

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

Andrew Ang[†] Jennie Bai[‡] Hao Zhou[§]

January 31, 2016

JEL Classification: D73, G12, G14, G28, H74.

Key Words: Chengtou bond, real estate, corruption, local government financing vehicle, government guarantee, systemic risk.

*We thank Jennifer Carpenter, Darrell Duffie, Arvind Krishnamurthy, Stijn Van Nieuwerburgh, Zhiguo He (AEA discussant), Wei Xiong (NBER discussant), Song Han, and seminar participants at AEA (2016), NBER Chinese Economy conference (2015), the “G2 at GW” conference on U.S.-China Economic Relations and Chinas Economic Development, the Summer Institute of Finance conference (2015), New York University, Stanford GSB, Georgetown, George Washington University, the IMF, the World Bank, Tsinghua University, Federal Reserve Bank of New York, Federal Reserve Board, for helpful comments and suggestions. We also thank Angsheng Gu, Biqing He, and Yichen Li for excellent research assistance. An animated graph of Chengtou bond issuance can be found at <http://www.columbia.edu/~aa610/chinamuni.html>

[†]Ann F. Kaplan Professor of Business, Columbia Business School, 3022 Broadway, 413 Uris, New York, NY 10027. Phone: (212) 854-9154, Email: aa610@columbia.edu.

[‡]Assistant Professor of Finance, McDonough School of Business, Georgetown University, Washington, D.C. 20057. Phone: (202) 687-5695, Email: Jennie.Bai@georgetown.edu (corresponding author).

[§]Unigroup Chair Professor, PBC School of Finance, Tsinghua University. Phone: +86-10-62790655, Email: zhouh@pbcfs.tsinghua.edu.cn.

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Abstract

Chengtou bonds — urban construction and investment bonds, issued by local government financing vehicles (LGFV) and backed mostly by land sales, are the major source of debt financing for Chinese local governments. We identify large heterogeneity in Chengtou bond yields, despite their implicit guarantee from the central government. We find that in China real estate is the most prominent determinant of the cross section of local government credit spreads, with one standard deviation increase in local real estate GDP corresponding to about 10% decrease in Chengtou bond yield spread. Political risk, a novel measure based on the recent anti-corruption campaign in China, also has a significant negative effect on Chengtou bond prices. The effect of corruption works mainly through the real estate channel—more corruption depresses the real estate value, which in turn elevates Chengtou bond yields.

1 Introduction

Chengtou bonds—urban construction and investment bonds—are financial obligations of Chinese local governments. Capital raised through the Chengtou bond market finances, to a large extent, the tremendous growth in the infrastructure projects in China—ranging from megaprojects like the \$2.4 billion Shanghai Tower (the second tallest building in the world) to the housing estates sprouting in many cities. From 2008 to 2014, the Chengtou bond market increased by 85% per year, and as of December 2014, there were RMB 4.95 trillion (\$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% of GDP in 2008 to over 200% at the end of 2014.

In this paper we study the dispersion of Chengtou bond yields and show that the Chengtou bond market can serve as a nexus for China’s real estate, political risk, and market distortions. We first highlight the special features of Chengtou bonds in contrast to municipal bonds in the United States. These features discussed below set the foundation upon which the Chinese local government bonds differ remarkably from the U.S. municipal bonds, and such differences in turn provide unique explanations why Chengtou bond yields have provincial variations that are statistically significant and economically large.-

While its large size, fast growth, and central role in developing infrastructure of China make the Chengtou bond market interesting to study in and of itself, there is one feature that makes it uniquely suited to investigating the effect of government guarantees, political risk, and distortions in market pricing induced by such effects. Although Chengtou bonds are set up by local governments, they are implicitly guaranteed by the central government. This is a crucial feature that distinguishes them from municipal bonds in the United States. Under China’s fiscal and tax system, the central government takes final responsibility for revenues and deficits of local governments. Chengtou bonds are local government obligations and thus are ultimately backed by the central government. Given this unique feature, one may hypothesize that all Chengtou bonds have similar yields. However, we show that despite the tacit endorsement by the central government, Chengtou bonds yields exhibit significant *economic* heterogeneity across provinces.

In addition to the implicit central government guarantee, another main feature of

Chengtou bonds is that Chengtou bond issuance mostly requires collateral, which often involves the land-use rights. In contrast, the US 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 receive funds to supplement the direct transfers they receive from the central government. In a typical structure, an LGFV provides funds to a local government which is recorded as revenue, and the municipality in turn transfers land-use rights, or existing assets such as highways or bridges, to the LGFV. LGFVs issue Chengtou bonds, literally translated as “urban construction and investment bonds”, using the land-use right and the alike as collateral.

The central role of land-use right as bond collateral naturally links the Chengtou bond market to China’s real estate market. In China, real estate plays a vital role in economic development, and the key components driving the real estate market are the supply of land and the rental price of land-use right, which is controlled and implemented by the local government. Our second hypothesis is that the cross-section of Chengtou bond yield spreads should reflect the issue province characteristics, especially the conditions in the local real estate market. Indeed we find the most important drivers of Chengtou bond yields are variables related to real estate. In particular, the coefficient of the value-added real estate GDP ratio, given as a percentage of total local GDP, is negative and significant: an increase of one standard deviation in the cross-section of real estate GDP corresponds to a decrease in Chengtou bond yields of approximately 0.17%. Given that the average Chengtou bond yield spread (in excess of corresponding central government bond yield) is 1.98%, the impact is almost 10% which turns out to be a very large economic effect.

A third feature of the Chengtou bond market is its close relationship to political risk, especially corruption. While corruption and political connections influence market prices even in developed countries—Butler, Fauver, and Mortal (2009), for example, uncover a significantly positive relationship between high levels of corruption and the high yields of U.S. municipal bonds at issue—there is a significantly higher level of corruption, combined with the greater opacity of the political system, in China. Unlike municipal governments in the United States, Chinese local governments are not authorized to levy sales, property, or income taxes (with this arrangement dating back from the budget law enacted in 1994). Chinese municipalities also cannot directly borrow from banks or issue bonds, except

with approval from the State Council.¹ 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 including land leasehold sales and the issuance of Chengtou bonds. The process of seeking financial resources creates space for the possibilities of corruption—Cai, Henderson, and Zhang (2013) offers micro evidence of corruption in leasehold sales. Our third hypothesis is thus that the cross-section of Chengtou bond yield spreads should capture investor’s concerns about local political risk.

To study the influence of political risk, we create a novel measure of corruption by utilizing a manually collected dataset based on the officials investigated by the Central Commission for Discipline Inspection (CCDI). Among the 753 officials across 31 provinces who were named in CCDI’s graft probes, more than half of the officials had “undesirable working practices” related to the real estate sector. Confirming our hypothesis, we find a statistically significant and economically meaningful positive relationship between risk-adjusted Chengtou bond yields and two corruption measures: the rank-weighted average index and the total number of graft cases which we call “Tigers” and “Flies”, respectively, to reflect the depth and the width of corruption. A one standard deviation move by a province in the cross-section from less to more corrupt increases excess Chengtou bond yields by 0.09% under the Tigers measure, and 0.05% under the Flies measure.

We show further that province-level corruption is significantly and negatively related to the local real estate GDP, suggesting that the influence of corruption on local government credit spreads is likely through the (impaired) real estate channel. The intuition is that corruption by local government officials conducted via land allocation and rental pricing of land-use right during the development of real estate projects, will reduce the local real estate value-added GDP ratio, and further dampen the collateral value of Chengtou bonds, finally increasing the financing cost of local government, that is, the higher excess yields of Chengtou bonds. We conduct event studies on the Chengtou bond market upon the announcement of graft reports for high-ranking officials. The results indicate that provinces with the most severe corruption conditions are inclined to respond positively on the announcement days

¹When approved, municipal bond issuance is via the Ministry of Finance on behalf of the municipality. With an explicit guarantee from the central government, these “local government bonds” are quasi-treasuries and indeed behave like treasuries (Wang and Yu, 2014).

with decreasing bond yields.

