Local guarantees and SOE bond pricing in China ☆

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A B S T R A C T

We study the changing landscape of credit market guarantees by examining the risk-pricing of the Chinese state-owned enterprise (SOE) bonds, which have experienced rising defaults across provinces from a zero record. Using primary market bond issuance data, we identify a *province premium* that captures the perceived local government support for local SOEs. We find that on average the perceived local government support is on the decline, while the subnational debt market has become more segmented since 2018. This evidence is found to be closely related to the divergence in local government's fiscal space and the occurrence of SOE default incidents in the area, highlighting the adverse linkage between public debt and corporate financing costs.

1. Introduction

State-owned enterprises (SOEs) in China have long enjoyed preferential access to bank credit. More recently the fast growing bond market has become another major source of funding for SOEs (Milhaupt, 2020; Molnar & Lu, 2019). One important feature of SOEs in China is that some of them, i.e. central SOEs, are backed by the state, while the vast majority of local SOEs are owned by local governments. Much of the literature has so far focused on SOE's widespread financing discount compared to private-owned enterprises (POEs) in China (Geng & Pan, 2019). However, there is little empirical evidence on the credit differentiation among SOEs themselves. One reason for this is the lack of transparent large-scale data on SOEs' financing costs, as bank borrowings are often opaque. In this paper, we rely on bond market evidence to study the determinants of the risk pricing of local SOE bonds in China and shed light on the changing landscape of credit market segmentation and perceived local government guarantees.

Since the first SOE bond default in 2015, defaults from local SOEs have been on the rise and experienced two heightened waves during 2016–2017 and 2019–2020 (Fig. 1), amid China's deleveraging campaigns, stretched local government fiscal positions (Bai, Hsieh, & Song, 2016; Huang, Pagano, & Panizza, 2020) and the outbreak of COVID-19. As the Chinese authorities transit to market-based approaches to restructure underperforming SOEs (Jin, Wang, & Zhang, 2020), eyes are on whether allowing SOE defaults would facilitate better risk-pricing, and whether government guarantees would be reduced universally. For example, following several high-profile SOE defaults in the fourth quarter of 2020, including the default of Yongcheng Coal in Henan, "…*confidence in bonds issued by*
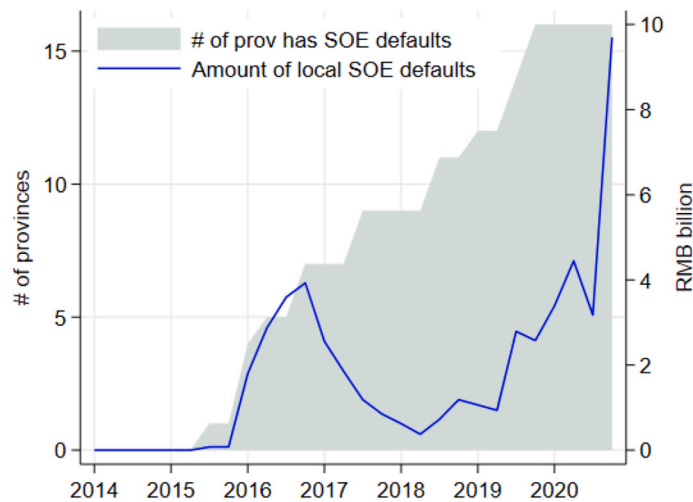
Fig. 1. Local SOE Bond Default in China. The amount of local SOE defaults is calculated as four-quarter moving average, and the # of provinces is an accumulated number of provinces that have experienced local SOEs defaults. *Source:* Wind.

state firms from provinces with weaker finances or a similar investment profile have been hard hit…" (Reuters, 19 November 2020).[1] This anecdotal evidence suggests that market stress may affect especially SOEs from certain provinces, that may be disadvantaged based on fiscal strength, default history and other factors of their residing provinces. The direct consequence of such a differentiation could be a divergence in financing costs and market segmentation.

In this paper, we exploit rich data on the primary issuance of SOE bonds in China to quantify a "province premium" in an SOE's real financing cost that cannot otherwise be explained by its financial fundamentals and the credit risk of the bond. Since the province premium is only based on the provincial location of the bond issuer, we attribute it to how much support investors believe there will be from this particular provincial government. This price-based approach to measure debt market fragmentation has been adopted in several papers (Baele, Ferrando, Hördahl, Krylova, & Monnet, 2004; Zaghini, 2016; De Santis, 2018; Horny, Manganelli, & Mojon, 2018), most of which have an exclusive focus on the euro area corporate bond market. To our knowledge, we are the first to apply this approach to China's SOE bond market and infer subnational debt market fragmentation. The special two-tier SOE system in China makes it an ideal setup, where central SOEs are used as a benchmark with the highest central government support and the lowest default likelihood.

We estimate that the overall local government's guarantee perceived by the market has weakened, relative to support for central SOEs from the central government, between 2013 and 2020. These results point to an overall improvement in the risk-pricing of local SOE bonds. We also find that over the same period, divergence in the perceived guarantees of different provincial governments has widened. Prior to any SOE default, bonds issued by SOEs from different provinces were deemed almost homogeneous by the market. Therefore, funding costs were largely reflecting the bond terms and the issuer's quality. After waves of SOE defaults, market perceptions shifted dramatically: SOEs from certain provinces (e.g. those residing in provinces with tight fiscal space, or a recent default, etc) face higher funding costs, leading to a more fragmented bond market. Our estimation results are consistent with actual government actions or inactions observed in the real world. We link our empirical findings to real-world cases of provinces where an increase in premia coincided with a decline in the local government's support to troubled or defaulted local SOEs and the vice versa.

We then formally investigate the drivers of the estimated time-varying province premium. We follow the literature on sovereign risk determinants (see for example Aizenman, Hutchison, & Jinjarak, 2013) and examine how fiscal space at provincial government level in China together with other macroeconomic fundamentals affect the province premia demanded by investors. More interestingly, we incorporate information on various local SOE defaults that occurred across more than half of China's provinces over time, and examine if past credit events may additionally affect investors' perception of risk towards other SOEs in the same province. We find that local government fiscal space is closely associated with the province premium, apart from the effects of fixed asset investment, regional economic development, and trade openness. A one standard deviation rise in the local debt to GDP ratio is estimated to increase the province premium by 11–15 basis points. The results indicate that indebted local government can exert a negative externality on local firms by subjecting them to a disproportionately higher financing cost, regardless of their own financial strength. On top of a straining fiscal space effect, we also find that previous bond defaults from SOEs would lead to an increase of 17–18 basis points in funding costs for other local SOEs in the same province. One interesting finding is that our results show a consistently significant adverse effect on province premia from local government indebtedness and fixed asset investment. This is consistent with the institutional feature in China that local officials rely on debt-fueled infrastructure investment and often even inflate their investment

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[1] https://www.reuters.com/article/china-bonds-shanxi/refile-update-1-state-firms-from-chinas-shanxi-can-meet-near-term-bond-repayments-official-idUKL1N2I509P.

figures to achieve growth targets for their own career incentives (Xiong, 2018; Chen, Chen, Hsieh, & Song, 2019). Indeed, we find that provinces that severely over-report their fixed asset investments are viewed by investors as riskier, thus facing an even higher province premium.

We conclude the study by exploring the effect on resource allocation associated with credit market differentiation. We show that weakened perception of local government guarantees, reflected in higher borrowing costs at the provincial-level have real consequences on firms' investment behaviors. Our results highlight potential negative spillovers from financially strained local governments to local SOEs, as the reduction in the size of investment is not observed along with improvement in investment efficiency.

Our study contributes to the literature on financial market segmentation in China. There is well-documented evidence on the geographic segmentation of the Chinese financial system. This line of literature often comes with a geographic angle and focuses on limited internal capital mobility, built on evidence from opaque bank loan data or gaps between investment and saving (Boyreau-Debray & Wei, 2004; Boyreau-Debray & Wei, 2005 & Huang et al., 2020 among others). Our paper is the first to document the extent of credit market segmentation using bond pricing information. We take the provincial government perspective that links provincial government fiscal strength to the corresponding SOE financing cost. This approach is closely related to testing financial market segmentation in a monetary union with heterogeneous fiscal space from member states. To the extent that provincial governments in China have discretion over their fiscal budget plans while all provincial level monetary authorities are subject to the monetary policy set out by the People's Bank of China, China's context highly resembles the euro area.[2]

Our study also adds new evidence on the changing landscape of government guarantees in China. Previous evidence points to the prevailing government guarantees of SOE over POE issuers due to investors' seek-for-safety motives (Geng & Pan, 2019).[3] Our study shows that the debt market is also segmented among SOEs themselves, the issuer group that contributes the lion's share of total corporate debt in China (Molnar & Lu, 2019). Liu, Lyu, and Yu (2021) study the relationship between local government financing vehicle (LGFV, one type of local SOE) bonds and local governments, while our study uses a more general framework applying to all SOEs, which allows us to incorporate the important role of local SOE defaults.[4] Our finding is consistent with the line of literature that stresses negative effects of public guarantees on price efficiency and market discipline. For example, Allen, Gu, Qian, and Qian (2018) show that the expectation of an implicit guarantee flattens the risk-sensitivity of the price of debt using evidence from the Chinese trust industry.

Finally, our work contributes to a broader literature on sovereign to corporate sector risk spillover. Ağca and Celasun (2012) and Dailami and Dailami (2010) highlight adverse linkages between public external debt and corporate bond spreads in emerging economies. In developed economies, extensive studies establish evidence that sovereign risk and downgrades could spillover to financial and non-financial sector during a sovereign crisis (see for example Augustin, Boustanifar, Breckenfelder, & Schnitzler, 2018; Klein & Stellner, 2014; Bevilaqua, Hale, & Tallman, 2020 on spillovers of sovereign risk to corporate risk in the euro area in the wake of the Greek crisis).[5] Our study presents new evidence that provincial government fiscal strength is a key determinant in the risk-pricing of SOE bond issuers in the context of China. Allowing SOE bonds to default implies that the local government fails or is unwilling to bailout distressed SOEs. Although the exact reason is unknown ex-ante, default events undermine sound fiscal responsibility in provincial governments. Shifts in perception from a "full-bailout" opens up the possibility of risk transfers between provincial governments to local SOEs. Straining fiscal space could also reinforce an expectation on future defaults, further aggravating the divergence in financing costs in a self-fulfilling manner.

2. Institutional background

2.1. The two-tier SOE system in China

In this section we discuss the ownership structure of state-owned enterprises in China at different administrative levels and provide a clear mapping of the linkage between central SOEs, provincial SOEs and the debt (partially) assumed by them. One unique feature of the corporate bond market in China is that it has served as a major source of funding for SOEs, rather than private-owned enterprises (POEs), given the still prevalent, though reduced, implicit government guarantees to SOEs (Milhaupt, 2020; Molnar & Lu, 2019).[6] There are two main types of SOEs in China: central SOEs and local SOEs:

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[2] In the euro area, failing to service debt at the sovereign level dimmed the growth prospect and repayment ability of local firms. Instead, the tightened fiscal position and indebtedness at the local government level in China is reflected as allowing defaults by local SOEs, which is due to local governments not being able to or willing to bail them out.

[3] Using a similar framework to ours, Geng and Pan (2019) derive an SOE's financing discount compared to a similar POE and show that the perceived guarantees of SOEs have increased rapidly since 2018.

[4] Many LGFVs have also gone through commercialization in recent years and the potential support from the local government for this type of commercialized LGFVs may not be so different than other local SOEs.

[5] For example, Augustin et al. (2018) shows that the first Greek bailout shifts investors' perception of "no-bailout" belief and increases the interdependence between sovereign and corporate credit risk, both within Greece and across other member states in the EU.

[6] Molnar and Lu (2019) reports that as of mid-2018, 82 percent of total corporate debt in China was attributable to SOEs. In addition to direct borrowing through the debt market, SOEs in China also financed through borrowing from state-controlled banks, with the share of new bank loans going to SOEs increased significantly to 80 percent in 2016, up from 32 percent in 2012 (Lardy, 2019). In addition, about 1100 central and local SOEs have accessed equity capital by listing on the A share market (Rosen, Leutert, & Guo, 2018). While this represents about 30 percent of the total number of listed firms, it is a small fraction of the roughly 170,000 SOEs in China.

