of AAA, 27 percent are rated AA+, and 37 percent are rated AA. Most bonds differ from one another by at most one or two notches. Therefore rating contains little information in explaining the cross-sectional bond yields. The homogeneous bond rating likely reflects the fact that Chengtou bonds are collateralized with land-use right and Chengtou bonds are backed implicitly by the local governments. Table A.3 in the appendix reports the summary statistics of bond characteristics.

[17] We calculate the Amihud measure as an alternative liquidity proxy, and the results are similar.

[18] 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).

4.3.2 Province Risk Exposure

As explained in Section 2.1, local governments have limited legal financing power and all Chengtou bonds, regardless of issuing provinces, are indirectly backed by the central government as it is ultimately responsible for the finances of the local government. The risk exposure of each province to the central government therefore play an important role in determining the cross section of Chengtou bond yields.

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

$$\Delta Y_{jt} = \alpha_j + \beta_{j,F(k)} \Delta F(k)_t + \varepsilon_{jt} \tag{5}$$

where ΔY_{jt} is the monthly change of province-level excess yields, which are computed by averaging across all bond-level excess yields issued in province j during month t. $\Delta F(k)_t$ is the change of national economic barometers from month $t-1$ to month t, which are introduced in Section 3.4 and capture China's solvency risk, monetary policy, and financial market conditions. We run the regression (5) for each province 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 excess yields to the changes in national economic conditions.

We report summary statistics of the distribution of betas in Table A.4 of the appendix. The betas exhibit significant variation across provinces, with the largest dispersion between the 10th and 90th percentiles being 1.79 for betas on the Chinese stock market return (RET) and 1.17 for betas on the change in the one-year time deposit rate (ΔRF). In Panel B, we sort provinces into three portfolios: Low, Medium, and High, based on the betas for each factor. We report the Chengtou bond excess yields in the Low and High portfolios, along with a t-test for the difference. There are significant differences in the excess yields for all macro factors. Provinces 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 provinces most exposed to central government also increase. Provinces with higher betas to the effective real exchange rate tend to have lower yields. This is possibly due to local government finances in provinces with high exchange rate betas benefiting from increased exports when the RMB depreciates. These univariate portfolio sorting results suggest that Chengtou bonds yields are sensitive to province risk exposures to national solvency risk, monetary policy, and financial market conditions. We will include all province risk exposures, the betas, as control variables in our main empirical tests of the next section.

5 Main Results

In this section we provide empirical evidence that the large cross-sectional variations in Chengtou bond excess yields are mainly driven by two factors—real estate and political risk. In particular, local real estate GDP tends to lower Chengtou bond yields hence reduces the local government's financing cost, while political risk tends to elevate the local government's financing costs. Moreover, real estate 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.

5.1 Real Estate

We now examine the provincial economic variables, in particular, the real estate variables in explaining the cross-section of Chengtou bond excess yields. As explained in the introduction, the higher proportion of real estate value in the local GDP can either boost or dampen local governments' future revenue, hence affect their capability in supporting LGFVs to pay back the interests and principals of Chengtou bonds. Our empirical findings support the "growth engine" story, that is, local real estate value strongly and *positively* favors the Chengtou bond market and lowers Chengtou bond yields. There is no empirical evidence of the "ghost

town" effect in whole sample analysis, i.e., the oversupply in real estate sector causing higher financing cost for the local governments.

Table 4 presents the results. Columns (1) through (4) report the regression coefficients taking just one GDP component at a time. Most local GDP components are statistically significant. The coefficient on *REAL ESTATE GDP* is -0.17, implying that if a given province moves by one standard deviation in the cross section, that province's Chengtou bond excess yields would decrease by 0.17 percent. Given that the average Chengtou bond excess yield is 1.98 percent, the impact is about 8.6 percent decrease in Chengtou bond excess yields which turns out to be a large economic effect. When including them together in the multivariate regression, as shown in column (5), only the real estate sector remains significant, indicating 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 column (6) of Table 4. The coefficient of the local GDP growth is positive but not significant. The fiscal surplus is positively and significantly related to Chengtou bond yields. These results echo the distribution of Chengtou bond yields in portfolios sorted by these two economic barometers, as shown in Table 3. A priori we might expect that provinces with higher growth and higher fiscal surplus may enjoy lower cost of financing, that is, lower Chengtou bond yields. The positive coefficients thus seem counter-intuitive. One possible reason for the positive sign is that provinces with higher GDP growth and higher fiscal surpluses also exhibit higher volatilities of growth. This conjecture is confirmed by the right panel in Table 3. When dividing the provinces into high, middle, and low terciles, provinces in the high tercile of fiscal surpluses have a mean of 20.73 percent and a standard deviation of 9.94 percent. The provinces in the low fiscal surplus tercile have, by construction, the lowest mean of fiscal surplus of 3.18 percent but also a low standard deviation of 3.04 percent.

In column (7) of Table 4, we consider the full set of provincial economic variables. When jointly taking local GDP components, GDP growth and fiscal surplus in the multivariate regression, the real estate GDP becomes the only variable which maintains its significant

pricing power. In addition, the magnitude of the coefficient remains almost the same, -0.18 percent compared to -0.17 percent in column (1), indicating a robust explanatory power. It is worth noting that all findings hold after controlling for province risk exposures and bond characteristics.

In sum, all regression specifications favor real estate GDP. This strong result indicates that real estate sector plays an essential role in explaining the cross-section of Chengtou bond excess yields.

5.1.1 Alternative Real Estate Measures

The real estate variable studied above is the real estate contribution to the local GDP, that is the real estate value scaled by GDP. It is a synthetic measure that includes different dimensions of information in the real estate sector. In this subsection, we further examine each of such dimensions including *LAND COST*, the total amount used to purchase land as a ratio of local GDP, *RE TAX*, the ratio of tax on 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 C of Table 2, these real estate variables are positively related to each other, with the correlation coefficients ranging from 0.17 to 0.71. In particular, *RE GDP* is highly correlated with *RE TAX*, *RE PRICE*, and *RE LOAN*, with the correlation coefficient of 0.67, 0.70, and 0.65, 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 yields. Table 5 shows that one standard deviation increase in *LAND COST* leads to 0.09 percent decrease in Chengtou bond yields, and the coefficient is -0.11 percent (t-stat= -2.78) for *RE TAX*, -0.16 percent (t-stat= -6.01) for *RE PRICE*, -0.16 percent (t-stat= -4.62) for *RE LOAN*, and -0.01 percent (t-stat= -0.16) for *RE INVEST*. 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 yields.