Finally, we find that Chengtou bond yields are also sensitive to variables reflecting aggregate credit risk and monetary policy. In particular, provinces with larger factor loadings on China's credit risk, as proxied by Chinese sovereign CDS spreads, and larger loadings on effective real exchange rate changes have significant positive and negative prices of risk, respectively. The former result is consistent with the close link between local and central government finances: as China becomes riskier, yields of Chengtou bonds in the provinces most exposed to central government risk increase. The latter result is possibly driven by provinces with a strong export sector whose local economies, and thus municipal budgets, improve when the effective real exchange rate depreciates. These findings indicate that Chengtou bond market could potentially pose a systemic risk and thus plays an important role in China's financial system.

Literature

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 risk characteristics of LGFVs as bond issuers can determine Chengtou bond yields. We go beyond bond-level pricing, instead focus on how provincial characteristics, especially real estate variables, political risk such as corruption, and provincial risk exposures, are priced in the cross-section of Chengtou bonds. Our goal is to identify risk factors that drive the sharp and large economic variations across provinces, even under the implicit guarantee of the central government.

Our paper also relates to the literature about market distortion under government guarantee. 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 the 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, political risk, and systematic relevance.

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, Fisman and Wang, 2015a, 2015b). 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 corruption on local government credit spreads is probably through the (impaired) real estate channel.

Lastly, 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 credit spreads through its collateral channel.

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 how we construct Chengtou bond excess yields, detail the national and provincial macroeconomic barometers, and construct the political risk proxies. Section 4 sets up the empirical specification and Section 5 presents the main findings. Section 6 further examines the relationship between real estate and corruption in China. We conclude in Section 7 with a discussion on the relevance of our findings for China's current policies.

2 Institutional Background

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 municipal bonds, except with approval from the State Council. 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 answer the increasing 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, the Chengtou bond, literally "urban construction and investment bond." LGFVs play a crucial role in promoting China's infrastructure development and economic growth, as they provide off-balance sheet quasi-fiscal support for local governments. For example, they are primarily engaged in the construction of public welfare projects such as affordable housing construction,

infrastructure, social services, and ecological and environmental protection. The first Chengtou bond, Pudong development bond, was issued in Shanghai in 1997 with a value of RMB 500 million. As shown in Table 1 and Figure 1, both the number of bonds issued and the issue amounts were negligible before 2005 but since the fiscal stimulus in late 2008, the Chengtou bond market has expanded dramatically. The number of bonds issued in 2009 jumped to 258 compared with just 79 in 2008. The post-2008 average growth rate of new issues has been 85% per year. In 2014, the number of new Chengtou bond issues reached 1,704, with a total amount outstanding of RMB 4.95 trillion (\$0.82 trillion).

Chengtou bonds are, according to China Central Depository & Clearing Co., held mainly by commercial banks (31.0%), funds (24.8%), and insurance companies (21.4%)—the latter two types of investors belong to China’s shadow banking sector. As the issuers of Chengtou bonds, LGFVs do not consider the liabilities as official debt, nevertheless, LGFV liabilities are backed by local governments, and thus Chengtou bonds represent a very large off-balance sheet obligation. The central government is ultimately responsible for all local government finances.

Figure 2 shows the relationships of the 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.² Many financial institutions and financing sources are thus connected through issuing, holding, or collateralizing Chengtou bonds.

2.2 Real Estate and Corruption

Given the relationships involved in local government finances, the real estate sector plays a central role. Rapidly decreasing land prices may be a trigger for a systemic event as LGFV

² Commercial banks cannot directly lend to local governments. According to China’s National Audit Office, commercial banks are the primary financing source for local governments mainly through their loans to LGFVs.

collateral consists of property, land-use, development rights, and other real estate related assets. In normal times, land value increases and LGFVs are able to rollover debts without increasing their cost of financing. In stressed times of low land prices, 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 prices played a major role in many bankruptcies of over-leveraged savings and loan 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 and financial market conditions influence Chengtou bond prices.

The real estate sector 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.³ 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.⁴ 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, called the Eight-point Regulations, explicitly designed to tackle corruption. In the next two 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. Land has become a hotbed for the misuse of power and malpractice. Table A.I lists the examples of local authorities that have been investigated for real estate corruption. These investigative actions on local government

³ See the article "Corruption nourished by complicated land deals," as of January 23, 2013, China Daily.

⁴ http://news.xinhuanet.com/politics/2006-12/25/content_5528527.htm

officials may as well reflect investor concerns about Chengtou bond yields because the issuance of Chengtou bonds, as explained in the previous subsection, is often collateralized by land and is implicitly guaranteed by local government. Pricing in Chengtou bond market therefore provides a particularly fitting laboratory to test the impact of corruption and real estate risk in local government finances.

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 municipal bond issues (through the central government). Except for Chengtou bonds, none of these have market prices.⁵ In so far as Chengtou bonds reflect risk that is shared by other types of local government financing—credit risk, exposure to local economic growth and real estate conditions, fiscal health of the issuing province—the relatively transparent Chengtou bond market provides a window through which we can appraise the risk exposure of Chinese local governments in general, and examine how that risk is related to broad financial market and macro factors. In particular, the relationships we uncover between Chengtou bond yields and real estate variables, corruption, aggregate monetary policy and economic growth factors, are of interest to the broad policy debate on Chinese local government finances.

2.3 Other Characteristics of Chengtou Bonds

The rapid expansion of the Chengtou bond market goes hand-in-hand with higher yields, which is consistent with investors perceiving greater risks with increasing LGFV liabilities. Table A.II shows that yields of newly issued bonds increased from an average value of 3.5% in 2007 to 6.9% in 2014. There are increases in yields even for short-term bonds with a maturity less than one year; such bonds exhibit yield increased from 2.7% in 2009 to 5.4% in 2014. The average maturity dropped from 6.0 years in 2009 to 5.3 years in 2014, implying that investors prefer shorter-term maturities as the risks of Chengtou bonds increase.

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 amounts issuance are Jiangsu, Zhejiang, Beijing, Shanghai,

⁵Directly issued 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.

and Guangdong. These provinces represent 40% 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.I, 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, and these tenors account for 66% of the total issued bonds in 2014.

Chengtou bonds are rated from A to AAA, with short-term notes rating from A1 to A1+. Each bond is 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). We quantify bond ratings by assigning numerical values, where higher numbers indicate higher credit quality. We assign a value of six to the highest rated bonds (AAA), a value of one for the lowest rated bonds (A), and fill in the numbers in between. Except for non-rated bonds (16% of the total issuance), 18% of bonds have a rating of AAA at issue, 27% are rated AA+, and 37% are rated AA. The lower-quality bonds with AA-, A+ and A ratings only account for 1.5% of the total issuance.

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, chengtou bonds trade in the interbank bond market with a market share of 68% and in the Shanghai and Shenzhen stock exchange markets with a market share of another 30%. 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 or

putable.

To get a sense of the 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% before 2006, jumps to 65% in 2007, remains stable between 60% to 70% 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.

3.1 Chengtou Bond Excess Yields

We study the impact of real estate sector and political risk on local government credit spreads through Chengtou bond excess yields, which is the cornerstone of our analysis. We first define Chengtou bond excess yields in this subsection.

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.I), 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 matching central government bond yield:

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

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), who assumes the following functional form for the instantaneous forward rate, f :⁶

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

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 , $y_i^{CGB}(t)$, 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 $\{r_s(t)\}$:

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

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 issued in 28 provinces from August 2007 to December 2014.

⁶The Svensson (1994) model produces smaller fitting errors than the Nelson and Siegel (1987) procedure.

3.2 Nationwide Economic Barometers

To isolate the impact of real estate and political risk on local government credit spreads, we need to control for province-level risk exposure to the central government or national economic conditions. 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*).

3.3 Province-Level Economic Barometers

We expect that Chengtou bond yields should reflect the underlying quality of their collateral – real estate variables, and local economic conditions. We obtain province-level economic indicators from the National Bureau of Statistics and WIND. These variables reflect local economic and fiscal conditions and are available for each province at the annual frequency from 2005 to 2014:

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

3.4 “Tigers” and “Flies” – Corruption Measures

Corruption in China seems to be endemic. The Carnegie Endowment estimates that the cost of corruption in China in 2003 was \$86 billion, or 3% of GDP, and in 2013 this increased to 13% of GDP.⁷ When China’s new Politburo took power in November 2012, the Communist Party of China launched an anti-corruption campaign. President Xi Jinping has vowed to crack down on both ”tigers” and ”flies” — a reference to powerful leaders and low-level local officials — in his campaign against corruption.⁸ 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 corruption by considering both its depth and width through CCDI’ 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 31 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 *Corruption_Tigers*, is a weighted ranking of corrupt officials in each province, which gauges the depth of corruption. 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 *Corruption_Flies*, which gauges the width of corruption. The average corruption index number is 2.1 with a standard deviation of 0.4 across 30 provinces

⁷See www.carnegieendowment.org/files/pb55_pei_china_corruption_final.pdf.