Central SOEs refer to non-financial companies directly and fully-owned by the central government and administered by the State-owned Assets Supervision and Administration Commission (SASAC) or the Ministry of Finance. Central SOEs include the largest and best-known state firms, like Sinopec, State Grid, and State Power Investment. Many of them are concentrated in industries with high strategic value and barriers to entry, including defense, electricity, petroleum, telecommunications, and transportation, while others are operating in more competitive industries like electronics, construction and automobiles. Central SOEs are probably the least risky borrowers among all SOEs, as they are fully backed by the central government and come with the lowest default likelihood.

Local SOEs refer to companies owned by local governments or State-Owned Asset Super-vision and Administration Commissions at the municipal provincial level and below. Local SOEs are active players in a variety of industries, ranging from mining, and materials to construction. There were approximately 116,000 local SOEs located at various levels of government in China as of 2017 (Leutert, Bernier, Florio, & Bance, 2020). Bonds issued by local SOEs are presumably backed by provincial governments to various degrees, depending on factors including the issuer's strategic importance in the region as well as the local government capability of providing guarantees. One special type of local SOE is the local government financing vehicle (LGFV), which borrows on behalf of local governments to finance infrastructure investments. LGFVs bonds are perceived to be backed by stronger implicit guarantees from corresponding local governments, hence enjoy the extra safety of municipal bonds.[7] The bailout expectations, especially for LGFVs that are both SOEs and backed by local governments, are wide spread and particularly relevant in China (Chen, He, & Liu, 2020).

2.2. The provincial government support

Provincial governments have the ultimate responsibility for handling SOE debt-related emergencies, even for SOEs that are owned by lower level local governments (Document No. (2016) 88, State Council).[8] Prefecture or city level governments often lack proper resources to bailout local SOEs in their governing territories, as prefecture level governments are not allowed to issue debt on their own behalf.[9] To the best of our knowledge, there has not been any local SOE bond default that did not involve the provincial level government.[10]

The local government provides support to local SOEs both explicitly and implicitly in China. For SOEs operating in the public sector that incur losses, local governments provide *explicit support* to strengthen their financial positions through (i) providing subsidies, and (ii) injecting assets.[11] More subtly, local governments provide *implicit support* to help resolve risk events. There is no systematic or official documentation of what each local government can do or has done in this regard. Based on anecdotal evidence and various media reports, we summarized the implicit support into a number of categories, differing in the timing and format of the support provided. We present selective examples in Table 3.

Before a risk event happens, the local government may plan to help alleviate local SOEs' debt burden or liquidity constraints. For example, the Jiangsu provincial government uses proceeds from local government special bonds to support weak LGFVs in the region, and facilitates transactions between local SOEs and China Development Bank (CDB) aimed at swapping high-cost debt for long maturity, low-cost policy bank loans. In addition, the local government may provide a verbal guarantee, promising to take measures to ensure no default happens. This is especially the case after the introduction of the 2014 New Budget Law and ensuing policies (i.e., the often referred "Document No. 43", "Document No. 88") which outlawed formal government guarantee letters for local SOEs.[12] After a default, government may provide financial support to help with restructuring and repayment. This is usually done through mobilizing resources of other local SOEs or commercial banks in the region.[13]

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[7] Publicly issued LGFV bonds have never defaulted so far, showing a stronger "implicit guarantee" by the governments. However, nonstandard LGFV borrowing (those on contract terms from specific parties) has experienced clustered defaults in 2018, after the Chinese authority's campaign to contain financial risk and deleverage in 2017.

[8] http://www.gov.cn/zhengce/content/2016-11/14/content_5132244.htm.

[9] According to the New Budget Law passed in August 2014 (Zhongqing Yin, Ten highlights of the New Budget Law, The National People's Congress Magazine), only three types of entities can issue local government bonds (LGBs): provinces, autonomous regions, and municipalities directly under the central government. All three entities are at the provincial level in China's administrative hierarchy, directly under the central government.

[10] Though lower-level governments bear responsibilities according to the "territorial principle", demanding resource deficient local governments to bailout would be inconsistent with the goal of "maintaining stability and protecting the bottom line of no regional systemic risk events" (Document No. (2016) 88, State Council).

[11] Nearly all subway companies are city-owned enterprises, incurring losses and relying on government subsidies to maintain operation. Other example includes Zhenjiang city government injecting affordable housing projects into Jiangsu Hanrui, a local SOE, to improve its balance sheets.

[12] Against the backdrop of supply side reform started in November 2015 which shocked overcapacity sectors (i.e., the coal industry), the deputy governor of the coal-producing province Shanxi met with investors in Beijing and gave a verbal guarantee that the seven major SOE coal companies in Shanxi will not default, encouraging investors to buy bonds issued by these companies.

[13] For example, after the default of Sichuan Coal Industry Group (SCIG) on June 15, 2016, another local SOE in Sichuan province provided entrusted loans (which it borrowed from four commercial banks in the region) to SCIG to help make the bond payment, under the direction of the provincial government. Another example is the default of Yongcheng Coal and Electricity Holding Group (Yongcheng Coal) in 2020. With the support of Henan provincial government, Yongcheng Coal was able to make 50% of the bond payment and extend the rest of the debt.
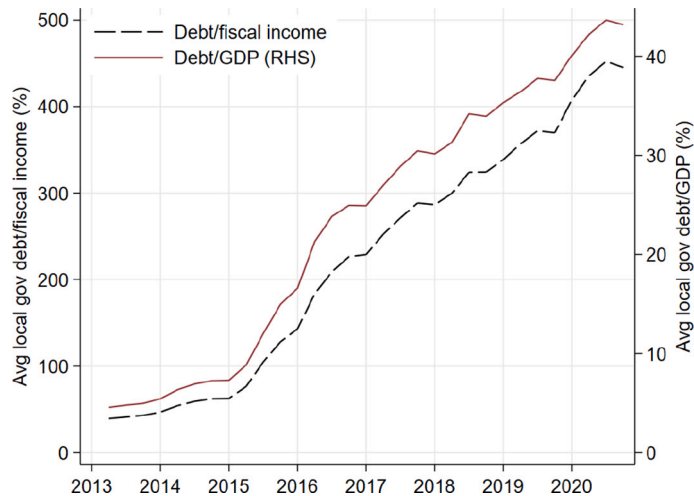
Fig. 2. China's Local Government Fiscal Space over Time. Local government debt includes outstanding local government bond and LGFV bonds at quarter-end. *Source:* CEIC.

2.3. The provincial government fiscal space

The bailout expectations for stressed local SOEs are formed on the willingness and the ability of local governments, with the latter critically depending on the local government's fiscal space, which is measured as public debt scaled by GDP or fiscal income at the provincial level (Fig. 2).[14] While two provinces may have a similar GDP level, the fiscal income (mostly from tax revenue) however depends also on the industrial structure, with service sectors generating much more tax revenue than agricultural sectors. Public debt in turn has two metrics - explicit debt and contingent debt, with the former including outstanding general and special bonds issued by local governments, and the latter also including outstanding LGFV bonds. It is worth noting that as local government borrowings become integrated with local government bonds post the 2014 New Budget Law, theoretically the remaining LGFV debts should not be borne by local governments. However, currently LGFVs are viewed as more closely related to local governments than regular local SOEs, thus, LGFV debts may still be considered as government debt by investors when assessing government fiscal space (Ang, Bai, & Zhou, 2016). The dynamics of local government debt are closely related to several policy reforms (i.e. Tax Sharing Reform in 1994, the New Budget Law in 2014) and financial events (i.e. the Global Financial Crisis in 2008, and the COVID-19 outbreak in 2020). In particular, the aggregate local government debt almost quadrupled from 5.8% to 22% of GDP between 2006 and 2013 as a result of the 2008 fiscal stimulus, coupled with reduced reliance on central government debt and transfers (Huang et al., 2020). Debt-fueled infrastructure-driven growth further pushed up the local government debt between 2015 and 2018. With the outbreak of COVID-19, local government debt rose further by 20% yoy in 2020 (compared to 15% yoy in 2019) due to the pandemic relief measures. For a brief historical review of local government debt, see Annex A.

3. Data and sample characteristics

Our study uses data compiled at the security, firm, and province levels. Our main data source is Wind Financial Terminal, supplemented by CEIC and Province Year Book. Our sample covers 30 provinces in Mainland China (Tibet has insufficient number of bond issuance). Our sample period is from 1 January 2013 to 31 December 2020, expanding for the year prior to any SOE bond default to the year after two heightened waves of SOE bond defaults.

3.1. Security-level data

Our bond sample includes primary issuance of more than 35,000 bonds issued by 69 central SOEs (of 2,576 securities) and 4,579 local SOEs, including both non-LGFV and LGFV issuers.[15] We use bonds issued by central SOEs as a benchmark and this allows us to

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[14] Fiscal space is generally defined in the literature as the budgetary room a government has for fiscal manoeuvre, in order to provide resources for desired purposes while still maintaining debt sustainability (Heller, 2015; Ostry, Ghosh, Kim, & Qureshi, 2010). Besides measuring along the lines of fiscal solvency and sustainability, fiscal space can also be viewed from the perspective of balance sheet vulnerabilities such as the ratio of external debt to foreign reserves or nonresident shares of government debt (World Bank, 2015). But this is more relevant for sovereigns rather than provincial governments in China, which do not have the authority to assume foreign debts.

[15] Primary market credit spreads are used to capture the real financing cost of firms, similar to Zaghini (2016). Sufficient primary issuance of SOE bonds over a long time horizon also makes it possible to fully exploit the time dimension of firms' financing costs. On the contrary, trading data is limited due to a less active secondary bond market in China.

Table 1
Summary statistics: SOE bond characteristics and provincial macro-variables.

	Mean	SD	Min	P50	Max
Local SOE bonds					
No. of issuers per province	303.15	244.33	9.00	178.00	738.00
No. of bonds per province	2727.10	2515.11	63.00	1560.00	7508.00
Issuance amount (RMB 100 million)	9.11	6.84	0.10	7.50	130.00
Maturity at-issue (years)	3.15	2.35	0.02	3.00	28.00
Credit rating of the issuer at-issue	–	–	C	AA+	AAA
Yield at-issue (%)	5.05	1.56	1.13	4.97	12.00
Credit spread over the treasury yield(bps)	217.87	125.65	−108.94	197.08	821.78
Central SOE bonds					
No. of issuer	69	–	–	–	–
No. of bonds	2576	–	–	–	–
Issuance amount (RMB 100 million)	29.42	25.42	1.00	20.00	250.00
Maturity at-issue (years)	2.08	2.40	0.02	0.74	20.00
Yield at-issue (%)	3.66	1.13	0.95	3.75	6.90
Credit spread over the treasury yield(bps)	90.78	68.93	−173.39	92.52	436.39
Provincial macro-variables					
Fixed asset investment (% of GDP)	80.46	26.06	20.76	83.94	149.88
Trade openness (% of GDP)	3.74	3.91	0.10	2.10	21.04
GDP per capita (RMB 10 k)	5.81	2.86	2.28	4.86	16.46
Local government + LGFV debt (% of GDP)	23.58	17.23	1.40	21.43	108.41
Local government + LGFV debt (/fiscal income)	2.24	1.71	0.10	1.96	8.86
Local government debt (% of GDP)	15.40	15.00	0.00	13.19	80.64
Local government debt (/fiscal income)	1.48	1.48	0.00	1.21	8.25

Note: Provincial macro-variables are at quarterly frequency. The fixed asset investment is not the same as the investment component of GDP, as it also includes costs that are not recorded in the current period GDP, such as costs of land-purchasing and costs of buying used machinery and buildings. Thus, the fixed asset investment could be larger than GDP in some cases. *Data source:* Wind Financial Terminal and CEIC.

derive the extra financing cost of local SOEs from a particular province, holding other things equal. Our list of central SOEs is taken from the "Directory of central SOEs" published by SASAC.[16] Among 96 central SOEs listed, we identify 69 issuers that have issued debt instruments. On average, central SOE bonds have three times the issue amount and less than half of the credit spread than that of local SOE bonds (Table 1). Borrowing by local SOEs through the bond market shows significant heterogeneity across provinces. Table 2 further describes the bond issuance activity for each province. Local SOEs from Jiangsu, Zhejiang and Shandong are very active in bond market financing. In comparison, issuers from Qinghai, Hainan and Heilongjiang are far less active in borrowing. In terms of borrowing cost, local SOEs from Guizhou, Heilongjiang, and Hainan face relatively higher borrowing costs, with a yield spread of more than 300 bps relative to the risk-free rate. In contrast, issuers from Shanghai, Beijing and Fujian could borrow as low as less than 150 bps of credit spreads. Central SOEs face the lowest borrowing cost on average, at only 91 bps.