5.2 Political Risk

In this section, we examine whether political risk can explain the cross-section of Chengtou bond excess yields. We use the two proxies for political risk: the rank-weighted index, *GRAFT–TIGERS*, and the number of cases in graft probes, *GRAFT–FLIES*, which we describe in Section 3.3. As hypothesized in the introduction, provinces with higher political risk could have either higher or lower cost of financing. If a province has more officials involved in graft probes, these legal investigations could hinder local economic development and thus increase financing cost. Alternatively, provinces with more officials involved in graft probes, especially high-ranking officials, are typically the provinces with good economic development and aggressive political leaders, hence they should have lower financing cost since corruption greases the wheels of economic growth. We test the "value destruction" versus "greasing the wheels" hypotheses.

Table 6 confirms the "value destruction" hypothesis. Columns (1) and (2) consider the political risk proxies individually, showing a statistically significant and economically meaningful positive relationship between risk-adjusted Chengtou bond yields and *GRAFT–TIGERS*. A one standard deviation move by a province in the cross section from less to more corruption increases Chengtou bond yields by 0.15 percent under the *GRAFT–TIGERS* measure. The results suggest that graft probes on high-ranking officials likely increase the uncertainty of the local government for providing backing income stream for LGFVs hence increase corresponding Chengtou bond yields. The coefficient on *GRAFT–FLIES* is positive but insignificant. Column (3) considers two proxies jointly. Though two proxies are negatively related with a correlation of -0.08, as shown in Panel B of Table 2, the multivariate regression results remain almost the same: *GRAFT–TIGERS* has a positive and significant coefficient of 0.14 (t-stat= 3.99) while *GRAFT–FLIES* has a positive but insignificant coefficient of 0.03 (t-stat= 0.67) , after controlling for province risk exposures and bond characteristics.

Our empirical results refute the "greasing the wheels" hypothesis—government corruption and economic growth go hand-in-hand. Instead, we find political risk, especially when involving higher-ranking officials, increases the uncertainty of the local government in providing sustainable backing income stream for LGFVs, hence increase corresponding Chengtou bond yields.

5.2.1 Event Study of Corruption Announcement

Given the fact that corruption involved irreplaceable information during the anti-corruption campaign, we further examine the impact of the corruption announcement on the Chengtou bond market. 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 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 excess yield to the national average excess yield, 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 in realized province excess yield and that predicted, where the prediction is based on the realized national excess yield and the regression coefficients in the estimation window.

Table 7 reports the abnormal yield spread 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 for the top 5 provinces with the highest corruption indexes. The results indicate that provinces

with the most severe political risk are inclined to respond positively on the announcement days, and their average excess yields are lower than those predicted, suggesting a decreasing financing costs for these provinces. 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 CCDI 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.

5.3 Interaction of Real Estate and Political Risk

So far we have shown that real estate variables and political risk have strong explanatory power in the cross-section of Chengtou bond excess yields, after controlling for bond characteristics and province risk exposures. Real estate and political risk, however, are not orthogonal to each other. In China, real estate is in particular a hotbed for corruption, as the anti-corruption cases indicate. We therefore include the interaction of real estate and political risk in the research design.

In Table 8, column (1) shows the result with only political risk proxies, column (2) adds *REAL ESTATE GDP*, and columns (3)-(5) further adds the interaction of real estate GDP with TIGERS and FLIES separately. *REAL ESTATE GDP* remains to be the primary factor that explains the cross-section of Chengtou bond excess yields, with significant and robust coefficients between -0.14 to -0.18 which dominates the magnitudes of other estimated coefficients. *GRAFT–TIGERS* also remains to be significant and positive in all four regression specifications, yet with decreasing explanatory power from column (1) to column (5): the estimated coefficients are 0.14 (t-stat= 3.99) in column (1), 0.08 (t-stat= 2.89) after including the real estate GDP in column (2), and 0.05 (t-stat= 1.91) in column (5) after including the real estate GDP and its interactions with corruption measures.

It is worth noting that conditional on *GRAFT–FLIES*, provinces with higher real estate value in the local GDP become to have higher financing cost, i.e., higher Chengtou bond

yields. The coefficient of the interaction term *RE GDP * FLIES* is robust with a value of 0.07 significant at 1 percent in both columns (4) and (5). This conditional finding is important as it indicates that only in relatively healthy (less corrupt) provinces, real estate value is positively related to local government's sustainable backing income stream. Alternatively speaking, provinces with both higher corruption and higher proportion of real estate value to local GDP will not benefit from local real estate revenue, since such revenue may not be durable and likely is impaired by political risk, especially corruption.

One implication of this interaction effect is that, although real estate overall has a "growth engine" effect on Chengtou bond yields nationwide, for high political risk provinces real estate seemingly has a "ghost town" effect—elevating local government financing cost. To better understand this nonlinear effect, we examine the relationship between real estate and political risk in the next subsection.

5.3.1 Relationship between Real Estate and Political Risk

As discussed in Section 2.2, real estate sector is closely related to local governments, through channels including land allocation, changes of the purpose of land (e.g., from public-use to commercial use), and especially the sales of land-use rights. In theory, local governments should supervise all the functioning departments in managing the real estate industry, however, many of government officials have directly participated in or even organized real estate corruption. Table A.1 lists some examples of high-ranking local officials involved in real estate corruption. For example, 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 9. The dependent variable is *REAL ESTATE GDP* for each province 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, columns (1) and (2), and in the multivariate regression, column (3). The

magnitude is particularly large for the *GRAFT–TIGER* measure, -1.22 (t-stat= -4.51) compared to -0.02 (t-stat= -3.01) for the *GRAFT–FLIES* measure, indicating that provinces 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 column (4), after controlling for province risk exposures.