⁸Cited 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.

whose LGFVs issue Chengtou bonds. On average, there were 21.2 officials investigated for each province, with a standard deviation of 13.7. 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 corruption measures are static evaluations for each province based on the aggregate graft investigation results from the beginning of the anti-corruption campaign to the end of our sample. That 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 6.4.

4 Heterogeneity and Empirical Design

Under China's current fiscal and tax system, the central government is ultimately responsible for all local governments revenues and deficits. If investors perceive that Chengtou bonds have an inviolable central government guarantee, there should be no predictable cross-sectional variation in excess Chengtou bond yields and we should expect to observe the same average Chengtou bond yields across provinces. Is this true?

4.1 Heterogeneity of Chengtou Bond Excess Yields

Figure 3 plots the dispersion of issue yields in the primary market in Panel A and excess Chengtou bond yields in the secondary market in Panel B. We mark the median value

along with the 10th and 90th deciles from 2007 to 2014. The graph in Panel B reveals that Chengtou bond excess yields are persistent, with a first-order autocorrelation of 0.79. Evidently, there is also large heterogeneity in both issue yields and excess yields. In the primary market, the average range between the 10th and 90th deciles is 2.95% with a standard deviation of 0.95%. In the secondary market, the corresponding range is 1.84% with a standard deviation of 0.87%. Figure 3 shows that the dispersion of excess bond 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.

We further report the summary statistics of Chengtou bond excess yield in Table 2. Overall, Chengtou bonds earn a premium of 1.98%, on average, over matching central government bond yields. Table 2 also shows the subsample excess yields when dividing all bonds into three portfolios according to province characteristics such as: 1) geography, 2) the local fiscal surplus (or deficit if the value is negative) to GDP ratio, 3) local GDP growth rate, 4) real estate rank (measured by the average price per squared meters during 2008 to 2014), 5) corruption measure by depth, *Corruption_Tigers*, and 6) corruption measure by width, *Corruption_Flies*.

There is predictable variation in excess yields across provinces: more expensive bonds (lower yields) tend to be those issued in provinces located along the coast, those bonds issued in provinces with higher housing prices, bonds issued in provinces with lower GDP growth rates and smaller fiscal gaps, and in provinces with more political risk such as corruption. It's also worth noting that contrary to conventional wisdom, provinces with higher fiscal surplus or with higher local GDP growth tend to have higher Chengtou bond excess yields. That is, the financing cost is higher for provinces with relatively better economic foundation. Meanwhile we note that those provinces with better economic performance also have a high volatility of corresponding economic barometers.

In summary, we find evidence supporting a large cross-sectional heterogeneity in Chengtou bond excess yields even though Chengtou bonds, regardless of issuing provinces, are guaranteed by the Chinese central government. The financial market seems to perceive that all Chengtou bonds are not equal. We now describe potential risk factors which may be priced in the cross-section of Chengtou bonds.

4.2 Regression Specification

Given the large cross-sectional heterogeneity in Chengtou bond excess yields, we examine the pricing power of risk factors in the cross section of Chengtou bond excess yields through the following panel regression:

$$Y_{ijt} = \alpha_0 + \eta_t + \alpha Y_{ij,t-1} + \xi' \mathbf{m}_{j,[t]} + \lambda' \mathbf{f}_j + \gamma' \mathbf{Z}_{ijt} + \varepsilon_{ijt}, \quad (4)$$

where Y_{ijt} is the excess yield of Chengtou bond i in province j in month t . $\mathbf{m}_{j,[t]}$ is a vector of macroeconomic variables for province j which is available up to month t (denoted as $[t]$),⁹ characterizing the local economic outlook especially that in the real estate sector. \mathbf{f}_j is a vector of corruption measures for province j , indicating the local political risk. The corruption 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 provincial risk exposures to national economic barometers. The primary parameters of interest are ξ and λ .

In the panel regression, we include the lagged yields, $Y_{ij,t-1}$, on the right-hand side because Chengtou bond spreads are persistent (see Figure 3, the one-month autocorrelation of the median excess yield across all bonds is 0.79.). The monthly fixed effect, η_t , captures any unobservable (bond-invariant) factors that can influence Chengtou yields not spanned by risk factors or province risk exposures. In some of the specifications, we also include bond characteristics as additional control variables such as bond size, time-to-maturity, bond liquidity proxied by the bid-ask spread. In all regressions, we cluster standard errors at the bond level.

When running regression (4), we standardize the explanatory variables in the cross section each month. We do not standardize the lag of the excess yield or the betas. In this way, the estimated coefficients in the regression can be interpreted as the effect of a one standard deviation move in the cross section, so the economic scale is also comparable across variables.

⁹The province economical barometers are available at the annual frequency. In regressions, we use the previous annual value for all months in the current year.

4.3 Control Variables

We consider two types of control variables: bond characteristics and provincial 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 yield spreads 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, which is calculated based on the daily highest and lowest prices following Corwin and Schultz (2012). Among these variables, we exclude bond rating from the list of control variables since Chengtou bond ratings in China are highly inflated and most bonds differ from each other by at most one or two notches (See Section 2.3). Therefore rating contains little information in explaining the Chengtou bond excess yields. Table A.III in the appendix reports the summary statistics of bond characteristics.

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 implicitly guaranteed by the central government. The risk exposure of each province to the central government therefore likely play an important role in determining 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:

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

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 . $F(k)$ is the vector of national economic barometers introduced in Section 3.2 which captures China's solvency risk, monetary policy, and financial market conditions. $\Delta F(k)_t$, is the vector change of the macro risk factor from month $t - 1$ to month t .

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, $\beta_{j,F(k)}$, in equation (5) are analogous to betas computed in the first phase of the Fama-MacBeth (1973) regression in the equity market; the factor loadings measure the contemporaneous response of bond yields to the changes in macro conditions.

We report summary statistics of the distribution of betas in Table A.IV of the appendix. The betas exhibit significant variation across provinces, with the largest dispersion between the 10th and 90th percentiles being 1.17 for betas on the change in the one-year time deposit rate (ΔRF) and 1.79 for betas on the Chinese stock market return (RET). In Panel B, we sort provinces into three portfolios: Low, Medium, and High based on the betas for each factor. We report the excess Chengtou bond yields in the Low and High portfolios, along with a t -test for the average difference. There are significant differences in the excess yields for all the macro factors. Provinces with higher betas to China’s solvency risk, CDS, tend to have higher Chengtou bond yields, with the difference between the Low and High portfolios being -0.24%. Provinces with higher betas to direct foreign investment also tend to have higher yields. These univariate portfolio sorting results suggest that Chengtou bonds yields are sensitive to province risk exposures to national macroeconomic conditions, credit risk, monetary policy, and financial market conditions.

The appendix also provides a formal test on the explanatory power of province risk exposures in Table A.V. Among all risk exposures, the exposure to CDS and FX robustly maintain their strong power, both statistically and economically, in explaining Chengtou bond excess yields. The positive coefficient on China’s sovereign risk suggests that Chengtou bonds are economically leveraged versions of sovereign credit risk—the greater the exposure to China’s solvency risk, the higher the Chengtou bond yields. The negative coefficient on the real effective exchange rate is possibly due to government finances in provinces with high exchange rate betas benefiting from increased exports when the RMB depreciates.