3.2. Province-level macroeconomic data

To examine the determinants of province premia, we match below provincial-level macro variables with the issuers' residing province at quarterly frequency due to data availability. **Fiscal space** is proxied using four measures as mentioned in Section 2.3. Local government indebtedness has increased dramatically during the sample period, as governments increased investment to support local economic development. Meanwhile, local government fiscal space has tightened significantly: the average debt/GDP ratio at the provincial level was 4.8% in 2013 and increased to 42.3% in 2020. A similar trend is painted if measured by the ratio of debt/fiscal income, which increased to 435% in 2020 from just 41% in 2013. Some provinces experienced a much worsened fiscal space (such as Guizhou, Jilin, Qinghai, Inner Mongolia and Heilongjiang) than others (such as Beijing, Jiangsu and Fujian).[17]

To measure **regional economic development**, we use per capita GDP. For most provinces, per capita GDP almost doubled from 2013 to 2020, still as of 2020 per capita GDP is much lower for Guizhou, Guangxi and Gansu, and relatively higher for Beijing, Shanghai and Jiangsu (Table A4).[18] In general, provincial-level indebtedness and economic development are negatively correlated, with Qinghai and Guizhou being the most indebted provincial governments and the least developed regional economy, while Guangdong and Beijing are on the opposite spectrum. The fiscal space of Tianjin is ranked much higher when measured by fiscal revenue instead of GDP, and the fiscal space of Jiangsu is ranked much higher when not considering contingent debt assumed by LGFVs (Fig. 3).

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[16] For the Directory of central SOEs, please refer to http://en.sasac.gov.cn/directorynames.html.
[17] A detailed breakdown of the fiscal space by province using the above two measures over the sample period are shown in Tables A2 and A3.
[18] Per capita GDP is of yearly frequency, and is converted into quarterly frequency by assuming constant per capita GDP in all quarters of a year.

Table 2
Description of SOE bond issues by province.

Province	No. of Issuers	No. of Bonds	Maturity (years)	Issuance value (100 million rmb)	Spread (bps)
Anhui	178	1231	3.3	8.9	231
Beijing	126	1560	2.8	14.4	142
Chongqing	178	1313	3.7	7.8	283
Fujian	148	1945	2.3	7.2	149
Gansu	37	268	3.4	10.0	241
Guangdong	198	1887	2.5	9.9	130
Guangxi	91	884	3.0	7.4	258
Guizhou	172	538	5.0	9.6	370
Hainan	14	111	3.2	9.7	323
Hebei	77	853	2.5	10.2	221
Heilongjiang	26	139	4.0	7.9	324
Henan	130	1031	3.4	9.6	246
Hubei	170	1095	4.1	8.4	220
Hunan	223	1393	4.3	8.7	274
InnerMongolia	51	202	3.2	10.9	280
Jiangsu	738	7508	2.9	7.1	220
Jiangxi	149	976	3.7	9.4	203
Jilin	36	293	3.3	9.6	312
Liaoning	96	434	3.6	9.5	294
Ningxia	9	63	2.9	6.5	167
Qinghai	16	123	3.0	9.6	266
Shaanxi	109	946	3.1	14.3	219
Shandong	329	2580	3.0	10.3	209
Shanghai	131	899	2.6	12.1	117
Shanxi	70	1294	2.4	12.1	239
Sichuan	264	1535	4.0	8.5	256
Tianjin	96	1022	3.3	11.4	244
Xinjiang	83	705	2.8	6.4	235
Yunnan	98	861	2.8	9.6	262
Zhejiang	463	2874	3.6	8.2	191
Total	4579	39157	3.1	10.5	209

Source: Wind Financial Terminal.

Table 3
Representative ways of government implicit supports, selected examples.

	Province	Year	Type of support	Before or after a risk event	Description
1	Jiangsu	2020	Monetary support	Before	Jiangsu provincial government uses proceeds from government special bonds to support LGFVs in Zhenjiang city.
2	Jiangsu	2019	Facilitate bank loans	Before	Help obtain loans from China Development Bank (CDB) for Zhenjiang city LGFVs, swapping high interest rate debts for 10Y maturity, low interest rate loans from the CDB.
3	Sichuan	2016	Redirect other local SOE's resources	After	After the default of Sichuan Coal Industry Group (SCIG) on June 15, 2016, another SOE, Sichuan Provincial Investment Group, provided an entrusted loan to SCIG under the coordination of Sichuan provincial government, for SCIG to make the late payment in full.
4	Shanxi	2016	Provide verbal guarantee	Before	The deputy governor of Shanxi province promised to investors in a road show in Beijing on July 13, 2016, that Shanxi province had established mechanisms to ensure that its seven largest SOE coal companies won't default.
5	Henan	2020	Participate in debt restructuring	After	Henan SASAC participated in negotiating the debt restructuring with bond holders after the default of Yongcheng Coal and Electricity Holding Group (Yongcheng Coal); with government financial support, the offer Yongcheng Coal made rose from repaying 5% of the principal upfront to repaying 50% of the principal, with the rest extending 270 days.

Source: S&P Global Ratings, CICC Research, Caixin, various media reports, and authors' summary.
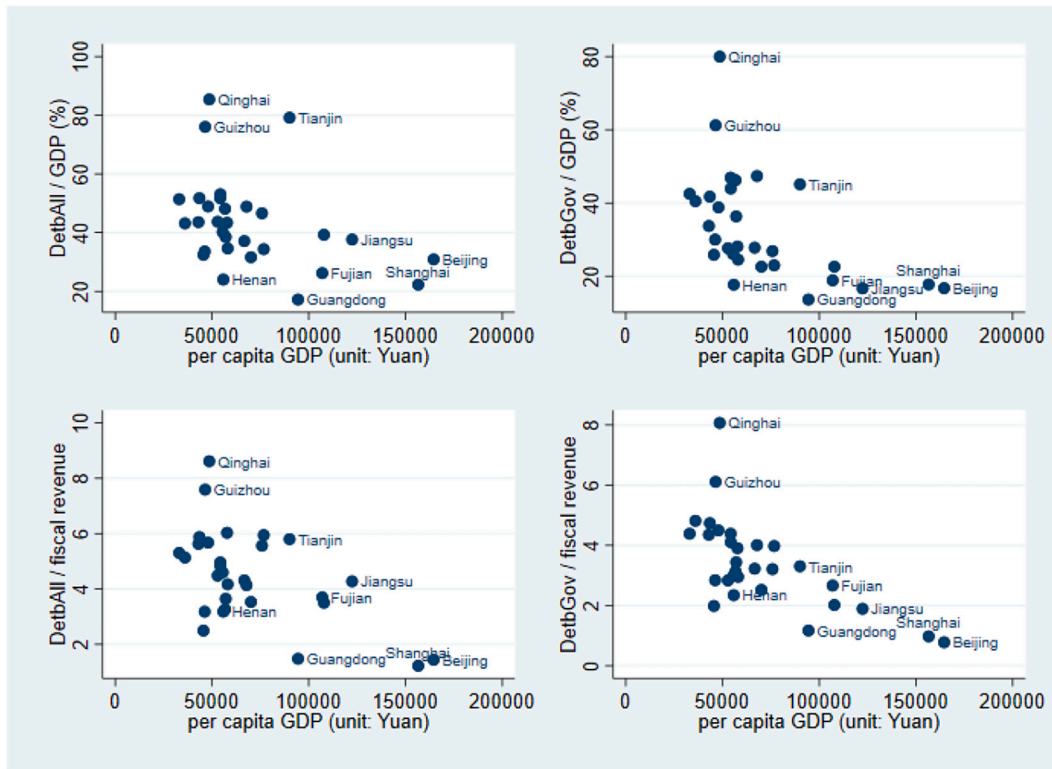
Fig. 3. Fiscal space and Economic Development Level in 2020. This figure plots different measures of fiscal space against the level of economic development for 30 provinces in China using end-2020 data. *Source:* Wind and China Electronic Local Government Bond Market Access.

An important macro variable that contributes to both regional economic growth and local government debt is **fixed asset investment** (FAI), often financed through local government borrowing. Because of its double-edged sword effect, FAI could exert an ambiguous impact on province premia: some investors may view a high level of FAI favorably, while others may be concerned with the sustainability of an investment-driven growth model. The provincial average FAI as a percentage of GDP is around 80% (bottom panel of Table 1), suggesting that the investment-driven growth model is still prevalent among Chinese provinces.[19]

Lastly, we include **trade openness**, defined as the sum of export and import volumes as a percentage of GDP. It is included as an indicator for the local economy's openness and thus the ability to generate foreign investment as well as foreign-currency denominated debt.[20] Trade openness varies significantly across provinces, with inland provinces like Qinghai and Guizhou on average below 0.5% of GDP and coastal regions like Shanghai and Guangdong above 10% of GDP during the sample period.

4. Estimating the province premium

4.1. Methodology and results

Empirical framework: Given the close ties between provincial governments and their local SOEs, the credit spread of local SOE bond contains important information about investors' perception of the provincial government's willingness and ability to aid local SOEs, i.e. the *province premium*, which are not directly observable. We attempt to identify this information using a price-based framework following Zaghini (2016) and De Santis (2018). This approach is based on the theory of the law of one price, which states that assets with identical cash flows and risk profiles should have the same price, regardless of where the issuer resides.

Empirically, by employing the following econometric model (1), we take away from the credit spread the part that can be explained by bond-specific, issuer-specific and sector-specific credit risk. The remaining component, varying by province and time, captures the extra funding cost of local SOEs from a certain province relative to central SOEs, i.e. the province premium:

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[19] FAI/GDP ratio could be larger than 100%, because FAI is not the same as the investment component of GDP (capital formation), as it also includes land-purchasing costs, costs of buying used machinery and buildings, which are not recorded in the current period GDP. Nonetheless, FAI data is more timely and a common measure of investment activities in a province, thus used here.

[20] For example, local government may borrow foreign-currency denominated debts from the World Bank through the central government.

Table 4

Risk premia determinants.

Dependent variable:	Full sample			Excl. LGFV
Yield spread at-issuance	(1)	(2)	(3)	(4)
Bond-level credit risk				
Maturity	8.315***	8.312***	7.798***	7.735***
	(0.928)	(0.965)	(0.833)	(1.676)
Log(issue amount)	−13.27***	−13.30***	−11.46***	−16.06***
	(1.929)	(2.094)	(1.828)	(3.748)
Optionality	30.89***	26.97***	22.24***	36.73***
	(4.215)	(4.534)	(4.998)	(10.60)
Guarantor dummy	14.19***	12.77***	9.894***	25.72**
	(3.896)	(4.047)	(3.493)	(9.845)
Issuer-level credit risk				
Issuer rating	−23.56***	−22.32***	−18.96***	−10.85***
	(4.903)	(5.183)	(4.844)	(3.280)
Size	−20.88***	−21.70***	−25.96***	−23.77***
	(3.287)	(3.258)	(3.540)	(3.089)
ROA	−10.26***	−9.257***	−6.783***	−7.845***
	(1.066)	(1.033)	(0.740)	(1.105)
Leverage	0.616**	0.597**	0.660***	1.012***
	(0.270)	(0.223)	(0.166)	(0.308)
Liquidity	−20.62***	−21.21***	−23.06***	−9.532
	(5.389)	(5.118)	(4.286)	(6.332)
Sector FE		Y	Y	Y
Province FE			Y	Y
Observations	34,803	34,803	34,803	12,577
R-squared	0.449	0.465	0.523	0.583

Table 4 presents estimation results using specification (1) while adding sector FE and province FE sequentially to the model. Column (4) uses full specification but with only non-LGFV sample. All specifications include year-quarter FE and standard errors clustering at the province level. Base group is the central SOE and Consumer Staple serves as the reference sector. Size refers to the logarithmic of total asset. A better issuer rating is coded as a higher number. Note that estimated province premia are omitted from the table to save space. ***$p < 0.01$, **$p < 0.05$, and *$p < 0.1$.

$$Spread_{i,p,t}[k] = \beta_0 + \underbrace{\beta_1 X_{i,p,t}[k]}_{bondrisk} + \underbrace{\beta_2 F_{i,p,t}}_{issuerrisk} + \underbrace{\beta_3 Z_{p,t}}_{provincepremium} + S_i + \lambda_t + \varepsilon_{i,p,t}[k] \tag{1}$$

The credit spread $Spread_{i,p,t}[k]$ of bond k issued by SOE i, located in province p, at time t is constructed as the spread of bond k's issuance yield over the yield of Chinese government bond (CGB) with the same maturity m on the same day t.[21] $X_{i,p,t}[k]$ includes variables that track the bond features, such as the bond maturity, the issuance amount, the bond rating at the issuance, as well as optionality, special clause embedded, and guarantor information of the security. $F_{i,p,t}$ are the variables characterizing the issuer feature, including the issuer's asset size, rating at the issuance, and key financial variables such as return on asset (ROA), leverage, and liquidity (defined as the ratio of cash to short-term debt). Issuers' financial variables are at yearly frequency and lagged by one year whereas the bond spread and bond-level information are at daily frequency. $Z_{p,t}$ is a vector of dummy variables for each province p and quarter t. Sector fixed effects S_i and year-quarter fixed effect λ_t are included to take into account the sector-specific risk-pricing and the financial market conditions prevailing at the time of the issuance.