This significant negatively relationship between real estate and political risk helps us understand the nonlinear interaction term in Table 8. Higher political risk in a province, measured by corruption proxies, may impair the real estate value hence reduce the collateral value of Chengtou bonds. Therefore, the nonlinear effect on Chengtou bond yields represents the net balance between the direct positive effect from real estate and indirect negative effect from political risk.

6 Conclusion

Chengtou bonds—urban construction and investment bonds—play a major role in financing for the local governments and represents a growing share of debt explosion problem in China. However, there has never been single default of Chengtou bonds, because they are mostly backed by land use rights as collaterals and issued by local government financing vehicles (LGFVs)–a special purpose vehicle. Therefore, the local governments implicitly guarantee Chengtou bonds, and under current budget law, the central government is ultimately responsible for the finances of all local governments.

We find that real estate GDP is the most important driver of the cross-section of Chengtou bonds excess yields, which is not surprising given that land use right as Chentgou bond collateral is the main determinant of the real estate value in China. We construct an index of corruption based on the officials investigated by CCDI and find a significantly positive correlation between risk-adjusted Chengtou bond yields and the corruption index. There is also a nonlinear effect—for high corruption provinces, high real estate GDP increases Chengtou bond yields; while low corruption regions enjoy low financing cost due to high real

estate value.

These findings have important policy implications. Starting from 2015, the Ministry of Finance has adopted a five-year debt-swap plan for exchanging Chengtou bonds (and loans) with provincial municipal bonds—similar to the U.S. municipal bonds. However, it is not clear whether the current provincial municipal bonds have priced in properly the important risk exposures identified in our Chengtou bond study, namely real estate and political risk. 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.

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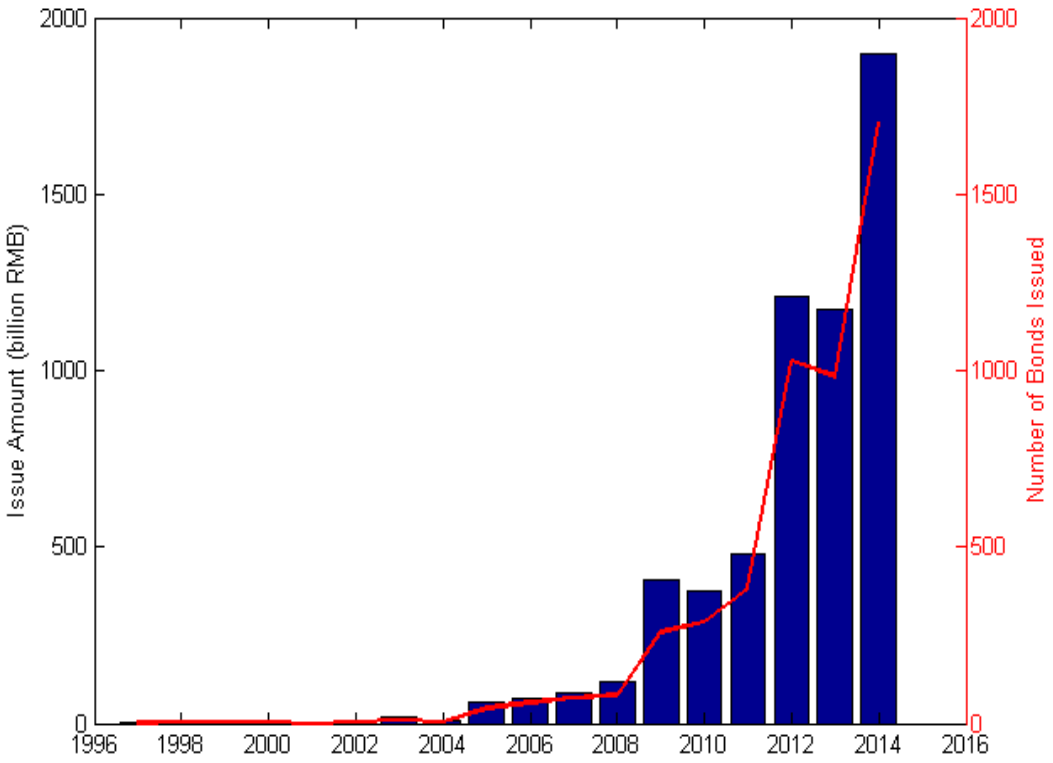