5 Main Results

5.1 Political Risk

We consider two proxies for political risk in explaining the cross-section of Chengtou bond excess yields: the rank-weighted corruption index, *Corruption_Tigers*, and the number of corruption cases, *Corruption_Flies*, which we define in Section 3.4. These two proxies measure the depth and width of corruption for each province. As explained in Section 2, local governments have a vested interest in selling land-use rights to promote economic growth and the issuance of Chengtou bonds are often collateralized by such land-use rights. However, real estate projects especially those related to land sales “need approval from 166 government departments, involving about 180 officials.”¹⁰ Such complicated administration procedures can nourish corruption. China’s anti-corruption campaign since the late 2012 reflects to some extent the severity of corruption in damaging the economy, such as in the local government financing cost reflected in Chengtou bond yields.

In Table 3, we run panel regressions as in formula (4). We consider the corruption series individually in specifications (1) and (2). Both variables are significant, with higher levels of corruption corresponding to higher yields. A one standard deviation move of a province in the cross section from less to more corruption increases excess Chengtou bond yields by 0.09% for the corruption index and 0.05% for the number of corruption cases. The adjusted *R*-squared values for these univariate regressions are around 20%, which is relatively high because we use time fixed effects. In the bivariate regression, column (3), both corruption measures maintain their own statistical significance and economic magnitude, indicating that these two proxies although correlated, target different dimensions of corruption.

In specifications (4) to (5), we add the control variables sequentially: the lagged yield in column (4), province risk exposures and the bond characteristics in column (5). Here province risk exposures refer to the betas with respect to *CDS* and *FX*, and the the bond characteristics include bond size (outstanding amount), time to maturity, and bond liquidity proxied by the bid-ask spread. In the presence of these control variables, there still exists a positive and highly statistically significant relationship between the level of corruption and Chengtou bond yields.

¹⁰See an article in China Daily on January 23, 2013, “Corruption nourished by complicated land deals.”

5.2 Real Estate

We now examine the province-level characteristics, in particular, the real estate variable in explaining the cross-section of Chengtou bond excess yields. In the terminology of asset pricing, we include characteristics in the cross-sectional regression as opposed to just risk factors (cf. Daniel and Titman, 1997).

Table 4 presents how provincial economic barometers, especially the various components of local GDP, influence the cross section of Chengtou bond yields. Columns (1) - (4) report the univariate regression coefficients taking just one GDP component at a time. All local GDP components are statistically significant. The coefficient on real estate GDP is -0.17, implying that if a given province moved by one standard deviation in the cross section, that province's Chengtou bond yields would decrease by 0.17%. Given that the average excess Chengtou bond yield is 1.98%, this is a large economic effect. In the multivariate regression, column (5), which also controls for the lagged excess yield, however, only the real estate GDP and service GDP remain significant, both with negative coefficients, with the service GDP only marginally significant at the 10% level.

Column (6) shows that both local real GDP growth and the fiscal surplus are positively related to Chengtou bond excess yields. These results echo the summary statistics of Chengtou bond yields in portfolios sorted by these two local economic barometers in Table 2. A priori we might expect that, like the negative coefficient on real estate GDP, higher real estate-related economic growth should indicate a lower risk of default due to higher collateral values, and thus lower yields. The positive coefficients thus seem counter-intuitive. One possible reason for this unexpected 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 2. When dividing the provinces into high, middle, and low terciles, provinces in the high tercile of fiscal surpluses have a mean of 20.73% and a standard deviation of 9.94%. The provinces in the low fiscal surplus tercile have, by construction, the lowest mean of fiscal surplus of 3.18% but also a low standard deviation of 3.04%. The same findings apply to GDP growth: the provinces with the highest average GDP growth also have the most volatile growth. The mechanical relationship between high economic growth and high volatility drives the positive coefficients in the regression specification, column (6),

as these provinces are actually risky!

In column (7), we consider the full set of provincial economic variables. When jointly taking local GDP components and GDP growth as well as fiscal surplus in the multivariate regression, the real estate value-added GDP ratio becomes the only variable which keeps its significant pricing power. The result remains the same when controlling for province risk exposures, the betas with respect to *CDS* and *FX*, in column (8) and controlling for additional bond characteristics in column (9).

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

5.3 Kitchen Sink Regressions

We now re-examine the pricing power of real estate variables and political risk using a kitchen-sink regression. Before the regression, we first check the correlation among explanatory variables. Table 5 shows that two corruption proxies, *Tigers* and *Flies* which represent corruption depth and corruption respectively, are negatively correlated. Real estate value-added GDP is also negatively related to both *Tigers* and *Flies*, indicating that provinces with higher corruption depth or corruption width are also those with lower real estate value-added GDP. Moreover, real estate GDP is negatively related to GDP growth and fiscal surplus.

Putting explanatory variables together in the kitchen-sink regression, we want to identify the primary risk factors that squeeze out other variables. Column (1) in Table 6 shows that political risks, both *Corruption_Tigers* and *Corruption_Flies* remain significant even after controlling for province risk exposures with respect to *CDS* and *FX*, lagged excess yields, and bond characteristics. However, when real estate GDP is considered in the regression, column (2), both measures of corruption risk lose their explanatory power. In the kitchen-sink regression with all risk factors considered in our tests, real estate GDP stands out again. The province risk exposures to the central government also matter; however, in province economic barometers, the real estate value-added GDP ratio is clearly the most important economic factor in determining the cross-section of Chengtou bond excess yields.

6 Economic Mechanism of Corruption Effect

So far we have shown that real estate variables and political risk have explanatory power in the cross-section of Chengtou bond excess yields, after controlling for bond characteristics and province risk exposures. In the kitchen-sink regression, however, real estate value-added GDP is the only important factor which drives out political risk. As discussed in Section 2.2, corruption is often embedded in real estate industry. In this section, we thus examine the relationship between corruption and real estate variables and show that the pricing power of corruption on Chengtou bond yields is indeed partially via the channel of real estate. Since the anti-corruption campaign, corruption also has its own independent explanatory power, even after controlling for real estate variables.

6.1 Corruption through Real Estate Chanel

As discussed in Section 2.2, the 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.I 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, according to the China Business News.

The correlation results in Table 5 has already suggested a negative relationship between real estate GDP and *Corruption_Tigers* as well as *Corruption_Flies*, although the two corruption proxies are negatively correlated. We now examine their relationship formally in regressions. The dependent variable is real estate value-added GDP for each province per year, and the explanatory variables are corruption proxies: *Corruption_Tigers* and *Corruption_Flies*, which are fixed for each province based on the aggregate investigation results during November 2012 to December 2014. Columns (1) and (2) in Table 7 report the univariate regression results. Both corruption depth and corruption width are negatively and

significantly related to real estate GDP. The magnitude is particularly great for corruption depth, indicating that provinces with higher corruption index value tend to have far lower real estate GDP. The results remain the same, as shown in Column (3) and (4), after controlling for province risk exposures measured by the factor loadings on China’s CDS spread and the real effective exchange rate. The multivariate regression in Column (5) further suggests that corruption index value and the number of corruption cases both contain marginal information that is negatively related to real estate GDP. The overall explanatory power is 11.2% in the adjusted R -squared value.

6.2 Instrument Variable Methodology

The degree of corruption in a province is likely to be endogenously explained by the same variables that also reduce local real estate GDP. Properly claiming the impact of corruption on Chengtou bond yields through the real estate channel, therefore, calls for controlling the unobserved common variations that underlie both corruption and real estate. We instrument the degree of corruption with two candidate variables: (i) the total assets of state-owned-enterprises (SOE) in a province scaled by local GDP; and (ii) the housing turnover measured by the ratio of trading volume to housing volume completed. The rationale for using these variables as instrument variables is that SOE assets and housing turnover are correlated with the corruption measures while they are not related to the common variation perhaps driving both corruption and real estate.¹¹

We start by testing whether instrument variables are correlated with corruption. The first stage regressions in Table 8 suggest that (i) SOE assets are negatively related to *Corruption_Flies*—larger SOE sizes typically associated with less small scale corruption cases, and (ii) housing turnover is positively related to *Corruption_Flies*—anecdotal news reports suggest that since the anti-corruption campaign began in 2012 there have been more anonymous apartments sales with large discounts.¹²

The second stage regressions provide evidence that when exogenizing the corruption

¹¹The above finding of a negative effect from corruption to real estate GDP already contradicts a simple hypothesis that both real estate and corruption are elevated with faster economic growth, a conventional wisdom held by the public and media but not supported by our empirical data. Regardless, SOE size and housing turnover may not be closely related to local GDP growth.