We use a published list of central SOEs from the SASAC as our benchmark province, as they are fully backed by the central government sovereign credit and have the lowest default likelihood. This allows us to derive the extra financing cost of local SOEs from a particular province with all dimensions similar except for the ownership structure. Our main object of interest is the estimated coefficient vector β_3, which permits to identify the time-varying unobserved provincial systematic component, or province premium, given by $\beta_3 Z_{p,t}$. The higher the province premium, the lower the investor-perceived support from the specific provincial government relative to support to a central SOE from the central government. β_3 is estimated at the quarterly frequency to capture the changing province premium while ensuring sufficient observations for each province.

Results: Table 4 shows the estimation results of the local SOE bond risk premia determinants from specification (1). As sector FE and province FE are added into the model sequentially, the explanatory power of the model improves. Bond-level and issuer-level characteristics are found to have consistent and significant effect on the risk-pricing of local SOE bonds across all specifications.

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[21] $Spread_{k,m,t} = Yield_{k,m,t} - Yield_{CGB,m,t}$, where maturity $m \in$ {1 M, 2 M, 3 M, 6 M, 9 M, 1Y, 2Y, 3Y, 4Y, 5Y, 6Y, 7Y, 8Y, 9Y,10Y, 15Y, 20Y, 30Y}. For bonds that have "unconventional" maturity which does not exactly align with the risk-free rate, we map CGB's maturity to a maturity bucket of the corporate bond's maturity, such that for any bond k, its maturity m is mapped into 2 M if 1 M $<$ m $\leqslant$2 M, and etc. We interpolate the yield of CGB on public holiday days with the yield from the previous day.
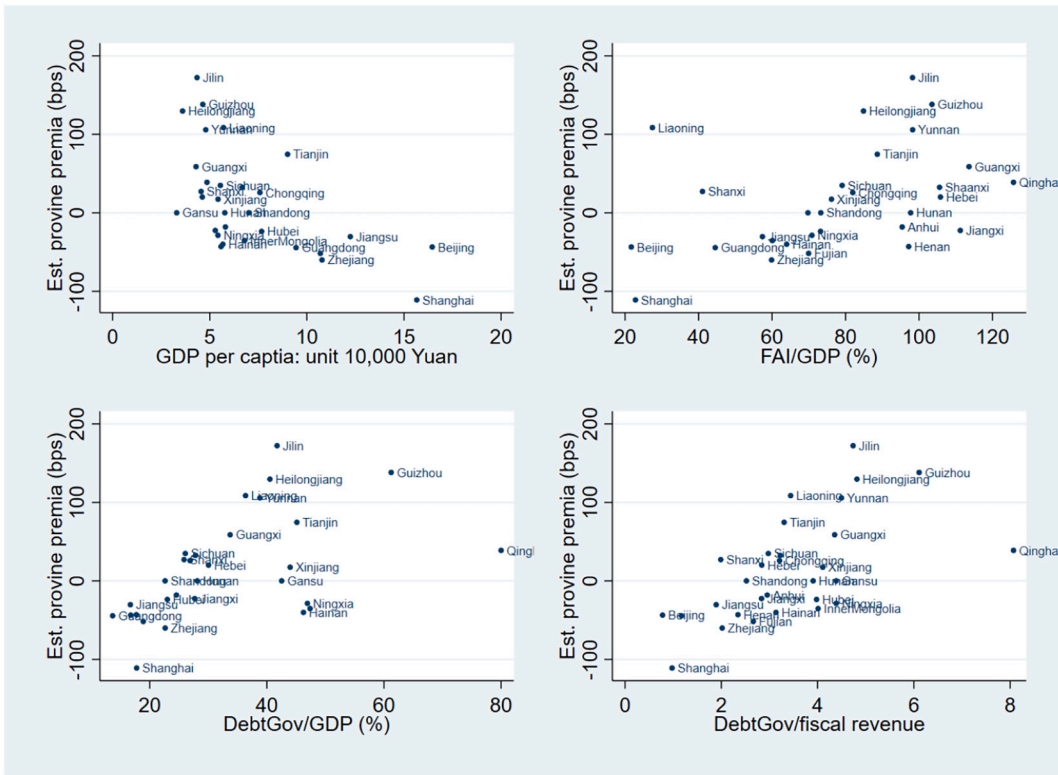
Fig. 4. Est. Province Premia and Provincial Economic Characteristics in 2020. This figure plots estimated province premia against different provincial economic characters using end-2020 data. The fiscal space uses the explicit debt measured by the outstanding local government bond only. *Source:* Wind and China Electronic Local Government Bond Market Access.
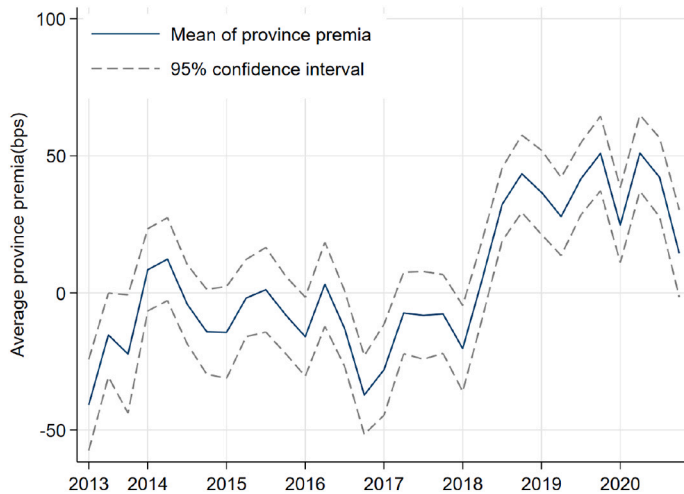
Fig. 5. Estimated Average Province Premia over Time. This figure plots the mean of the estimated province premia over the sample period. Province premia are calculated for 30 provinces in each quarter from the baseline specification (1). The dashed lines indicate a 95% confidence interval. Estimated province premia in each province is relative to the reference group - central SOEs and the base quarter is 2013Q1.
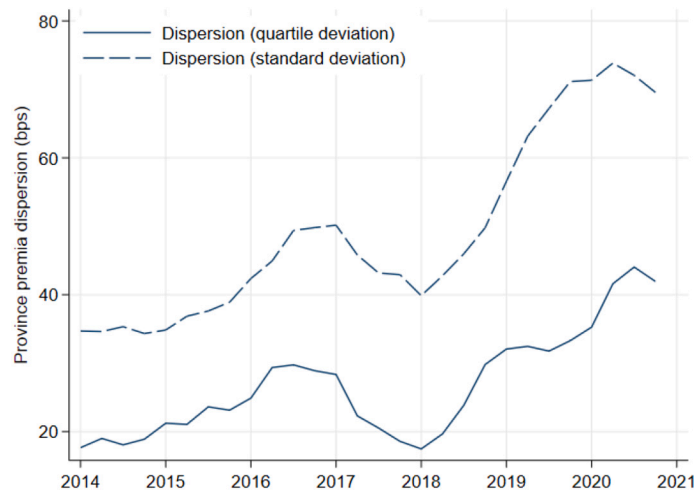
Fig. 6. Dispersion of Est. Province Premia over Time. Dispersion of the estimated province premia across 30 provinces in each quarter is calculated based on estimations from baseline specification (1). The dashed line uses the standard deviation as a measure of dispersion, and the solid line uses the quartile deviation as a measure of dispersion, and is defined as (75th percentile - 25th percentile)/2.

Specifically, a one-year longer duration of the bond will increase the spread-at-issuance over the risk-free treasury yield by around 8 bps, holding other things constant. A larger issuance value tends to reduce the bond risk premium, as a large issuance size tends to increase the liquidity supply in the secondary market. Optionality is found to increase the risk premium as investors and issuers are given the choice of a more flexible term.[22] The presence of Guarantor also increases the premium, because it is often the case that relatively weaker SOEs need the backup of a guarantor. On the issuer side, as expected, the issuer rating is found to have a significant negative effect on the risk premium. In addition, a larger issuer, with better profitability and liquidity condition are likely to reduce its risk premium, while having a higher leverage will drive up the premium. To show our results are not driven by LGFV bonds, column (4) uses non-LGFV bonds and presents similar results to the full sample. Thus, we will use the full sample for the rest of the study. Our main interest of the study (omitted in Table 4 to save space) - the estimated *province premia* are found to be time-varying and statistically significant, which we will discuss next.

4.2. Debt market fragmentation

We present the mean estimates of province premia with a 95% confidence interval in Fig. 5. The result shows that the national average province premia picked up notably from nearly 0 bps to between 20–70 bps in 2018–2020, implying a declining perceived supports for local SOEs. On the other hand, we find much of the premia increase was due to rising credit differentials, evidenced by a similar rise in the dispersion of province premium across different provinces, measured either by standard deviation or by quartile deviation (Fig. 6). Fig. 6 suggests that the estimated range of market-perceived risk increased more than two fold. This trend also appears to coincide with the default cycle of local SOEs and the dynamic of local government indebtedness, both picked up during 2015–2017 and rose further in 2019–2020. The rising credit market segmentation is also confirmed by a Wald test on the equality of the estimated coefficients across provinces in each quarter in specification (1), following De Santis (2018).[23]

To have a more direct view of the credit market differentiation, we highlight two points in time using the estimated time-varying province premium. In 2014, prior to any SOE bond defaults, local SOEs in nearly half the Chinese provinces (the two lighter-coloured groups) were perceived as having no or little risk (Fig. 7). However, the situation changed over the course of the next six years after the two heightened waves of local SOE default incidents. In 2020, the estimated province premia were higher across the board, except for a few Southeastern coastal regions. More notably, the province premia in Northeastern provinces rose from almost the lowest in 2014 to the highest in 2020. A similar shift appeared in the Southwestern regions as well, albeit to a lesser extent. We also develop an additional hypothesis at the firm level based on the degree of government ownership and results are presented in Appendix B.

4.3. Changing government support in different provinces

The estimation results above are consistent with actual government actions or inactions observed in the real world. Provinces where premia have increased over time have also experienced a reduction in government support to troubled or defaulted local SOEs,

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[22] Optionality usually comes with other special terms, some are to protect the bond issuers (e.g. coupon rate adjustment) and others to protect the investors. The general idea is that special clause increases the uncertainty of the bond price prospective thus the premia.

[23] De Santis (2018) shows that an overall increase in the F-statistics of the Wald test in a similar setup would be consistent with an increase in the degree of corporate bond market fragmentation, and the measure has an expected narrative when applied to the Euro area bond market.