Figure 1: Annual Issuance of Chengtou Bonds

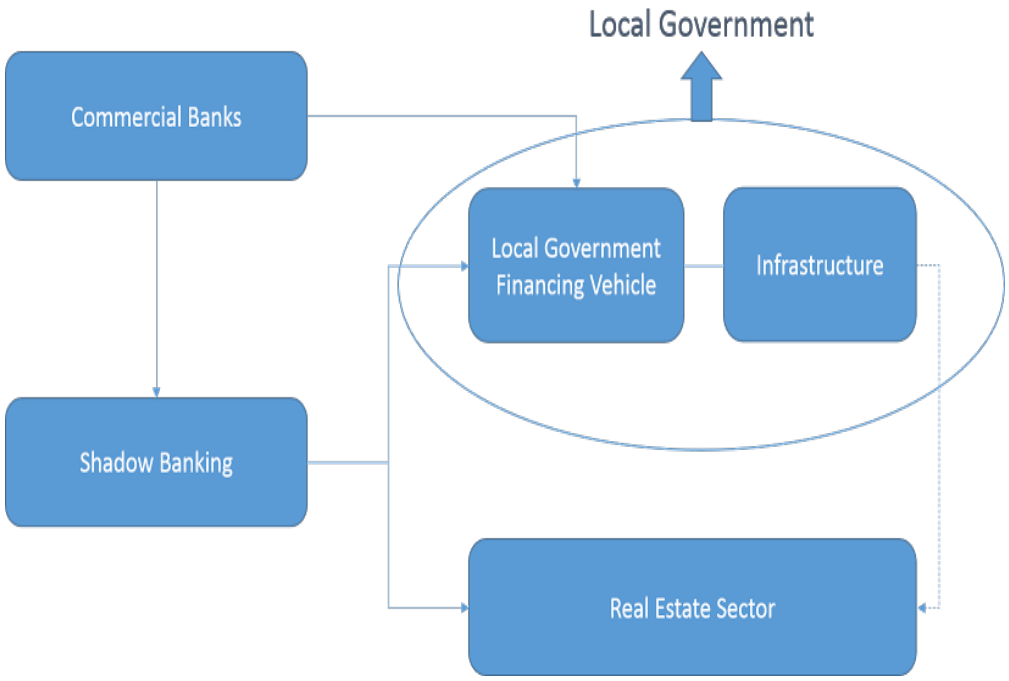
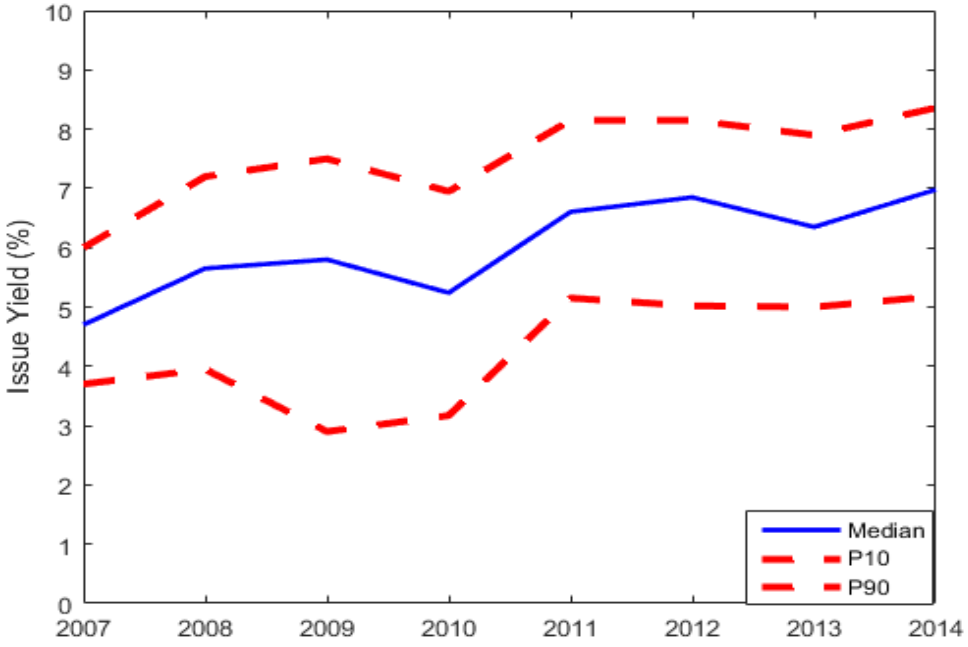


Figure 2: The Nexus of Chinese Local Government Debt

Panel A: Issue Yields in the Primary Market



Panel B: Excess Yields in the Secondary Market

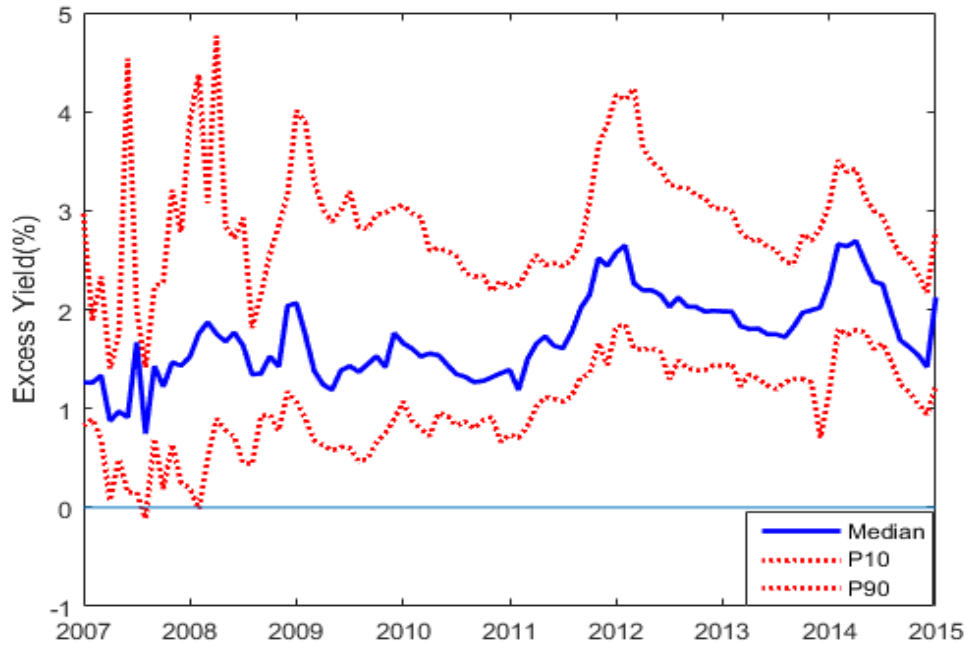


Figure 3: **Dispersion of Chengtou Bond Yields**

Table 1: **Chengtou Bond Issuance**

The table reports chengtou bond issuance in terms of the number of bonds issued each year and the issue amounts in billions of RMB 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 30 years, (7,30]. *Amount* in Panel B is in RMB billion. Integer values are assigned to ratings: one for A increasing to six for AAA. We report the average maturity and rating at issue.