¹²See the article in the Wall Street Journal on August 17, 2014, “Chinese Officials Rush to Sell Luxury Homes Amid Corruption Crackdown”.

proxies, *Corruption_Flies*, the significant effects of corruption on (lowering) real estate value remain statistically significant. In other words, there seems to be exogenous variations in the corruption measures that cause impairment in local real estate value. One possible channel is that more local government corruption would typically cause money to be siphoned away from land lease auctions, which in turn results in lower quality in the infrastructure constructions supporting the real estate development. The worse real estate value would further be translated into lower collateral value, and eventually a higher excess yield in Chengtou bonds.

6.3 Effect of Anti-Corruption Campaign

It is very important to point out that although our data sample spans from 2007 to 2014, the anti-corruption campaign only began in the late 2012. Whether corruption measures should be expected to impact the Chengtou bond excess yields significantly should therefore differ between the pre- and post-anti-corruption campaign. More precisely, if the market participants do not note that local government corruption will be punished severely and properly, they may not price in such a political risk correctly in the secondary market. Only when corruption is revealed and investigated effectively, can investors infer properly that more corruption probably leads to low quality infrastructure and thus causes shady real estate value.

We use the timing of President Xi Jinping's administration assuming power as the start of the anti-corruption campaign, which was November 2012 when the 18th National Congress of the Communist Party of China was held. Indeed, 19 days after the election of the new administration, the central government announced a set of policy reforms targeting corruption. We thus define the before-campaign period in our sample as August 2007 to October 2012, and the campaign period as November 2012 to December 2014.

Not surprisingly, Table 9 shows that before the anti-corruption campaign, only real estate GDP seems to be a dominant determinant of the Chengtou bond yields, while both *Corruption_Tigers* and *Corruption_Flies* are driven to be statistically insignificant. During the anti-corruption campaign, real estate GDP can no longer crowd out the *Corruption_Flies*, which suggests that the secondary market takes notice of which local province has more corruption and thus prices the Chengtou bond yields more aggressively,

above and beyond what traders can infer from the real estate channel alone.

This finding has an important policy implication that the anti-corruption campaign has an important economic value: the revealing of more corruption should indicate worse real estate value and lead to more risky Chengtou bonds. Therefore capital allocation should lean toward less corrupt and thus less risky real estate development projects, which improves the capital allocation efficiency in a society.

6.4 Event Study of Corruption Announcement

Given the fact that corruption involved irreplaceable information since 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, and the event 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 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 10 reports the abnormal yield spread for the event day, $AR(0)$, and the day before and after the event, $AR(-1)$ and $AR(1)$. For both types of events, 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 corruption conditions are inclined to respond positively on the announcement days, and their average excess yields are lower than those predicted, suggesting lower 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 corruption indexes, 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 corruption plays an important role in the Chengtou bond market.

7 Conclusion

Chengtou bonds—urban construction and investment bonds—play a critical role in the debt financing for Chinese local governments and, therefore, represents a larger problem of debt explosion in China. The market experienced tremendous growth after the 2008 global financial crisis and as of December 2014, there were RMB 4.95 trillion (\$0.82 trillion) of Chengtou bonds outstanding. The Chinese central government is ultimately responsible for the finances of all local governments, but despite this implicit guarantee, we find large heterogeneity in Chengtou bond yields.

We find that real estate GDP is the most important driver of Chengtou bonds, which is not surprising given that their collateral value is directly linked to the real estate market. We also find that Chengtou bond yields reflect political risk: we construct an index of corruption based on the officials investigated by the Central Commission for Discipline Inspection (CCDI). We find a significantly positive correlation between risk-adjusted Chengtou bond yields and the corruption index. Reflecting the systematic risk of Chengtou bonds, we find that variables reflecting aggregate credit risk and the real effective exchange rate are also priced in the cross section.

Furthermore, we demonstrate that the corruption’s effect on Chengtou bond yields works mainly through real estate channel—there are exogenous variations in corruption that cause the deterioration in real estate value, which in turn increases the funding cost of the local governments. Since the anti-corruption campaign started in late 2012, investor have taken further notice on the corruption level in pricing Chengtou bond yields above and beyond those already reflected in the impaired real estate value. Finally, for the most severely corrupted provinces, announcements of Corruption-Tigers—high level officials of Deputy Governors and above—significantly lower the Chengtou bond yields of the affected provinces.

These findings on Chenggou bond market have important policy implications for Chinese government. First, the local government debt explosion during the recent economic downturn may not only endanger China's financial stability and but also cause contagion around the world. Yet, to alleviate such a debt overhang problem, recovery in the real estate sector—essentially as collaterals for Chengtou bonds—are the necessary target of macroeconomic/fiscal policy. Second, on the financing side, the Ministry of Finance has recently adopted a swap plan for exchanging Chengtou bonds (and loans) with provincial municipal bonds. However, it is not clear whether the current swap plan for municipal bonds initiated in 2015 have priced properly various risk exposures identified in our Chengtou bond study, such as the real estate exposure, political corruption, sovereign default, etc. Finally, since the anti-corruption campaign started in 2012, there have been debates whether the campaign has caused negative economic impact. Our empirical evidence based on the investor reactions from the Chengtou bond market suggests that the anti-corruption campaign has a positive economic impact—the funding costs significantly differentiate between more and less corruption levels, which leads to more efficient capital allocation in Chinese society.

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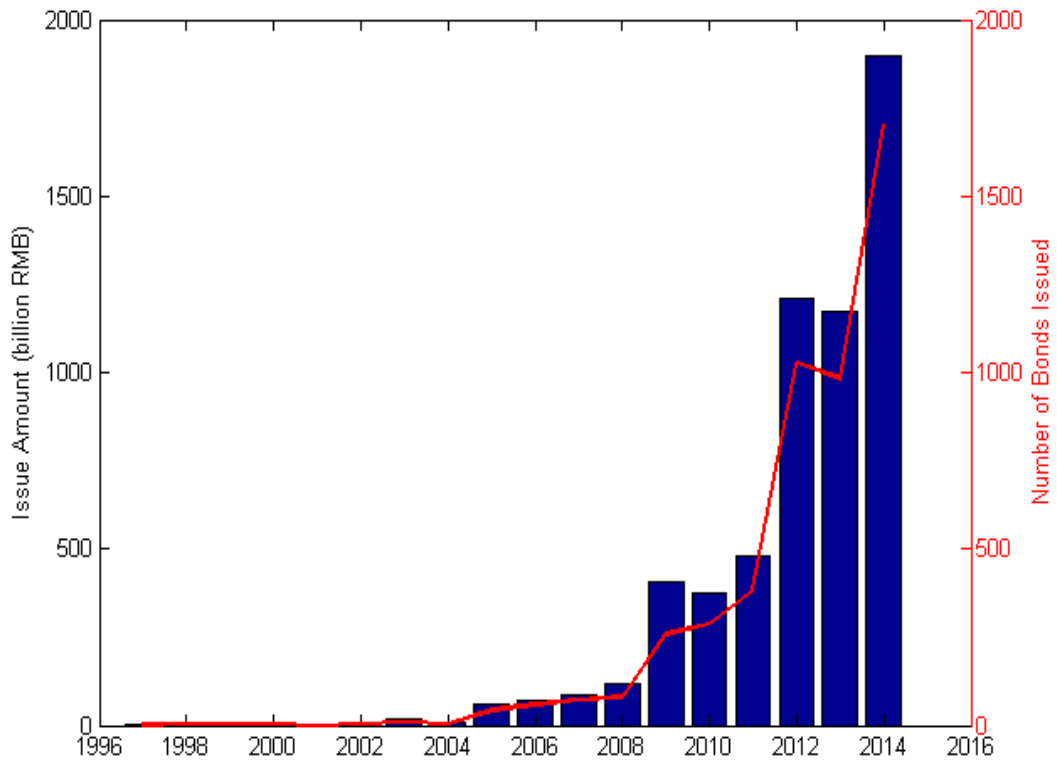