(a) 2014
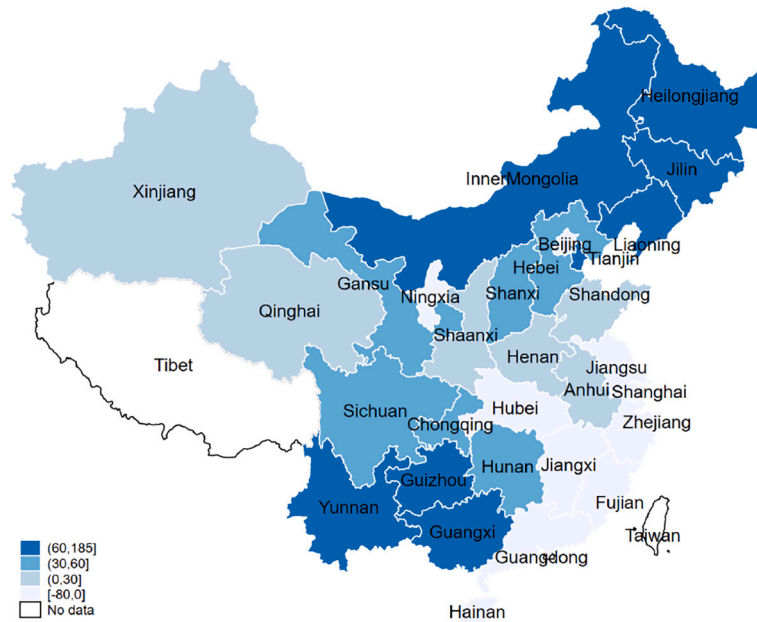
(b) 2020

Fig. 7. Estimated Province Premia across Provinces. This figure illustrates the estimated province premia from baseline specification (1) in 2014 (prior to any SOE bond defaults) and 2020 (after increased local SOE defaults). The estimated province premium in each province is relative to the reference group - central SOEs and the base year 2013.

and the vice versa. For example, according to our estimation, Liaoning province has experienced an increase in premia from nearly 0 in 2014 to 157 bps in 2020; meanwhile, the provincial government has abandoned bailout altogether since 2016 when it allowed Dongbei Special Steel Group (DSSG) to default. Note that the default of DSSG was the first material bond default of local SOEs and this is the "stigma" which many provinces tried to avoid: Xinjiang, Shandong, Yunnan all had cases in 2011 or 2012 when local SOEs were on the verge of default, but were bailed out by local government eventually. In the case of Shandong Hailong in 2012, market analysts

2015

Xinjiang

2012/9/15
Xinjiang Chalkis defaulted on bank loans in Sep. 2012.
- Its controlling shareholder, Xinjiang Production and Construction Corps Division VI promised to coordinate funding to repay bonds. Xinjiang Chalkis successfully repaid bonds in Dec. 2012, then entered bankrupcy restructuring

2018/5/23
Bond default of Xinjiang King Tec Steel
- Subsidiary of a central SOE
- Retail bondholders were repaid in full; institutional investors took a 40% haircut

2018/8/13
Bond default of Xinjiang Production and Construction Corps Division VI
- Repaid in full two days later
- Market analysts commented that the default was mainly due to bad liquidity management, and reflected the company was not very conscious of capital market rules

Liaoning

2016/03/28
Bond default of Dongbei Special Steel Group
- First material default of local SOE bond
- Bankruptcy restructuring process took about 1.5 years to finish, investors incurred major losses (78% haircut, debt for equity swaps)

2019/7/27
Bank loan default of Shenyang Machine Tool Group (SMTG)
- Before the default, STMG and Shenyang SASAC signed strategic partnership agreement with CCB in May 2017, and conducted a RMB 9.25 bn debt for equity swap in November 2017.
- After the default, SMTG went bankruptcy restructuring and was restructured by a central SOE

2020/10/23
Bond default of Huachen Automotive Group Holding (Huachen)
- Right before the default, Huachen promised to fulfill SOE's reponsibility and make payment on time. Huachen's CEO said Liaoning provincial government has prepared funding for Huachen
- Government did not bailout

Tianjin

2016/5/16
Dim Sum bond default of Bohai Steel Group (BSG)
- Repaid in full a month later
- It announced in August 2016 that Tianjin government would establish a special bailout fund to swap BSG's bank loans and reduce its debt burden

2017/06
Tianjin started mixed ownership reform for 194 SOEs in the region, aiming to introduce strategic investors and attract over RMB 110 bn funding. This includes finding investors for Tianjin Realty Development (TRD), which failed and TRD defaulted on 2019/3/30, cut the amount of bonds it had to buyback by 74%

2018/8/24
Bohai Steel Group (BSG) entered bankruptcy restructuring process
- Official news agency Xinhua commented that BSG's debt disposal was market-oriented and law-based

2019/7/25
Tewoo Group defaulted on dollar bonds
- ICBC repaid one bond as the issuer of Standby Letter of Credit (SBLC)
- Other dollar bond holders have to accept bond swaps entailing a 33%-67% haircut
- Tewoo entered bankruptcy restructuring process in 2020

(a) Support-weakened Provinces

2015

Shanxi

2016/7/13
Deputy governor of Shanxi province, Yixin Wang, led a team of coal company CEOs to Beijing and tried to convince investors to actively purchase bonds issued by coal companies in Shanxi. Wang said the government had proper mechanisms in place to ensure no bond default would happen

2020/11/18
Deputy governor of Shanxi province, Yixin Wang, commented after Yongcheng Coal's default event that "debt must be repaid, this is in the genes of Shanxi businessmen", "we must cherish the reputation of Shanxi like cherishing our eyes"

Sichuan

2016/6/15
Bond default of Sichuan Coal Industry Group (SCIG)
- Another SOE, Sichuan Provincial Investment Group, provided an entrusted loan to SCIG under the coordination of Sichuan provincial government, for SCIG to make the late payment in full

2018/10/14
Bond default of SCIG again
- Repaid in full 8 days later
- SCIG entered bankruptcy restructuring process on 2020/6/12

Henan

2020/11/10
Bond default of Yongcheng Coal and Electricity Holding Group (Yongcheng Coal)
- Henan SASAC participated in negotiating the debt restructuring
- With government financial support, the offer Yongcheng Coal made rose from repaying 5% of the principal upfront to repaying 50% of the principal, with the rest extending 270 days

Jiangsu

Actions taken in 2020 to strengthen weak SOEs and prevent defaults:
- Help obtain loans from China Development Bank (CDB) for Zhenjiang city LGFVs, swapping high interest rate debts for 10Y maturity, low interest rate loans from the CDB
- Provincial government uses proceeds from government special bonds to support Zhenjiang LGFVs

(b) Support-unchanged/Strengthened Provinces

Fig. 8. Changes in Government Support over Time. Green highlighted words indicate strong government support or government actions that improve investors' confidence. Red highlighted words indicate government inactions in dealing with a local SOE default or government actions that decrease investors' confidence. *Source:* S&P Global Ratings, CICC Research, Caixin, various media reports and authors' summary.

widely expected a government bailout after Hailong showed warning signs. A recurring argument used by analysts to justify this expectation was that that "no local government wants to be the first to default". Not only did Liaoning allowed the first local SOE default, the provincial government also stayed away from providing support in DSSG's bankruptcy restructuring process, resulting in investors having to choose between a 78% haircut or a debt-equity swap, which investors strongly opposed. This was in stark contrast

Table 5
Drivers of province premia.

| Dependent variable: | Contingent debt: | | | Explicit debt: | |
| | LGB + LGFV bonds | | | LGB | |
Est. *province premia*	(1)	(2)		(3)	(4)
Macro-fundamental					
FAI/GDP	0.489***	0.551***		0.517***	0.571***
	(0.128)	(0.131)		(0.128)	(0.130)
Trade openess	1.221	2.498		1.778	2.683*
	(1.765)	(1.744)		(1.631)	(1.614)
Per capita GDP	−12.43***	−13.67***		−10.45***	−12.32***
	(3.491)	(3.380)		(3.513)	(3.389)
Fiscal space					
Debt/fiscal income	0.109***			0.125***	
	(0.032)			(0.033)	
Debt/GDP		0.645**			0.849***
		(0.314)			(0.316)
Credit event					
Default	16.92***	17.71***		16.65***	17.37***
	(6.222)	(6.486)		(6.202)	(6.418)
Province FE	Y	Y		Y	Y
Observations	900	900		900	900
R-squared	0.581	0.576		0.583	0.579

Table 5 presents estimation results from specification (2). Two sets of results are presented, differing in the measure of fiscal space. (1)–(2) use the local government's contingent debt including bonds issued by local government financing vehicles (LGFVs) as a measure for total debt, and (3)–(4) only consider local government bonds (LGB). All specifications include year-quarter FE and estimated with robust standard errors. ***$p < 0.01$, **$p < 0.05$, and *$p < 0.1$.

to the Shandong Hailong and Xinjiang Chalkis cases in 2012, where though both companies went bankrupt eventually, they only entered the process after repaying bond investors in full, with the support of local governments.

Among provinces where there was no change or even increase in local government support, we have Henan province. Henan province experienced a high-profile local SOE default in recent years, the bond default of Yongcheng Coal on November 10, 2020 which shocked the market, and triggered bond sell-off of SOEs in Henan and other coal-producing provinces. However, Henan SASAC participated in the restructuring process and boosted the upfront payment to bondholders from Yongcheng Coal's original offer of 5% of face value to 50%. This intervention showed the government's willingness to support its SOEs and helped reduce its provincial premia. In Fig. 8, we show how the trends of local government support differ among provinces with different premia.[24] Overall, our findings suggest that perceived province risk and credit market differentiation have both risen during 2013–2020. Local SOE credit events and strained fiscal space may lead investors to differentiate provinces and their expected support at the regional level, which we will explore next.

5. Identifying the drivers: fundamentals, fiscal space and default incidence

5.1. Methodology and baseline results

Empirical framework: In this section, we formally identify the potential drivers of the province premium using model (2) below.

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[24] On top of local government actions that could have affected investors' confidence, media reports and agency downgrading actions also increased investors' awareness that lead to demanding higher compensation. For example, in October 2016, CICC Research stated that bailout expectation and government's commitment to maintaining stability are still strong, though the costs of bailout are on the rise and uncertainties around timely repayment are increasing. In November 2019, S&P Ratings stated that it has performed 21 downgrades on China's SOEs since 2018 to reflect the weakening of government support. S&P Ratings also stated that they expect SOE defaults to be rising given governments' ability to bailout has weakened.

Table 6
Potential endogeneity issue of fiscal space.