Panel A: Issuance over Time

	Number of Bonds Issued (Years)					Issue Amount (¥Bil)					Outstanding
Year	(0,1]	(1,3]	(3,7]	(7,30]	Total	(0,1]	(1,3]	(3,7]	(7,30]	Total	(Bil RMB)
1997	0	0	1	0	1	0	0	0.5	0	0.5	0.5
1998	0	3	2	0	5	0	0.9	0.8	0	1.7	2.2
1999	0	1	2	1	4	0	0.2	1.1	0.8	2.1	4.3
2000	0	2	3	0	5	0	0.3	2.1	0	2.4	6.7
2001	0	0	0	0	0	0	0	0	0	0	5.8
2002	0	0	0	5	5	0	0	0	7.5	7.5	12.6
2003	0	0	0	8	8	0	0	0	16.6	16.6	28.1
2004	0	0	1	4	5	0	0	1.4	7	8.4	35.4
2005	12	0	6	25	43	18.2	0	7	33.3	58.5	91.8
2006	19	0	3	37	59	23.1	0	1.8	44.3	69.2	142.3
2007	34	0	1	38	73	42.1	0	1.5	43.8	87.3	205.2
2008	36	4	32	7	79	49.3	8.5	50.7	11.7	120.2	280.9
2009	40	11	162	45	258	45.6	22.6	248.7	92.4	409.3	648.3
2010	68	17	156	47	288	79.4	19.9	203.2	72.8	375.3	964.2
2011	74	26	243	41	384	70.7	33.4	314.3	63.3	481.6	1362.2
2012	139	49	763	76	1027	133.1	35.6	930.1	109.1	1207.8	2469.4
2013	184	78	678	44	984	210.5	51.6	816.3	95.5	1173.8	3435.3
2014	352	139	1129	84	1704	381.9	56.01	1303.1	159.0	1900.0	4954.5
Total	958	330	3182	462	4932	1053.9	229.0	3882.5	756.9	5922.3	

Panel B: Issuance by Province

	At Issue			Outstanding		Maturity	Rating
Province	Amount(¥Bil)	Bonds	Issuers	Amount(¥Bil)	Bonds	(year)	
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

Table 2: **Summary Statistics of Key Variables**

Variables are defined in Sections 3.2 and 3.3. The correlation matrix is calculated based on the full sample from August 2007 to December 2014.

Panel A: summary statistics

Variable	Mean	Median	SD	P10	P90
GRAFT–TIGERS	2.08	2.06	0.33	1.73	2.52
GRAFT–FLIES	19.61	18.00	12.85	8.00	36.00
REAL ESTATE GDP (%)	4.95	5.31	1.53	2.91	6.77
GDP GROWTH (%)	13.79	11.95	5.71	7.30	22.35
FISCAL SURPLUS (%)	6.38	2.97	7.31	1.67	13.63
SERVICE GDP (%)	11.97	12.12	2.63	8.70	15.63
RETAIL GDP (%)	9.84	9.54	2.70	6.86	13.38
HOTEL GDP (%)	2.02	1.93	0.43	1.55	2.63
LAND COST (%)	2.57	2.11	1.72	1.01	5.62
RE TAX (%)	2.39	2.36	0.62	1.61	3.31
RE PRICE ($'000¥/m^2$)	7.49	6.26	4.14	3.56	14.46
RE LOAN (%)	1.17	1.24	0.63	0.43	1.97
RE INVEST (%)	2.51	2.45	0.29	2.20	2.94

Panel B: correlation of main explanatory variables

	TIGERS	FLIES	RE GDP	GROWTH	SURPLUS	SERVICE	RETAIL	HOTEL
GRAFT–TIGERS	1	.	.	.	.	.	.	.
GRAFT–FLIES	-0.08	1.00	.	.	.	.	.	.
REAL ESTATE GDP	-0.45	-0.31	1.00	.	.	.	.	.
GDP GROWTH	0.23	0.02	-0.39	1.00	.	.	.	.
FISCAL SURPLUS	0.18	0.02	-0.59	0.21	1.00	.	.	.
SERVICE GDP	-0.22	-0.48	0.60	-0.31	-0.50	1.00	.	.
RETAIL GDP	-0.23	-0.49	0.58	-0.35	-0.49	0.76	1.00	.
HOTEL GDP	0.19	0.37	-0.26	0.02	0.15	-0.18	-0.32	1.00

Panel C: correlation of real estate variables

	RE GDP	LAND COST	RE TAX	RE PRICE	RE LOAN	RE INVEST
RE GDP	1.00	.	.	.	.	.
LAND COST	0.47	1.00	.	.	.	.
RE TAX	0.67	0.55	1.00	.	.	.
RE PRICE	0.70	0.61	0.58	1.00	.	.
RE LOAN	0.65	0.57	0.48	0.65	1.00	.
RE INVEST	0.25	0.71	0.17	0.32	0.52	1.00

Table 3: **Distribution of Chengtou Bond Excess Yields**

The table reports the distribution statistics of the excess yield (%) on chengtou bonds based on transaction data. We also report the bond excess yield distribution for portfolios sorted by six criteria based on province-level characteristics: (1) *GEOGRAPHY*, (2) *FISCAL SURPLUS*, the ratio of local fiscal surplus or deficit to GDP, (3) *GDP GROWTH*, the growth rate of local real GDP, (4) *REAL ESTATE PRICE*, the average price per squared meters during 2008 to 2014 for each province, (5) *GRAFT–TIGERS* , the rank-weighted average graft index, and (6) *GRAFT–FLIES*, the number of graft cases in each province. P10 and P90 denote the 10th and 90th percentiles, respectively. Right panel reports the mean and standard deviation (*SD*) in each portfolio for corresponding criteria. The sample period is from 2007 to 2014.