Figure 1: Annual Issuance of Chengtou Bonds

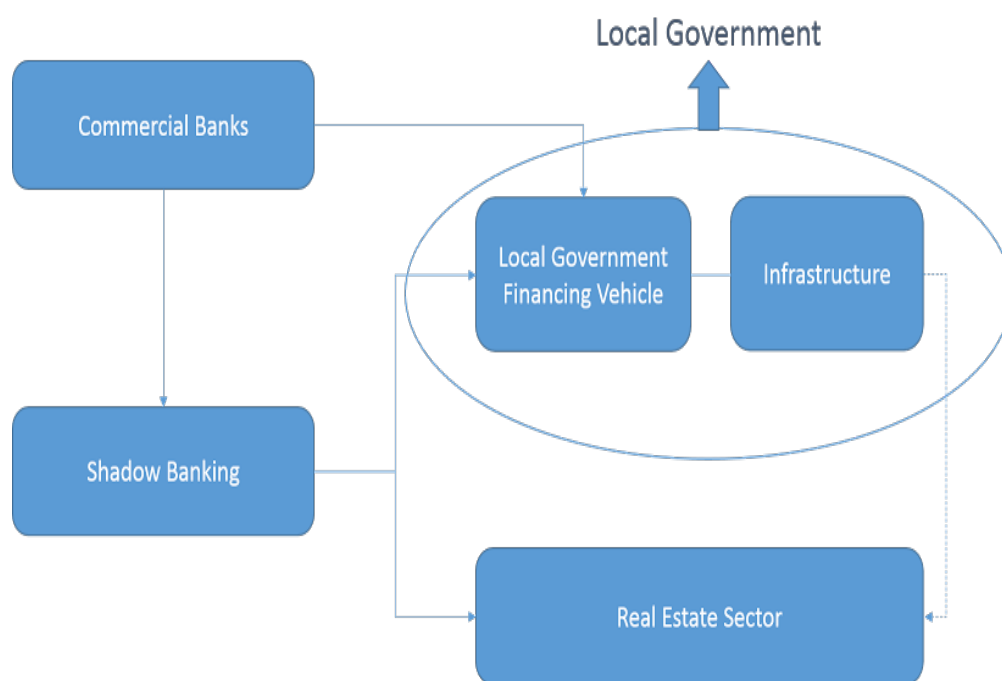


Figure 2: The Nexus of Chinese Local Government Debt

Panel A: Issue Yields in the Primary Market



Panel B: Excess Yields in the Secondary Market

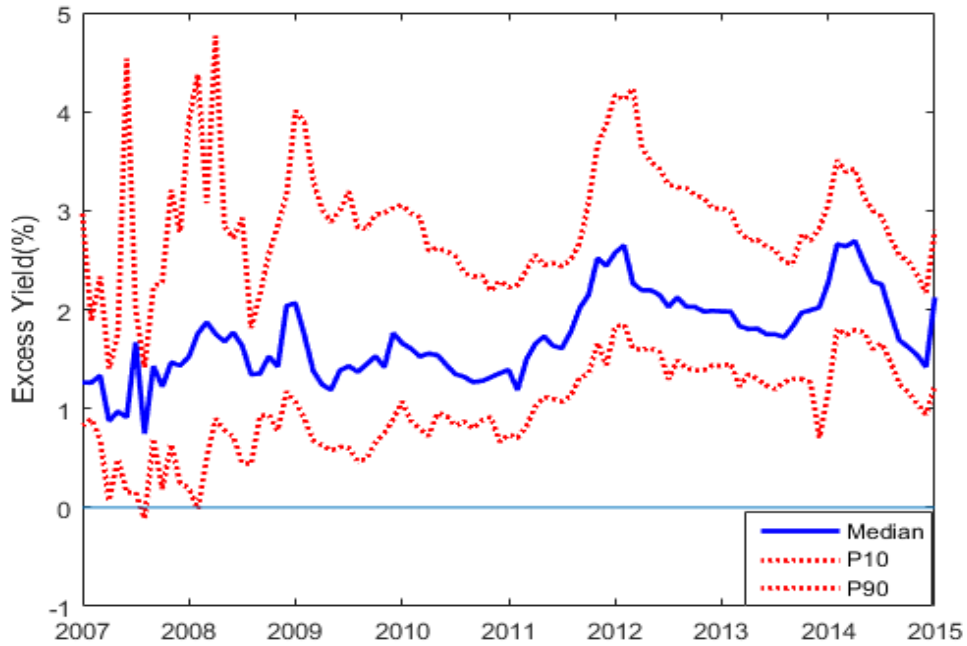


Figure 3: Dispersion of Chengtou Bond Yields

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												
Year	Number of Bonds Issued (Years)				Issue Amount (Bil RMB)				Outstanding (Bil RMB)			
	(0,1]	(1,3]	(3,7]	(7,30]	Total	(0,1]	(1,3]	(3,7]	(7,30]	Total	Total	
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

Province	At Issue			Outstanding		Maturity (year)	Rating
	Amount	Bonds	Issuers	Amount	Bonds		
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 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 subdivided by six criteria based on province-level characteristics: (1) geography, (2) the local fiscal surplus to GDP ratio, (3) local GDP growth rate, (4) real estate price (the average price per squared meters during 2008 to 2014), (5) Corruption_Tigers (the rang-weighted average index), and (6) Corruption_Flies (the number of graft cases). P10 and P90 denote the 10th and 90th percentiles, respectively. Right panel reports the mean and standard deviation (*SD*) for corresponding criteria. The sample period is from 2007 to 2014.

		Excess Yields (%)					Characteristics	
		Mean	Median	SD	P10	P90	Mean	SD
All Bonds		1.98	1.90	0.81	1.11	2.98		
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
Corruption_Tigers							Corruption 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
Corruption_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

Table 3: Political Risk and Chengtou Bond Excess Yields

This table presents the panel regression results of chengtou bond excess yields on political risk of local governments, f_j , as in formula (4). We use two proxies for political risk: *Corruption_Tigers* which is the weighted-average index by the ranking of officials investigated by the CCDI in each province, and *Corruption_Flies* which is the number of officials listed in graft cases in each province. The former measures the depth of corruption whereas the latter measures the width. Both measures are fixed for each province based on the aggregate investigation results from November 2012 to December 2014. We average bond yields over each month to obtain monthly frequency values. We include the lagged bond excess yields as a control variable. In Column (5) we also include additional control variables of bond characteristics such as bond size, time-to-maturity, and bond liquidity proxied by the bid-ask spread, as well as the province-level *CDS* and *FX* risk exposures. Standard errors are clustered at the bond 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)
Corruption_Tigers	0.09*** [4.33]		0.09*** [4.65]	0.02*** [4.39]	0.02*** [3.72]
Corruption_Flies		0.05*** [3.09]	0.06*** [3.58]	0.01*** [2.92]	0.01** [2.54]
β_{CDS}					0.08*** [3.33]
β_{FX}					-0.43*** [-2.26]
Lagged yield				0.77 [49.10]	0.76 [44.39]
Month FE	Y	Y	Y	Y	Y
Cluster (Bond)	Y	Y	Y	Y	Y
Bond Controls	N	N	N	N	Y
Observations	20342	20342	20342	18772	18772
Adjusted R2	0.198	0.191	0.203	0.620	0.621

Table 4: **Real Estate and Chengtou Bond Excess Yields**

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 bond yields over each month to obtain monthly frequency values. We include the lagged bond excess yields and the province-level *CDS* and *FX* risk exposures as control variables. In Column (9) we also include additional control variables of bond characteristics such as bond size, time-to-maturity, and bond liquidity proxied by the bid-ask spread. Standard errors are clustered at the bond 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)	(8)	(9)
Real Estate GDP	-0.17*** [-9.69]				-0.03*** [-5.03]		-0.03*** [-3.80]	-0.04*** [-4.50]	-0.04*** [-4.36]
Service GDP		-0.06*** [-10.23]			-0.01* [-1.85]		-0.01 [-1.91]	-0.02 [-1.26]	-0.02 [-1.13]
Retail GDP			-0.05*** [-10.38]		0.01 [1.23]		0.01 [1.30]	0.01 [0.80]	0.02 [1.16]
Hotel GDP				0.12*** [2.95]	0.01 [0.55]		0.01 [0.57]	0.00 [0.79]	0.01 [0.99]
GDP Growth						0.02*** [2.94]	0.00 [0.50]	-0.01 [-0.75]	0.00 [-0.23]
Fiscal Surplus						0.01** [2.31]	0.00 [-0.66]	0.00 [0.23]	0.00 [0.22]
β_{CDS}								0.06** [2.47]	0.08*** [2.98]
β_{FX}								-0.69*** [-2.80]	-0.71*** [-2.86]
Lagged yield					0.78 [43.15]	0.77 [46.23]	0.78 [42.97]	0.77 [43.65]	0.77 [40.28]
Month FE	Y	Y	Y	Y	Y	Y	Y	Y	Y
Cluster (Bond)	Y	Y	Y	Y	Y	Y	Y	Y	Y
Bond Controls	N	N	N	N	N	N	N	N	Y
Observations	17524	17524	17524	17524	16238	18741	16194	16194	16194
Adjusted R2	0.214	0.222	0.219	0.191	0.628	0.620	0.628	0.628	0.629