Dependent variable:	Debt/GDP		Debt/fiscal income		Aggressive fiscal
Est. *province premia*	(1)	(2)	(3)	(4)	(5)
Fiscal space					
Debt ratio	0.849***	0.513	0.125***	0.085**	
	(0.316)	(0.373)	(0.033)	(0.041)	
COVID#Debt ratio		0.797**		0.084**	
		(0.374)		(0.035)	
Aggressive fiscal					42.33***
					(9.747)
Macro-fundamentals					
FAI/GDP	0.571***	0.586***	0.517***	0.531***	0.643***
	(0.130)	(0.129)	(0.128)	(0.128)	(0.127)
Trade openess	2.683*	2.927*	1.778	2.042	3.548**
	(1.614)	(1.606)	(1.631)	(1.649)	(1.493)
Per capita GDP	−12.32***	−12.02***	−10.45***	−10.32***	−14.28***
	(3.389)	(3.373)	(3.513)	(3.509)	(3.337)
Credit event					
Default	17.37***	16.69**	16.65***	15.85**	17.28***
	(6.418)	(6.508)	(6.202)	(6.321)	(6.396)
Province FE	Y	Y	Y	Y	Y
Observations	900	900	900	900	900
R-squared	0.579	0.582	0.583	0.587	0.585

Table 6 presents estimation results on premia considering explicit government debt, scaled either by provincial GDP or local government fiscal income. Column (1) and (3) are estimates from baseline specification (2). Column (2) and (4) estimate the differential effects of fiscal space on premia caused by the COVID shock. Column (5) replace fiscal space with a dummy variable equal to one if post COVID shock the province adopted a more aggressive fiscal policy to increase spending to achieve a higher-than-normal growth target. All specifications include year-quarter FE and estimated with robust standard errors. ***$p < 0.01$, **$p < 0.05$, and *$p < 0.1$.

$$premium_{p,t} = \alpha_0 + \alpha_1 X_{p,t} + \alpha_2 Default_{p,t-1} + \theta_p + \lambda_t + \varepsilon_{p,t} \tag{2}$$

The dependent variable *premium*$_{p,t}$ is the estimated province premium from model (1).[25] We consider several macroeconomic factors $X_{p,t}$ that are often used in the sovereign credit risk literature (Aizenman et al., 2013), including the government fiscal space, FAI/GDP, trade openness and the economic development level, as defined in Section 3.2. We also include a default dummy that takes the value of one if there is any local SOE bond default in the same province in the previous quarter, and zero otherwise. We use the fixed-effect model with all variables at quarterly frequency.[26]

Results: As a preliminary illustration, we present several scatter plots of estimated province premia with key provincial economic characteristics using then end-2020 data in Fig. 4. These plots provide graphical evidence of a clear negative association between province premia and provincial economic development, and strong positive relationships between province premia and provincial indebtedness and investment level. We then present two sets of regression results in Table 5, differing in whether the local government's contingent debt or only the explicit debt is considered. Across all specifications, the coefficient of FAI/GDP ratio is found to be significantly positive, implying that investors may demand a higher province premium when local economic growth relies more on investments. Per capita GDP is negatively related to the province premium, showing that economic development tends to reduce provincial risk. Trade openness, on the other hand, does not seem to matter. Apart from the significant impacts of economic fundamentals on the province premium, the fiscal space of local governments is found to be a statistically significant and an economically important determinant as well. Specifically, an increase in the debt/fiscal income ratio by one standard deviation (about 171%) is estimated to increase the province premium by 17–21 basis points, while an increase in the debt/GDP ratio by one standard deviation (about 17.2%) is estimated to increase the province premium by 11–15 basis points. On top of the effect of fiscal space, our empirical analyses suggest that, on average, any default incidence in the previous quarter would lead to an increase of 17–18 basis points in the

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[25] In particular, we collect the estimated coefficient vector β_3 for each province p in quarter t to obtain the estimated province premium as:

$$premium_{i,t} = \begin{cases} \hat{\beta}_{3,p,t}, & \text{if } \alpha \leqslant 0.1 \\ 0, & \text{if } \alpha > 0.1 \end{cases} \tag{3}$$

where α is the P value of the point estimate of parameter $\beta_{3,p,t}$.

[26] As premia can be serially correlated, thus for robustness we also estimate a dynamic panel model using the Arellano-Bond estimator to include its own lag as an explanatory variable. Results are similar to our fixed-effect model and are available upon request.

Table 7
FAI over-reporting and province premia.

	Severe over-reporting			Over-reporting	
Dependent variable:	above 40 ppts			above 30 ppts	
Est. *province premia*	(1)	(2)		(3)	(4)
	Debt/GDP	Debt/fiscal income		Debt/GDP	Debt/fiscal income
FAI/GDP	0.290*	0.261		0.566**	0.549**
	(0.181)	(0.179)		(0.258)	(0.256)
Debt ratio	0.784**	0.117***		0.848***	0.126***
	(0.322)	(0.033)		(0.312)	(0.333)
Overreport#FAI/GDP	0.572**	0.527**			
	(0.245)	(0.248)			
Overreport#FAI/GDP				0.006	−0.044
				(0.290)	(0.292)
Trade openess	2.683*	1.829		2.688*	1.737
	(1.607)	(1.613)		(1.584)	(1.617)
Per capita GDP	−12.59***	−10.80***		−12.32***	−10.44***
	(3.381)	(3.532)		(3.392)	(3.528)
Default	15.98**	15.41**		17.38***	16.59***
	(6.305)	(6.111)		(6.431)	(6.225)
Province FE	Y	Y		Y	Y
Observations	900	900		900	900
R-squared	0.582	0.586		0.579	0.583

Table 7 presents estimation results on premia, by differentiating the degree of local government FAI inflation. Overreporting is a dummy variable that equals to 1 if a province is found to make an upward adjustment of its FAI in 2015 by at least 40 percentage points (in column (1) and (2)) or by at least 30 percentage points (in column (3) and (4)). Explicit government debt, scaled either by provincial GDP or local government fiscal income is used. The rest of the variables have the same definition as our baseline specification (2). All specifications include year-quarter FE and estimated with robust standard errors. ***$p < 0.01$, **$p < 0.05$, and *$p < 0.1$.

funding cost for a local SOE issuing bonds in the following quarter.

5.2. Exogenous shocks to fiscal space

Since all macroeconomic variables are correlated with one another, it is difficult to tease out the exact impact of one particular factor. For example, worsened fiscal space can lead to a higher province premium directly arising from a deteriorated repayment ability, or indirectly through increasing the default likelihood of local SOEs (less likely to bailout). There may also be omitted variables that affect both fiscal space and premia, resulting in a biased estimate of the effect of fiscal space on province premia.

To address this issues, we explore a specific setting leveraging the shock of COVID-19, which occurred at the end of 2019 and early 2020.[27] In response to the public health shock, local governments increased public expenditure and implemented tax cut to support the economic recovery, which further strained fiscal space. Two points are noted here. First, although the same shock could also affect other macroeconomic variables, the impact on local government fiscal space is the most direct and quick in nature. Second, local governments differ in the degree of resorting to fiscal support, implied by their desired growth target set for 2020. We therefore implement two additional checks. First, we check the differential effect of fiscal space on province premia caused by the COVID shock, which could potentially capture the marginal effect of fiscal space only.

In Table 6 column (1)-(4), we show that the effect of fiscal space on premia became stronger after the COVID shock, and the effect is particularly strong when using fiscal income to measure fiscal space (column(4)), implying that changes in expectations of government support can be more responsive to the fiscal income variation, especially in the face of a shock to fiscal position. Second, we construct a dummy variable that equals one if the local government intended to adopt a more aggressive debt-driven fiscal approach to support the local economy after the COVID health shock, and use it to replace the fiscal space variable. We identify a province adopting an aggressive approach if after the adverse shock of COVID, they announced a growth target of 2020 that was either higher or the same as 2019 (before the shock). Our hypothesis is that given reduced private sector activities, a more ambitious growth target indicates government's intention to use up more fiscal space to stimulate the local economy. Our result shows that provinces that adopted a more aggressive fiscal policy to achieve a higher-than-normal expected growth rate experienced a higher province premium (column (5)). This result could reflect the marginal effect of changes in local government's fiscal space, proxied by a more expansionary fiscal approach, on province premia.[28]

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[27] We thank the referee for suggesting this point.

[28] Note that we are not claiming a causal effect, instead, our goal is to show that the local government indebtedness is highly associated with province premia, both economically and statistically.

Table 8
Local credit market depth and growth prospect.

| | Explicit debt: LGB | | | |
| Dependent variable: | Credit market depth | | Growth prospect | |
Estimated *province premia*	(1)	(2)	(3)	(4)
Macro-fundamental				
FAI/GDP	0.637***	0.708***	0.545***	0.601***
	(0.133)	(0.135)	(0.127)	(0.129)
Trade openess	0.734	2.216	1.876	2.716*
	(1.829)	(1.819)	(1.626)	(1.616)
Per capita GDP	−12.53***	−14.98***	−10.49***	−12.20***
	(3.774)	(3.666)	(3.534)	(3.415)
Fiscal space				
Debt/fiscal income	0.144***		0.121***	
	(0.392)		(0.329)	
Debt/GDP		0.749*		0.844***
		(0.384)		(0.314)
Credit event				
Default	15.88**	16.71***	16.53***	17.14***
	(6.238)	(6.426)	(5.994)	(6.121)
Additional variables				
Loan/GDP	0.024	−0.185		
	(0.339)	(0.332)		
%Δ FAI			−0.597	−0.690*
			(0.388)	(0.395)
Province FE	Y	Y	Y	Y
Observations	837	837	900	900
R-squared	0.604	0.597	0.585	0.581

Table 8 presents estimation results by adding provincial-level loan/GDP ratio and fix asset investment growth rate into specification (2), respectively. Results are shown using local government explicit debt (LGB) only. (1) and (3) use the local government debt scaled by fiscal income and (2) and (4) scaled the local government debt by GDP. All specifications include year-quarter FE and estimated with robust standard errors. ***$p < 0.01$, **$p < 0.05$, and *$p < 0.1$.

5.3. Correlated indebtedness and fixed asset investment

One interesting finding, across different specifications, is that both fiscal space and FAI/GDP have a positive and significant impact on province premia. A potential mechanism that drives the observed correlation might come from local officials' short-termist behaviors that increased both local investment and indebtedness, as explained theoretically in Xiong (2018). Xiong (2018) models an important government system in China where powerful career incentives exist among local officials to excel in the economic tournament established by the central government. As more investment on infrastructure improves regional output, the tournament led local governors to engage in large infrastructure investments to stimulate the economy. Thus, the strong career incentives could potentially drive up both FAI/GDP and local government debt, as much of the investment comes from debt-financing (Zhang & Barnett, 2014; Chen et al., 2020). On the empirical side, the official FAI is found to have overstated China's investment level, especially before 2017, as pointed out by Chen et al. (2019). The degree of FAI inflation could be viewed as evidence of the mechanism studied in Xiong (2018).

To further probe into this dimension, we check whether provinces that over-report FAI face a higher province premium. The idea is that investors may perceive it as unsustainable if the local economy is over-reliant on investment, which most often is the case when the province over-reported its FAI by a large margin. In other words, the more severely the FAI is over-reported, the more likely investors perceive a deterioration in fiscal space and the province's repayment ability. It is equally possible that investors may be aware of the biased FAI figure, based on news coverage, so that they demand higher compensation from debt borrowed by local SOEs from that province. In the empirical analysis, we divide all provinces into two groups, differentiated by their degree of FAI inflation, based on Chen et al. (2019)'s reconstructed figure of FAI in 2015. In the first set of tests, we draw the division among the severely over-reporting group with official figure inflated by above 40 percentage points (which accounts for one third of the sample provinces) versus the rest. In the second set of tests, we draw the division using a milder cutoff value of 30 percentage points (which leads to classify about half of the sample provinces as over-reporting). We keep other aspects the same as our baseline specification.

Our estimation results shown in Table 7 again confirm the positive effect of FAI/GDP on premia. Moreover, we show that over-reporting FAI indeed aggravated the adverse impact of FAI on premia. This effect is economically and statistically significant especially when the official FAI figure is reported with an upward bias of more than 40 percentage points (column (1) and (2)). On the other

Table 9

The effect of credit market differentiation on investment.

Dependent variable:	Investment size:		Investment efficiency:			
	Investment/lagged asset		ROA		Log(MRPK)	
	current yr	two-yr	current yr	two-yr	current yr	two-yr
	(1)	(2)	(3)	(4)	(5)	(6)
A. Use staggered local SOE default						
First default	−0.212	−0.171	−0.143**	−0.197***	0.025	0.017
	(0.212)	(0.164)	(0.064)	(0.069)	(0.047)	(0.042)
Controls	Y	Y	Y	Y	Y	Y
Firm FE	Y	Y	Y	Y	Y	Y
Sector# Year FE	Y	Y	Y	Y	Y	Y
Observations	9,362	9,276	9,480	9,401	9,353	9,281
R-squared	0.468	0.640	0.660	0.712	0.815	0.863
B. Use estimated premia						
Premia	−0.654**	−0.631***	−0.106	−0.001	−0.095	−0.028
	(0.319)	(0.247)	(0.115)	(0.001)	(0.066)	(0.058)
Controls	Y	Y	Y	Y	Y	Y
Firm FE	Y	Y	Y	Y	Y	Y
Sector# Year FE	Y	Y	Y	Y	Y	Y
Observations	9,362	9,276	9,480	9,401	9,353	9,218
R-squared	0.469	0.640	0.659	0.711	0.814	0.863

Table 9 examines the effects on local SOEs' investment behaviors from the province's first local SOE's default event (Panel A) and from the province premium (Panel B). Column (1) and (2) present results on firms' current period and two-year period investment size, and column (3)–(6) present results on firms' investment efficiency, proxied by two meausures: firms' ROA and the logarithmic of firms' marginal revenue product of capital and investment efficiency, also for the current period and two-year period. All regressions include firm FE, sector#year FE and firm-level controls, which include firm's lagged size, leverage, ROA, and liquidity (cash to current debt). Clustered standard errors at the issuer firm level are reported in parentheses. ***$p < 0.01$, **$p < 0.05$, and *$p < 0.1$.

hand, when FAI inflation is less severe, the resulted differential effect can be statistically trivial (column (3) and (4)). There are two potential explanations. First, for those provinces with only mild over-reporting, investors may have already priced in a high FAI, thus no additional cost is required. Second, a more severe mis-reporting behavior may not be perceived as harder to correct, compared with cases of mild inflation.[29]

### 5.4. Local credit market depth and economic growth prospect

Previous literature shows that higher borrowing costs paid by firms can also be negatively related to the depth of the credit market in the local economy (see for example Huang et al., 2020). Therefore, it is plausible that the observed higher yields paid by local SOEs may be attributed to a less developed credit market of their residing province, leading to an omitted variable bias of our estimation. To mitigate this concern, we extend our specification (2) by including a measure of the credit market depth, which is proxied by the ratio of total loans to GDP in each corresponding province and quarter, following Huang et al. (2020). As shown in Table 8 column (1) and (2), we find that even after considering this factor, local government indebtedness and previous SOE defaults are still important drivers of the funding premia. When using the debt over GDP ratio as the measure of fiscal space, the loan-to-GDP ratio shows negative correlation with premia, although not significant.