		Excess Yields (%)					Characteristics	
		Mean	Median	SD	P10	P90	Mean	SD
GEOGRAPHY								
	Coastal	1.87	1.77	0.81	1.04	2.83		
	Middle	2.15	2.11	0.83	1.19	3.19		
	West	2.21	2.16	0.75	1.34	3.10		
FISCAL SURPLUS							Fiscal Surplus (%)	
	High	2.37	2.35	0.76	1.43	3.29	20.73	9.94
	Mid	2.13	2.07	0.79	1.24	3.09	10.44	3.13
	Low	1.85	1.76	0.80	1.03	2.81	3.18	3.04
GDP GROWTH							GDP Growth (%)	
	High	2.09	2.00	0.80	1.25	3.05	19.08	7.34
	Mid	2.10	2.06	0.81	1.20	3.07	16.51	5.02
	Low	1.79	1.69	0.79	0.97	2.79	13.93	5.73
REAL ESTATE PRICE							RE Price (¥/m^2)	
	High	1.92	1.81	0.81	1.08	2.90	7659	3629
	Mid	2.08	2.03	0.81	1.14	3.11	3687	267
	Low	2.17	2.18	0.76	1.26	3.07	3145	144
GRAFT–TIGERS							Graft Index	
	High	2.20	2.13	0.82	1.26	3.18	2.47	0.23
	Mid	1.89	1.80	0.79	1.07	2.87	2.13	0.13
	Low	1.91	1.84	0.80	1.04	2.87	1.75	0.09
GRAFT–FLIES							Number of Cases	
	High	2.01	1.95	0.78	1.17	2.97	39	9
	Mid	2.04	1.98	0.83	1.12	3.05	23	3
	Low	1.92	1.82	0.82	1.08	2.94	9	4
WHOLE SAMPLE		1.98	1.90	0.81	1.11	2.98		

Table 4: **Chengtou Bond Excess Yields and Provincial Economic Conditions**

This table presents the panel regression results of chengtou bond excess yields on the provincial economic barometers, as in formula (4). The provincial economic barometers include the real estate value-added GDP, the service value-added GDP, the wholesale and retail value-added GDP, the hotel value-added GDP, as well as the local real GDP growth, and fiscal surplus, all scaled by the local GDP. 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.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
REAL ESTATE GDP	-0.17***				-0.21***		-0.18***
	[-5.48]				[-5.13]		[-3.76]
SERVICE GDP		-0.01			-0.04		-0.04
		[-0.41]			[-1.15]		[-1.25]
RETAIL GDP			-0.11***		0.04		0.06
			[-3.30]		[0.87]		[1.36]
HOTEL GDP				0.08**	-0.03		-0.04
				[1.98]	[-0.48]		[-0.66]
GDP GROWTH						0.04	0.03
						[1.09]	[0.50]
FISCAL SURPLUS						0.11**	0.05
						[2.62]	[1.41]
β_{CDS}	0.34**	0.3	0.23*	0.37*	0.36**	0.27**	0.33*
	[2.43]	[1.57]	[1.94]	[1.93]	[2.23]	[2.34]	[2.02]
β_{FDI}	0.05	0.07	0.05	-0.05	0.13	0.39**	0.29
	[0.22]	[0.27]	[0.28]	[-0.19]	[0.48]	[2.10]	[0.94]
β_{CA}	0.13	0.65	0.68	1.99	-0.74	-0.36	-1.29
	[0.13]	[0.57]	[0.78]	[1.40]	[-0.45]	[-0.45]	[-0.76]
β_{FX}	-3.60**	-2.57	-2.41*	-3.17*	-3.34*	-1.46	-2.62**
	[-2.23]	[-1.35]	[-1.77]	[-1.91]	[-1.93]	[-1.21]	[-1.42]
β_{RF}	-0.08	-0.01	-0.03	0.07	-0.12	-0.05	-0.14
	[-1.20]	[-0.06]	[-0.45]	[0.66]	[-1.08]	[-0.67]	[-1.25]
β_{RET}	-0.12***	-0.08	-0.01	-0.10	-0.12*	-0.09*	-0.13*
	[-3.49]	[-1.14]	[-0.26]	[-1.69]	[-1.72]	[-1.87]	[-1.91]
SIZE	-0.11***	-0.14***	-0.12***	-0.13***	-0.12***	-0.13***	-0.12***
	[-5.56]	[-6.29]	[-5.73]	[-5.80]	[-6.23]	[-5.96]	[-6.13]
MATURTY	0.08**	0.09***	0.07**	0.08**	0.08**	0.08**	0.09***
	[2.19]	[2.82]	[2.28]	[2.64]	[2.52]	[2.64]	[2.77]
LIQUIDITY	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
	[-0.53]	[-0.64]	[-0.51]	[-0.63]	[-0.60]	[-0.51]	[-0.60]
Month Dummy	Y	Y	Y	Y	Y	Y	Y
Cluster (Province)	Y	Y	Y	Y	Y	Y	Y
Observations	17524	20342	20342	20342	17524	20295	17477
Adjusted R2	0.257	0.232	0.245	0.237	0.260	0.255	0.260

Table 5: **Robust Check: Alternative Real Estate Barometers**

This table presents the panel regression results of chengtou bond excess yields on the real estate barometers measured in various dimensions. In addition to real estate GDP examined in previous tables, 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 LOA*N), the investment in real estate development scaled by local GDP (*RE INVEST*). 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.

	(1)	(2)	(3)	(4)	(5)
LAND COST	-0.09*				
	[-1.74]				
RE TAX		-0.11**			
		[-2.78]			
RE PRICE			-0.16***		
			[-6.01]		
RE LOAN				-0.16***	
				[-4.62]	
RE INVEST					-0.01
					[-0.16]
β_{CDS}	0.41**	0.44***	0.29***	0.40***	0.31
	[2.40]	[3.38]	[2.93]	[2.83]	[1.65]
β_{FDI}	-0.03	0.11	0.17	-0.07	0.04
	[-0.13]	[0.58]	[0.86]	[-0.22]	[0.17]
β_{CA}	0.72	0.80	-0.21	1.02	0.75
	[0.71]	[0.86]	[-0.24]	[1.03]	[0.61]
β_{FX}	-4.29*	-3.94**	-1.41	-4.72**	-2.83
	[-1.78]2	[-2.36]	[-0.85]	[-2.52]	[-1.38]
β_{RF}	-0.02	-0.03	-0.07	-0.04	-0.00
	[-0.32]	[-0.33]	[-1.17]	[-0.75]	[-0.04]
β_{RET}	-0.13*	-0.11*	-0.02	-0.06	-0.09
	[-1.97]	[-1.84]	[-0.45]	[-1.61]	[-1.18]
SIZE	-0.13***	-0.13***	-0.11***	-0.11***	-0.13***
	[-6.50]	[-6.29]	[-4.93]	[-4.99]	[-6.81]
MATURITY	0.08**	0.08**	0.07**	0.07**	0.09**
	[2.68]	[2.31]	[2.12]	[2.13]	[2.69]
LIQUIDITY	-0.01	-0.01	-0.01	-0.01	0.01
	[-0.88]	[-0.99]	[-0.96]	[-0.67]	[-0.64]
Month FE	Y	Y	Y	Y	Y
Cluster (Province)	Y	Y	Y	Y	Y
Observations	20342	18234	20342	20342	20342
Adjusted R2	0.241	0.238	0.264	0.263	0.231