Table 5: Correlation Matrix of Major Explanatory Variables

	Tigers	Flies	RE GDP	β_{CDS}	β_{FX}	GDP Growth	Fiscal Surplus
Corruption_Tigers	1	.	.	.	.	.	.
Corruption_Flies	-0.24	1	.	.	.	.	.
RE GDP	-0.25	-0.15	1	.	.	.	.
β_{CDS}	0.03	0.10	-0.16	1	.	.	.
β_{FX}	-0.15	0.17	-0.05	0.50	1	.	.
GDP Growth	0.08	-0.01	-0.28	-0.01	-0.12	1	.
Fiscal Surplus	0.12	-0.18	-0.60	0.05	0.05	0.15	1

Table 6: **Kitchen-Sink Regressions**

This table presents the kitchen-sink regression results of chengtou bond excess yields on all risk factors. We average bond yields over each month to obtain monthly frequency values. We include three types of control variables: the lagged bond excess yields, the province-level *CDS* and *FX* risk factor exposures, and the bond characteristics such as bond size, time-to-maturity, and bond liquidity proxied by the bid-ask spread. Standard errors are clustered at the bond 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)
Corruption_Flies	0.01** [2.54]	0.00 [0.12]	0.00 [-0.01]
Corruption_Tigers	0.02*** [3.72]	0.01 [0.92]	0.01 [0.92]
Real Estate GDP		-0.03*** [-5.19]	-0.03*** [-3.98]
Service GDP			-0.02 [-1.09]
Retail GDP			0.02 [1.18]
Hotel GDP			0.01 [0.86]
GDP Growth			0.00 [-0.34]
Fiscal Surplus			0.00 [0.18]
β_{CDS}	0.08*** [3.33]	0.08*** [2.85]	0.08*** [2.95]
β_{FX}	-0.43** [-2.26]	-0.62*** [-2.90]	-0.64** [-2.09]
Lagged yield	0.76 [43.97]	0.77 [40.34]	0.77 [40.19]
Month FE	Y	Y	Y
Cluster (Bond)	Y	Y	Y
Bond Controls	Y	Y	Y
Observations	18772	16238	16194
Adjusted R2	0.622	0.629	0.629

Table 7: **Corruption and Real Estate**

This table examines the relationship of corruptions of local governments and provincial real estate factor. The dependent variable is the real estate value-added GDP scaled by local GDP. The explanatory variables are two proxies of corruption: *Corruption_Tigers* which is the weighted-average index by the ranking of officials investigated by the CCDI in each province, and *Corruption_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 for provinces studied in our sample. We also include province risk exposures to national credit risk (β_{CDS}), and to national effective real exchange rate (β_{FX}), 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)	(5)
Corruption_Flies		-0.02** [-2.16]		-0.02** [-2.03]	-0.02*** [-2.92]
Corruption_Tigers	-1.05*** [-3.98]		-1.08*** [-3.90]		-1.24*** [-4.46]
β_{CDS}			-0.82*** [-2.75]	-0.80*** [-2.65]	-0.76** [-2.43]
β_{FX}			0.86 [0.27]	2.63 [0.92]	1.47 [0.49]
Observations	187	187	180	180	180
Adjusted R2	0.056	0.017	0.078	0.034	0.112

Table 8: Real Estate Effect of Corruption: IV Analysis

This table reports the estimates for an instrumental variable analysis, using two instruments for corruption of local governments: Panel A: the relative size of state-owned-enterprises scaled by the local GDP for Corruption_Flies; and Panel B: the housing turnover defined as the ratio of the house traded to the house completed in terms of squared meters, for Corruption_Flies. Corruption_Flies is the number of officials listed in graft cases in each province. Columns (1) and (2) present the estimates for the first stage, where the dependent variable is Corruption_Flies. Columns (3) and (4) display the estimates of the second stage, where the dependent variable is Real Estate GDP, and the indicator variable for corresponding corruption proxy is instrumented as per the first stage. All regressions are run using the province-year panel during 2007-2014 for provinces studied in our sample. *, **, and *** represent statistical significance at the 10%, 5%, and 1% confidence levels, respectively.

	Panel A: IV = Relative Size of SOE				Panel B: IV = Housing Turnover			
	Corruption_Flies		Real Estate GDP		Corruption_Flies		Real Estate GDP	
	First Stage		IV		First Stage		IV	
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
Relative Size of SOE	-6.53*** [-5.27]	-6.33*** [-5.07]			0.10*** [4.05]	0.09*** [4.28]		
Corruption Indicator			-0.07*** [-3.21]	-0.07*** [-3.23]			-0.08*** [-2.40]	-0.10*** [-2.98]
β_{CDS}		5.59 [1.22]		-0.90*** [-3.08]		3.17 [0.85]		-1.06*** [-3.53]
β_{FX}		11.20 [0.42]		2.56 [0.85]		46.91** [2.23]		2.76 [0.97]
Observations	174	168	174	168	240	232	187	180
Adjusted R2	0.096	0.111	0.039	0.063	0.057	0.076	0.026	0.064

Table 9: **Subsample Results Before and During the Anti-Corruption Campaign**

This table presents the panel regression results of chengtou bond excess yields on all risk factors for subsamples before and during anti-corruption campaign. The explanatory variables include *Corruption_Tigers* (the weighted-average index by the ranking of officials investigated by the CCDI in each province), *Corruption_Flies* (the number of officials listed in graft cases in each province), *Real Estate GDP* (the real estate value-added GDP scaled by local GDP). Control variables include the provincial *CDS* and *FX* risk factor exposures, bond characteristics such as bond size, time-to-maturity, and bond liquidity proxied by the bid-ask spread, and the lagged bond excess yields. We average bond yields over each month to obtain monthly frequency values. Standard errors are clustered at the bond level and corresponding *t*-statistics are reported in square brackets. *, **, and *** represent statistical significance at the 10%, 5%, and 1% confidence levels, respectively. The before-campaign sample period is from August 2007 to October 2012, and the campaign subsample is from November 2012 to December 2014.

	Anti-Corruption Campaign					
	Before			During		
	(1)	(2)	(3)	(4)	(5)	(6)
Corruption_Flies	0.01 [1.61]	0.00 [-0.05]	0.00 [-0.12]	0.02*** [4.17]	0.02*** [2.57]	0.01** [1.99]
Corruption_Tigers	0.03*** [2.84]	0.01 [0.91]	0.01 [0.93]	0.01** [2.13]	0.00 [-0.38]	0.01 [0.69]
Real Estate GDP		-0.04*** [-5.06]	-0.04*** [-5.15]		-0.04*** [-4.23]	-0.03*** [-3.80]
β_{CDS}	0.07* [1.92]	0.03 [0.98]	0.04 [1.04]	0.04 [1.53]	0.04 [1.30]	0.07** [2.08]
β_{FX}	-0.68*** [-2.65]	-0.84*** [-3.17]	-0.85*** [-3.31]	-0.08 [-0.34]	-0.49 [-1.67]	-0.43 [-1.48]
Lagyield	0.84 [40.49]	0.83 [40.70]	0.83 [36.78]	0.67 [37.43]	0.67 [29.18]	0.63 [25.53]
Month FE	Y	Y	Y	Y	Y	Y
Cluster (Bond)	Y	Y	Y	Y	Y	Y
Bond Attributes	N	N	Y	N	N	Y
Observations	8271	8271	8271	10501	7967	7967
Adj R2	0.708	0.709	0.709	0.505	0.484	0.495