Another concern is that most economic variables considered as potential drivers for province premia in specification (2) are contemporaneous or lagged. One may argue that the local economic growth prospect may also be priced in by the market when assessing local SOE bonds. This is because firms located in one province are likely to have their main operations and business within the province, and thus their profitability may be correlated with the local economic growth prospect. However, there is no readily available forecast of economic growth prospects at the province level, and ratings for provinces and cities by ratings agencies are only

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[29] This can be shown by the different dynamics of FAI/GDP between different groupings (Fig. A3): the potential over-reporting of FAI/GDP did not peak until the end of 2018, witnessed by the widening gap of FAI/GDP ratio between the most severely over-reporting group and the rest. Meanwhile the degree of FAI inflation seemed to be stable over time if mild adjustment is included into the over-reporting group.
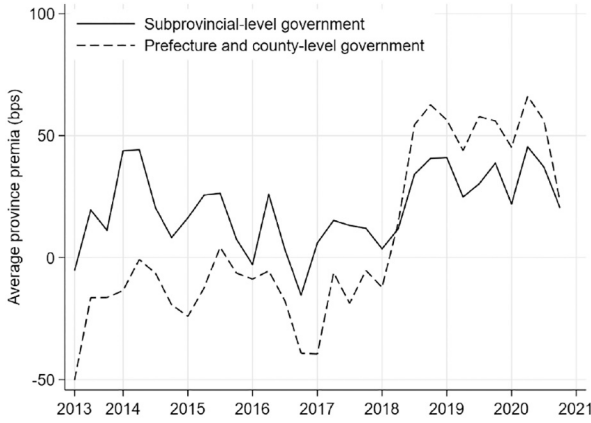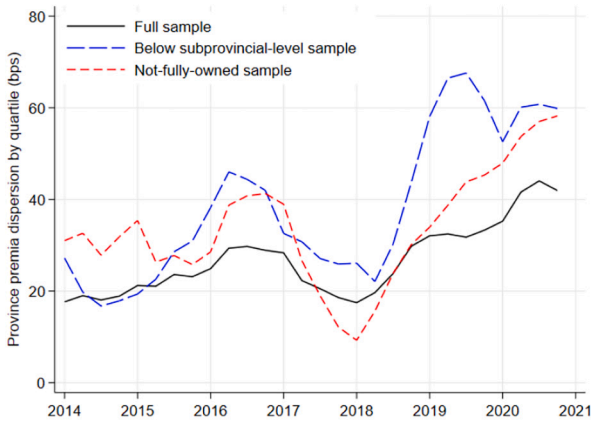
(a) State-ownership:
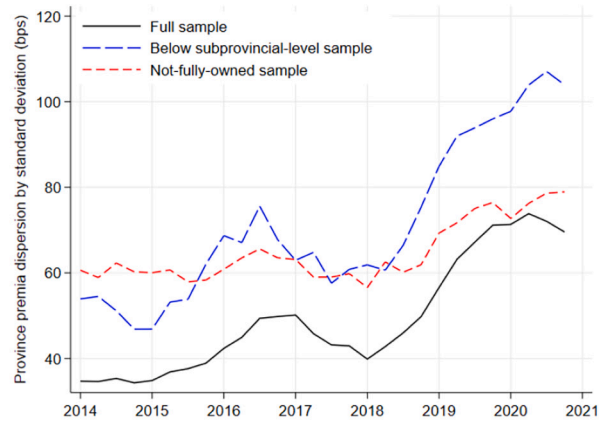subprovincial-level vs. below
subprovincial-level
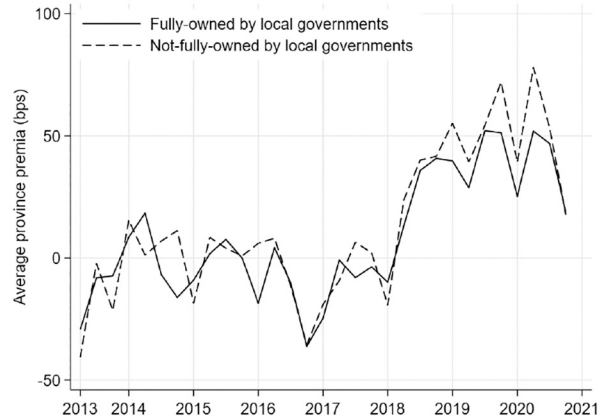
(b) State-ownership: fully-owned vs.
not-fully-owned

Fig. A1. Est. Average Province Premia over Time: by Level and Degree of State-ownership.

(a) Dispersion in quartile deviation
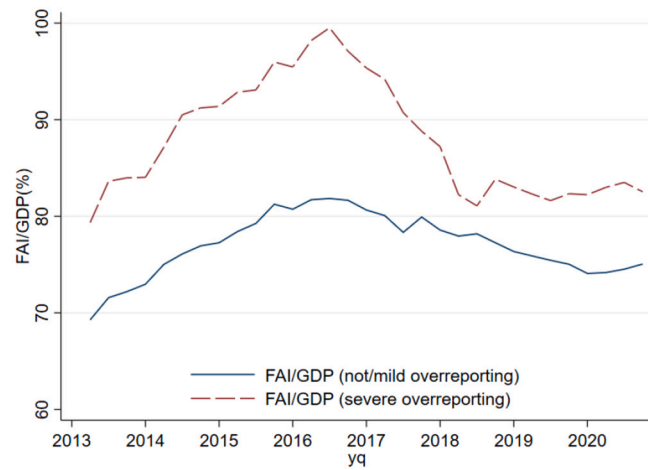
(b) Dispersion in standard deviation

Fig. A2. Dispersion of Est. Province Premia by Different State-ownership.

at the experimental stage.[30] Given the limitations and to further mitigate concerns about potential omitted variables problems in our setup, we attempt to address this issue using the growth of fixed asset investment as a measure of local economic growth prospects. This is because the fixed asset investment growth is forward-looking in nature, and in our sample period investment-driven growth still applies to most provinces in China. We show that our baseline results are robust to adding this variable (column (3) and (4)).
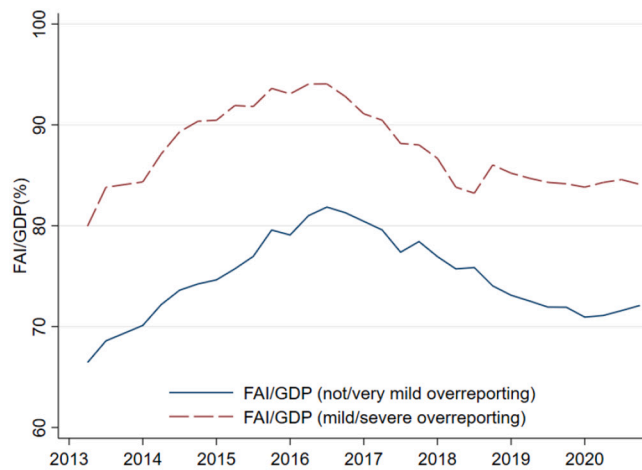
6. The real effect of credit market differentiation

In this section, we explore the real effect of credit market differentiation. We focus on SOEs' investment size and investment efficiency, which are important metrics for understanding the real effect on resource allocation. We adopt two specifications. In the first specification, we leverage the staggered timing of the first local SOE default in each province to examine how initial shock to perceived government guarantees affect the investment behaviors of SOEs from the defaulted province compared to SOEs elsewhere. The idea is

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[30] To forecast from a fundamental approach could be challenging given the difference in economic structures across regions, and their policy dependence (coal production in Shanxi, export-orienting industries in Guangdong, and dependence on transfer payment/central government policy in the Northwest, etc).

Table A2
Local government and LGFV bond to GDP ratio (%).

Province	2013	2014	2015	2016	2017	2018	2019	2020
Anhui	5.72	7.08	10.85	18.51	23.64	27.69	29.55	34.11
Beijing	11.06	11.96	15.15	21.34	23.65	24.16	26.07	31.11
Chongqing	9.71	13.09	18.28	31.29	36.23	38.80	40.87	46.63
Fujian	4.30	5.48	8.89	17.18	21.76	21.48	23.31	26.57
Gansu	7.99	10.00	14.68	26.28	30.29	35.87	43.45	50.30
Guangdong	2.67	3.63	4.88	9.36	10.68	12.03	13.86	16.81
Guangxi	3.63	5.46	9.99	19.63	27.23	33.57	39.07	42.49
Guizhou	4.86	6.91	18.88	50.67	65.03	70.77	70.48	75.43
Hainan	1.56	2.36	5.58	14.65	26.12	36.68	41.65	48.21
Hebei	1.43	2.33	6.01	13.38	17.01	22.02	26.90	32.08
Heilongjiang	2.57	3.15	5.22	13.67	19.78	28.30	37.18	42.63
Henan	2.17	3.19	5.70	12.23	15.55	17.58	19.63	23.27
Hubei	3.24	5.16	9.34	17.31	21.36	23.04	25.24	32.46
Hunan	4.28	6.39	9.60	22.03	30.31	35.72	38.33	42.75
InnerMongolia	2.31	2.90	6.81	20.71	29.19	42.76	43.72	48.17
Jiangsu	6.35	8.79	12.61	22.27	26.11	29.31	31.56	36.54
Jiangxi	4.97	6.76	11.24	21.61	24.98	29.96	34.18	42.12
Jilin	1.53	1.80	5.12	14.33	20.47	31.57	46.20	51.17
Liaoning	2.94	4.39	8.37	21.78	37.69	37.81	38.67	39.13
Ningxia	1.65	3.65	9.02	23.99	30.26	37.59	47.29	50.94
Qinghai	11.40	16.72	26.67	40.87	51.05	63.58	73.26	82.61
Shaanxi	4.80	6.31	10.20	22.67	27.70	30.71	32.56	36.47
Shandong	1.82	3.07	6.01	12.39	15.73	18.57	26.59	29.85
Shanghai	7.43	7.90	9.59	16.30	18.42	17.60	18.87	21.56
Shanxi	2.73	4.05	6.64	14.65	18.77	20.99	25.86	30.95
Sichuan	4.13	5.55	9.71	20.91	27.20	30.08	33.02	38.74
Tianjin	12.15	16.16	20.06	31.05	35.29	44.79	86.66	77.63
Xinjiang	4.39	6.79	12.84	26.16	34.36	37.95	40.95	51.14
Yunnan	4.56	7.46	15.09	32.18	43.59	48.12	42.34	49.35
Zhejiang	4.95	6.41	10.47	20.83	24.98	27.19	30.38	37.35
Average	4.78	6.50	10.78	21.67	27.81	32.54	37.59	42.29

Source: CEIC.

size as capital expenditures plus investments in intangible assets plus cash acquisitions, scaled by lagged total assets. For investment efficiency, we use both future realized ROA and the logarithm of marginal revenue product of capital (MRPK). We construct MRPK as the ratio of sales to fixed assets following Gopinath, Kalemli-Özcan, Karabarbounis, and Villegas-Sanchez (2017).