Table 6: **Chengtou Bond Excess Yields and Political Risk**

This table presents the panel regression results of chengtou bond excess yields on the political risk of local governments, f_j, as in formula (4). 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.

	(1)	(2)	(3)
GRAFT–TIGERS	0.15***		0.14***
	[3.74]		[3.99]
GRAFT–FLIES		0.05	0.03
		[0.94]	[0.67]
β_{CDS}	0.31**	0.25	0.28**
	[2.58]	[1.23]	[2.10]
β_{FDI}	-0.21	-0.09	-0.28
	[-1.08]	[-0.30]	[-1.07]
β_{CA}	0.7	0.97	0.84
	[0.75]	[0.78]	[0.85]
β_{FX}	-2.86**	-3.61	-3.34**
	[-2.09]	[-1.64]	[-2.11]
β_{RF}	-0.02	-0.03	-0.04
	[-0.32]	[-0.31]	[-0.51]
β_{RET}	-0.179***	-0.05	-0.15**
	[-2.90]	[-0.63]	[-2.34]
SIZE	-0.14***	-0.13***	-0.13***
	[-6.21]	[-6.32]	[-5.87]
MATURITY	0.08**	0.08**	0.08**
	[2.67]	[2.64]	[2.63]
LIQUIDITY	-0.01	-0.01	-0.01
	[-0.71]	[-0.67]	[-0.74]
Month Dummy	Y	Y	Y
Cluster (Province)	Y	Y	Y
Observations	20342	20342	20342
Adjusted R2	0.252	0.233	0.252

Table 7: **Event Study on Corruption Announcement**

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.

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

Table 8: **Chengtou Bond Excess Yields and Real Estate, Political Risk, and their Interaction**

This table presents the panel regression results of chengtou bond excess yields on the local real estate GDP, local political risk, and their interactions, as in formula (4). 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.

	(1)	(2)	(3)	(4)	(5)
REAL ESTATE GDP		-0.16***	-0.14***	-0.18***	-0.16***
		[-5.15]	[-5.10]	[-6.66]	[-6.69]
GRAFT–TIGERS	0.14***	0.08***	0.07*		0.05*
	[3.99]	[2.89]	[2.07]		[1.91]
GRAFT–FLIES	0.03	-0.06		-0.03	-0.02
	[0.67]	[-1.58]		[-0.84]	[-0.64]
*RE GDP * TIGERS*			-0.02		-0.04
			[-0.49]		[-1.61]
*RE GDP * FLIES*				0.07***	0.07***
				[3.24]	[3.34]
β_{CDS}	0.28**	0.41***	0.35***	0.39***	0.41***
	[2.10]	[2.88]	[2.60]	[2.55]	[3.01]
β_{FDI}	-0.28	0.12	-0.09	0.3	0.145
	[-1.07]	[0.46]	[-0.50]	[1.07]	[0.55]
β_{CA}	0.84	-0.38	0.14	-0.75	-0.67
	[0.85]	[-0.39]	[0.16]	[-0.69]	[-0.71]
β_{FX}	-3.34**	-2.39	-3.65**	-2.07	-2.34
	[-2.11]	[-1.32]	[-2.49]	[-1.08]	[-1.29]
β_{RF}	-0.04	-0.06	-0.08	-0.08	-0.09
	[-0.51]	[-0.87]	[-1.35]	[-1.36]	[-1.47]
β_{RET}	-0.15**	-0.22***	-0.17***	-0.18***	-0.22***
	[-2.34]	[-4.20]	[-4.05]	[-4.48]	[-4.19]
SIZE	-0.13***	-0.12***	-0.11***	-0.11***	-0.11***
	[-5.87]	[-5.96]	[-5.63]	[-5.69]	[-5.69]
MATURITY	0.08**	0.08**	0.08**	0.08**	0.08**
	[2.63]	[2.28]	[2.26]	[2.25]	[2.33]
LIQUIDITY	-0.01	-0.01	-0.01	-0.01	-0.01
	[-0.74]	[-0.51]	[-0.52]	[-0.60]	[-0.54]
Month FE	Y	Y	Y	Y	Y
Cluster (Province)	Y	Y	Y	Y	Y
Observations	20342	17524	17524	17524	17524
Adjusted R2	0.252	0.263	0.261	0.264	0.268

Table 9: **The Relationship of Real Estate and Political Risk**

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*

	(1)	(2)	(3)	(4)
GRAFT–TIGERS	-1.05***		-1.22***	-1.50***
	[-3.98]		[-4.51]	[-4.08]
GRAFT–FLIES		-0.02**	-0.02***	-0.02***
		[-2.16]	[-3.01]	[-2.73]
β_{CDS}				0.22
				[0.55]
β_{FDI}				2.70***
				[3.85]
β_{CA}				-1.14
				[-0.47]
β_{FX}				5.64
				[1.06]
β_{RF}				0.32***
				[2.65]
β_{RET}				-0.58**
				[-3.26]
Observations	187	187	187	156
Adjusted R2	0.056	0.017	0.091	0.209