Table 10: **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

Appendix

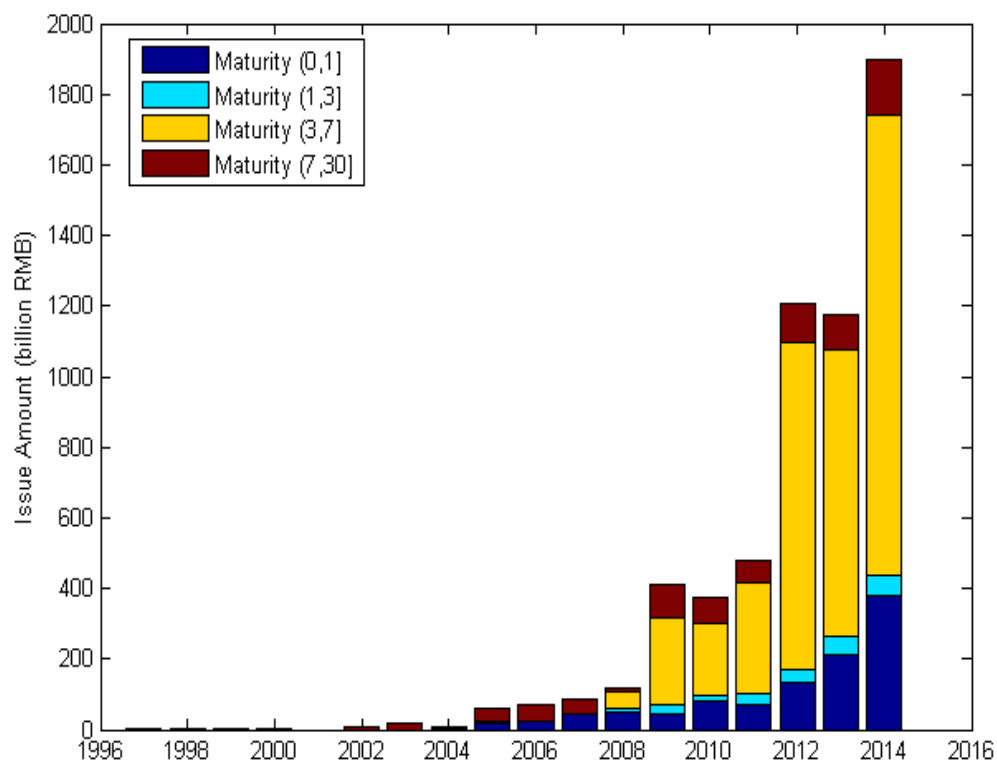


Figure A.I: Tenor Decomposition of the Annual Chengtou Bond Issuance

Table A.1: High-Rank Local Officials involved in Real Estate Corruption (selected)

Name	Province	Rank	Date Investigated	Real Estate Corruption
NiFake	Anhui	Vice Provincial	Jun2013	Illegal land transaction
BoXilai	Chongqing	Provincial	Apr2012	Related to RE company–Shide’s bribe
ZhouZhenhong	Guangdong	Vice Provincial	Fed2013	Related to his relatives’ speculation in RE market
WanQingliang	Guangdong	Vice Provincial	Jun2014	Illegally changing the volume ratio and taking bribes
LiDaqiu	Guangxi	Vice Provincial	Jul2013	Illegal land transaction
LiaoShaohua	Guizhou	Vice Provincial	Jan2013	Bank loans, taking bribes and seeking interests for RE developers
GuoYouming	Hubei	Vice Provincial	Nov2013	Related to some RE projects in Yichang City and Sanxia project
ChenBohuai	Hubei	Vice Provincial	Nov2013	Illegal land transaction
JiJianye	Jiangsu	Vice Provincial	Jan2013	Related to Wuzhong RE Company’s bribe
ChenAnzhong	Jiangxi	Vice Provincial	Dec2013	Taking bribes and seeking interests for RE developers
YaoMugen	Jiangxi	Vice Provincial	Mar2014	Taking bribes and seeking interests for RE developers
ZhaoShaolin	Jiangxi	Vice Provincial	Aug2015	Helping his son to make illegal profit in RE market
ChenTiexin	Liaoning	Vice Provincial	Jul2014	Taking bribes and seeking interests for RE developers
HuangSheng	Shandong	Vice Provincial	May2013	Related to several RE developers’ bribe
JimDaoming	Shanxi	Vice Provincial	Fed2014	Related to speculations in RE market
ShenWeichen	Shanxi	Vice Provincial	Apr2014	Taking bribes and seeking interests for RE developers
LiChuncheng	Sichuan	Vice Provincial	Dec2012	Illegal land transaction
LiChongxi	Sichuan	Provincial	Dec2013	Taking bribes and seeking interests for RE developers
Yanggang	Xinjiang	Vice Provincial	Dec2013	Taking bribes and seeking interests for RE developers
ZhangTianxin	Yunnan	Vice Provincial	Jul2014	Illegal land transaction
BaiEnpei	Yunnan	Provincial	Aug2014	Taking bribes and seeking interests for RE developers

Table A.II: **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.III: **Summary Statistics of Bond Characteristics**

	Mean	Median	SD	P10	P90
Bond size (log(¥ Bil))	2.49	2.48	0.70	1.61	3.40
Time-to-Maturity (year)	3.57	2.92	3.38	0.33	7.92
Coupon Rate (%)	4.99	4.98	1.10	3.57	6.48
Bid-Ask Spread	0.21	0.00	0.74	0.00	0.51

Table A.IV: **Provinces Sorted on Macro Factor Betas**

We estimate province-level betas by regression the changes in yields on the changes in nation-wide macro factors (equation (5)). We aggregate bond-level yields to the province level for the dependent variable. The macro factors are 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 on the betas into three portfolios: 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 returns 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 Macro Betas						
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
<i>t</i> -statistics	5.52	5.51	3.82	-1.81	-5.15	-2.49

Table A.V: **Province Risk Exposure and Chengtou Bond Excess Yields**

This table presents the panel regression results of chengtou bond excess yields on the risk exposures of local governments, as in formula (4). These risk exposures are constructed in a first-pass time-series regression (5), that is, the betas of regressing the change of province-level chengtou bond yields on the change of each of six macro factors: (i) the credit default swap on the Chinese central government (*CDS*), (ii) the log of foreign direct investment (*FDI*), (iii) the log of current account (*CA*), (iv) the effective real exchange rate (*FX*), (v) the one-year time deposit interest rate (*RF*), and (vi) the Chinese stock market return (*RET*). The β 's measure corresponding risk exposures for each province. We average bond yields over each month to obtain monthly frequency values. We include the lagged bond excess yields as a control variable. In Column (9) we also include additional control variables of bond characteristics such as bond size, time-to-maturity, and bond liquidity proxied by the bid-ask spread. Standard errors are clustered at the bond 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)	(8)	(9)
β_{CDS}	0.15*						0.24***	0.06***	0.08***
	[1.86]						[2.75]	[2.70]	[3.17]
β_{FDI}		0.12					-0.01	0.03	0.04
		[1.25]					[-0.08]	[0.75]	[1.02]
β_{CA}			0.50				1.07	0.15	0.07
			[1.35]				[1.53]	[0.79]	[0.37]
β_{FX}				-1.22*			-2.87***	-0.59**	-0.58**
				[-1.90]			[-2.89]	[-2.23]	[-1.97]
β_{RF}					-0.04*		0.02	0.01	0.00
					[-1.72]		[0.43]	[0.42]	[-0.03]
β_{RET}						-0.06**	-0.12***	-0.03**	-0.02
						[-2.15]	[-3.05]	[-2.32]	[-1.64]
Lagged Yield								0.77	0.76
								[48.21]	[43.71]
Month FE	Y	Y	Y	Y	Y	Y	Y	Y	Y
Cluster (Bond)	Y	Y	Y	Y	Y	Y	Y	Y	Y
Bond Controls	N	N	N	N	N	N	N	N	Y
Observations	20357	20357	20357	20357	20357	20357	20357	18785	18785
Adjusted R^2	0.185	0.184	0.184	0.186	0.185	0.186	0.199	0.620	0.621