The results are reported in Table 9. Panel A shows that local SOEs from provinces experiencing the first local SOE default did not change the amount of their investments (column (1) and (2)), but experienced reduction in investment efficiency measured by ROA (column (3) and (4)).[31] Results from panel B show that one percentage point increase in the province risk premium on average reduced investment of a local SOE from the same province by about 0.6 percentage points of assets in the current year and 0.8 percentage points of assets in the next two years. The result is statistically significant at 1% - 5% significant level. Again, we find almost no effect on investment efficiency from credit market differentiation.

Taken together, our results suggest that the first default incidence alone may not exert financial constraint on local SOE firms large enough for them to reduce investments. On the other hand, rising province premia, driven by local SOE defaults, strained fiscal space and other macroeconomic fundamentals are found to have a more significant adverse effect on local SOEs' investment decisions. A weakened perception of local government guarantees, reflected in a higher borrowing cost at the provincial-level is shown to have real consequences on firms' investment behaviors. Hence, our findings also shed light on the potential negative spillovers from financially strained local governments to local SOEs, as the reduction in the size of investment is not observed along with improvement in investment efficiency.

7. Conclusion

Our study leverages rich data on bond issuance and firms' characteristics in a fast-growing bond market in China, and provide evidence of an improving risk-pricing of SOE bonds over the past decade. This improvement is however accompanied by an increasingly fragmented bond market across provinces with different levels of fiscal space and past local SOE default incidents. To the extent that provincial disparities along many dimensions (e.g. the level of indebtedness, economic development and central government support) are sizable, the process of risk-pricing and a gradual removal of the government guarantee may not be universal and

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[31] Note that our results using the staggered local SOE default timing is different from Jin et al. (2020) who used a similar specification but with different sample period and default incidence.

Table A3
Local government and LGFV bond to fiscal income ratio.

province	2013	2014	2015	2016	2017	2018	2019	2020
Anhui	0.52	0.65	0.99	1.66	2.28	2.88	3.37	4.13
Beijing	0.59	0.63	0.75	1.04	1.22	1.34	1.56	1.87
Chongqing	0.69	0.98	1.35	2.36	3.06	3.54	4.25	5.55
Fujian	0.45	0.55	0.91	1.80	2.44	2.69	3.13	3.82
Gansu	0.85	1.02	1.41	2.35	2.89	3.33	4.26	5.33
Guangdong	0.24	0.31	0.39	0.71	0.85	0.96	1.17	1.45
Guangxi	0.39	0.60	1.10	2.22	3.26	3.95	4.53	5.16
Guizhou	0.32	0.46	1.33	3.67	5.23	6.17	6.66	7.46
Hainan	0.10	0.15	0.34	0.90	1.70	2.30	2.80	3.47
Hebei	0.18	0.28	0.69	1.46	1.86	2.11	2.44	3.05
Heilongjiang	0.29	0.36	0.67	1.79	2.60	3.16	3.88	5.01
Henan	0.29	0.41	0.71	1.51	2.04	2.28	2.61	3.15
Hubei	0.37	0.55	0.95	1.72	2.30	2.75	3.33	5.20
Hunan	0.52	0.77	1.11	2.53	3.70	4.53	5.05	5.91
InnerMongolia	0.23	0.28	0.63	1.87	2.73	3.89	3.74	4.18
Jiangsu	0.57	0.79	1.13	2.00	2.70	3.07	3.48	4.19
Jiangxi	0.44	0.58	0.89	1.72	2.25	2.72	3.37	4.29
Jilin	0.17	0.20	0.59	1.64	2.51	3.42	4.53	5.67
Liaoning	0.24	0.37	0.98	2.82	3.37	3.53	3.55	3.76
Ningxia	0.14	0.30	0.71	1.89	2.50	3.13	3.99	4.83
Qinghai	1.11	1.54	2.46	3.99	5.74	6.32	7.82	8.53
Shaanxi	0.43	0.59	0.92	2.16	2.96	3.30	3.58	4.36
Shandong	0.22	0.37	0.69	1.41	1.88	2.14	2.56	3.34
Shanghai	0.39	0.40	0.45	0.69	0.85	0.86	0.98	1.20
Shanxi	0.20	0.29	0.50	1.20	1.55	1.57	1.79	2.41
Sichuan	0.39	0.52	0.89	1.92	2.77	3.17	3.76	4.54
Tianjin	0.85	1.08	1.29	1.95	2.53	3.78	4.30	5.07
Xinjiang	0.35	0.49	0.96	1.88	2.47	3.01	3.71	4.61
Yunnan	0.34	0.56	1.15	2.49	3.65	4.34	4.99	5.69
Zhejiang	0.49	0.63	0.95	1.82	2.23	2.36	2.63	3.33
Average	0.41	0.56	0.93	1.91	2.60	3.09	3.59	4.35

Source: CEIC.

identical for all provinces, and spillovers from indebted local governments to local SOEs may occur. A fragmented debt market could also impair debt market functioning, reduce allocation efficiency, dampen financial stability and the effective transmission of policy (De Santis, 2018; Georgoutsos & Migiakis, 2013; Huang et al., 2020 & Paniagua et al., Paniagua, Sapena, & Tamarit, 2017). Thus, a better debt management of local governments, and further enhanced public communication of the authorities' policy framework to manage market perceptions of implicit guarantees, are critical to ensure a smooth transition towards a more market-based pricing in China's credit market.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

Data will be made available on request.

Appendix A. A review of local government debt in China

1994–2013: Tax sharing reform and the rise of LGFVs: China implemented Tax-Sharing Reform in 1994 that dramatically increased the share of taxes to the central government and reduced the share to local governments. Subsequently, local governments, who bear the responsibility for local economic development, found themselves short of fiscal resources. To obtain funding, various LGFVs were established to borrow on behalf of local governments. It was not until 2008 when the Chinese government introduced the RMB4 trillion stimulus package during the global financial crsis, that debt, which had accumulated at the local government level, had ballooned. According to a report compiled by the National Audit Office in 2011 (Document No. (2011) 35), the annual growth rate of local government debt was consistently above 20% in1997-2007, and the growth rate jumped to 62% in 2009. **2014 - present: The introduction of LGB and the remaining LGFVs:** Rising local government debt has raised concerns, especially since much of the debt is borrowed through LGFVs. In 2014, a new budget law was passed, which allows local governments to issue bonds (LGB) directly within a certain scope, and operate at a proper level of deficit. Year 2015 marked the transition to local government bonds, which

Table A4
Local government macro-fundamental variables, yearly average.

Province	FAI	Export	Import	GDP	Fiscal income	GDP per capita	Local gov +LGFV debt outstanding	Local gov debt outstanding
	annu.	annu.	annu.	annu.	annu.	annu.		
	RMB bn	RMB bn	RMB bn	RMB bn	RMB bn	RMB 10 k	RMB bn	RMB bn
Anhui	2,700.30	31.00	19.12	2,712.04	266.83	4.68	610.38	371.10
Beijing	754.88	28.83	96.89	2,714.16	501.81	13.45	603.12	256.38
Chongqing	1,562.92	43.15	22.51	1,825.90	208.86	6.22	596.95	275.47
Fujian	2,365.94	97.98	60.98	3,146.10	267.07	8.48	576.33	359.52
Gansu	693.72	2.00	3.46	746.81	76.37	2.83	221.37	145.16
Guangdong	3,426.80	712.94	466.73	8,453.68	1,030.09	7.91	875.84	616.04
Guangxi	1,802.92	15.02	36.28	1,810.40	157.27	3.56	455.65	309.17
Guizhou	1,310.74	4.81	1.90	1,253.65	154.16	3.62	670.63	506.06
Hainan	336.31	4.09	11.40	422.31	65.04	4.72	109.33	101.09
Hebei	3,088.67	46.15	40.45	3,184.74	302.71	3.99	521.70	427.85
Heilongjiang	1,057.85	7.27	14.50	1,452.41	122.37	3.29	277.12	227.78
Henan	3,950.82	49.01	28.82	4,264.20	327.40	4.57	601.57	396.96
Hubei	2,849.71	27.58	17.73	3,427.32	291.44	6.17	666.97	411.52
Hunan	2,816.74	19.49	12.24	3,232.92	259.78	4.78	862.72	494.78
InnerMongolia	1,315.33	6.26	10.09	1,720.85	187.71	5.78	427.77	373.89
Jiangsu	4,884.06	367.03	259.68	8,001.71	799.97	10.22	1,924.41	786.37
Jiangxi	1,986.82	27.14	12.61	1,939.36	215.86	4.31	483.62	274.78
Jilin	1,209.66	5.45	16.06	1,333.36	118.80	3.93	281.58	208.63
Liaoning	1,301.22	52.27	66.05	2,544.85	264.35	5.01	591.32	465.21
Ningxia	310.19	2.42	1.17	320.87	38.30	4.54	92.44	80.56
Qinghai	339.33	0.32	0.25	256.67	25.60	4.01	127.53	97.51
Shaanxi	2,107.26	19.79	16.73	2,077.59	202.52	5.51	495.39	334.04
Shandong	4,854.55	157.32	162.95	6,535.46	576.19	6.12	1,000.80	699.21
Shanghai	690.27	177.84	269.37	2,956.99	599.56	13.03	470.10	323.97
Shanxi	966.53	12.97	7.15	1,444.36	191.17	3.82	248.10	169.61
Sichuan	2,896.93	39.32	32.46	3,573.01	348.60	4.46	866.22	541.89
Tianjin	1,124.30	45.44	83.25	1,560.05	233.33	7.92	604.60	243.31
Xinjiang	947.12	15.26	16.22	1,082.08	136.73	4.59	327.29	231.30
Yunnan	1,617.00	10.94	11.83	1,677.21	185.23	3.80	585.08	407.61
Zhejiang	2,927.83	296.94	96.15	4,953.12	550.81	9.01	1,130.23	673.95

would gradually replace all existing local government debts. For the legacy "hidden debt" previously assumed by local governments, China's Ministry of Finance granted a RMB3.2 trillion "bond swap" quota in 2015 to incorporate them into the government budget in an orderly manner. With this swapping process, outstanding LGBs have increasingly become a conventional measure of local government indebtedness, as various government borrowings were integrated into this measure (Table A1). LGBs include general bonds, used to make up for local government budget deficits, and special bonds, which are mainly to fund local infrastructure projects, with incomes generated from these projects being the source of repayment. Local government special bonds replaced the general bonds as the largest component of outstanding LGB in 2018, and grew especially fast in 2020 when growth in infrastructure investment led the recovery of the Chinese economy.

Appendix B. The role of state-ownership structure

To further understand our findings on the rising credit market fragmentation, we develop an additional hypothesis at the firm level based on the degree of government ownership. Our hypothesis rests on the idea that SOEs headquartered in the local government with a higher administrative level and SOEs with a full government ownership are likely to be perceived as having stronger provincial government support (local government holdings can be particularly high in some industries such as utilities, telecommunications and transportation, thus SOEs with a high single government ownership are likely to be more closely linked to the government). To test this hypothesis, we divide our sample by whether a local SOE is owned by local governments at the subprovincial level (the highest level), or the prefecture- and county-level (lower level), or by whether a local SOE is fully-owned by the local government or instead having a joint-ownership by both local government and private entities. We obtain the average province premium over time for each of the four groups using our baseline specification (1).

The results in Fig. A1 show that the estimated province premia followed a similar rising trend for all groups, but the group consisting of a lower government administrative level shows a much stronger increase in province premium after 2018, when local SOEs defaults were ramping up. The same pattern is observed for the not-fully-owned SOEs group. In terms of market segmentation, we find when price dispersion is estimated using only SOEs from local governments either with a lower administrative level or without a full shareholding, the degree of credit market fragmentation exhibits a higher level of increase after 2018 and the results are illustrated in Fig. A2. These findings suggest that not only the perceived province risk and the credit market differentiation increased, but also the changes are more notable when looking at local SOEs headquartered in lower-level local governments and that have a more diverse

ownership structure.

Appendix C. Additional figures and tables

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