Appendix

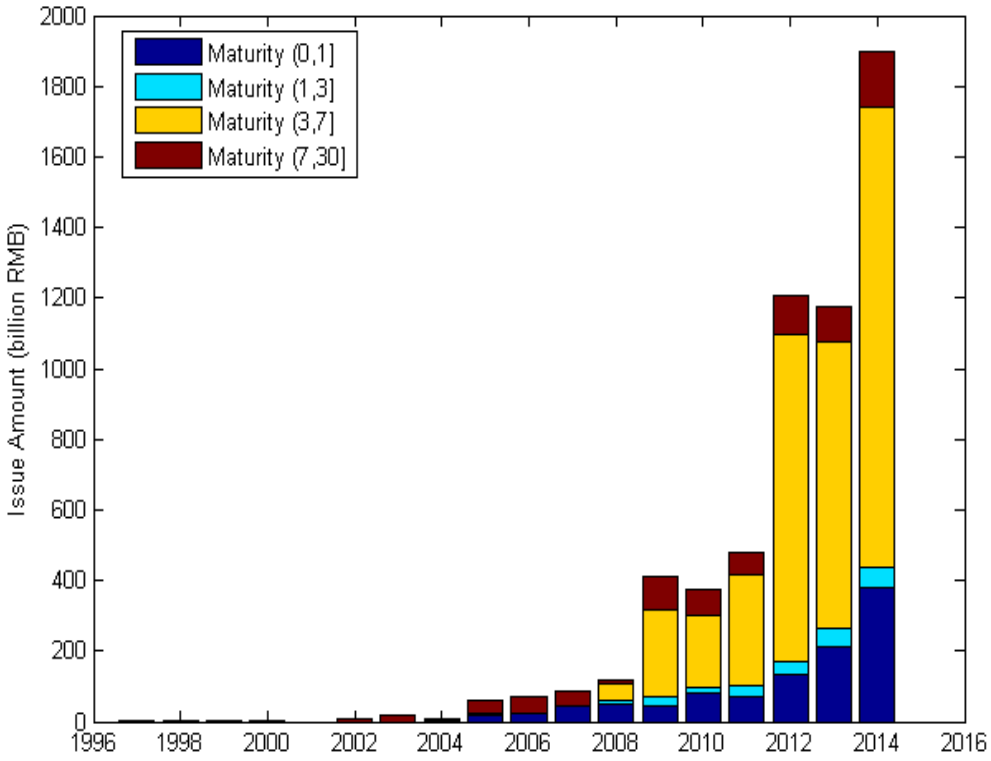


Figure A.1: Tenor Decomposition of the Annual Chengtou Bond Issuance

Table A.1: **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	Fed2013	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
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
LiChuncheng	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.2: **Yield at Issue (%) by Maturity (Years)**

The table breaks down chengtou issuance by maturity buckets: 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 30 years, (7,30].

	(0,1]	(1,3]	(3,7]	(7,30)	Average
1997			12.50		12.50
1998		7.64	9.00		8.32
1999		3.78	5.10	4.32	4.40
2000		3.72	4.00		3.86
2002				4.40	4.40
2003				4.43	4.43
2004			5.30	5.72	5.51
2005	2.95		4.58	4.98	4.17
2006	3.55		4.00	4.20	3.92
2007	4.38		1.00	5.19	3.52
2008	5.03	5.83	6.14	6.46	5.87
2009	2.72	3.75	6.10	6.13	4.68
2010	3.40	4.43	5.90	6.04	4.94
2011	5.64	5.76	6.88	7.06	6.33
2012	5.09	6.12	6.95	7.02	6.29
2013	5.40	6.88	6.58	6.07	6.23
2014	5.41	8.16	7.16	6.80	6.88

Table A.3: **Summary Statistics of Bond Characteristics**

SIZE is the logarithm of the amount outstanding of Chengtou bonds. MATURITY is the remaining years to maturity of a bond. LIQUIDITY referst to a bond trading liquidity, measured by the bid-ask spread based on the daily highest and lowest prices following Corwin and Schultz (2012). The sample period is from August 2007 to December 2014.

	Mean	Median	SD	P10	P90
SIZE (log(¥ Bil))	2.49	2.48	0.70	1.61	3.40
MATURITY (year)	3.57	2.92	3.38	0.33	7.92
LIQUIDITY	0.21	0.00	0.74	0.00	0.51

Table A.4: **Province Risk Exposure: Summary Statistics and Sorting Portfolios**

We estimate province risk exposure, β's, by regressing the changes in province-level Chengtou bond yields on the changes in China's economic and financial factors, as in equation (5)). We aggregate bond-level yields to the province level as the dependent variable. The economic and financial factors include the change in the credit default swap rate (CDS), the change of foreign direct investment to China (FDI), the change of the log of the current account (CA), the change of the effective real exchange rate (FX), the change in the one-year time deposit rate, (RF), and the stock market return, (RET). In Panel A, we report summary statistics of the betas. In Panel B, we sort provinces into three portfolios according to the betas: High, Medium, and Low. We report chengtou bond excess yields (in percentages) of the High and Low portfolios, and report the t-test for the difference of average yields across the High and Low portfolios. The sample period is from August 2007 to December 2014.

	β_{CDS}	β_{FDI}	β_{CA}	β_{FX}	β_{RF}	β_{RET}
Panel A: Summary Statistics of Betas						
Mean	0.14	0.11	-0.01	0.00	-0.33	0.12
Median	0.30	0.21	0.07	0.03	0.96	0.69
SD	0.13	0.09	-0.02	0.00	-0.12	0.16
P10	-0.15	-0.14	-0.04	-0.03	-0.92	-0.77
P90	0.35	0.34	0.03	0.03	0.25	1.02
Panel B: Excess Yields (%) Sorted by β's						
Low	1.91	1.89	1.98	2.05	2.15	2.11
High	2.15	2.10	2.13	1.97	1.94	2.01
High-Low	0.24	0.21	0.16	-0.07	-0.21	-0.09
t-statistics	5.52	5.51	3.82	-1.81	-5.15	-2.49