HONG KONG INSTITUTE FOR MONETARY AND FINANCIAL RESEARCH

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HKIMR Working Paper No.06/2020

May 2020

Hong Kong Institute for Monetary and Financial Research

香港貨幣及金融研究中心

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The Effect of Government Reference Bonds on Corporate Borrowing Costs: Evidence from a Natural Experiment *

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May 2020

Abstract

Researchers have recently studied the interactions between corporate and government bond issuances within many countries. Some conclude that government bonds compete with private bond issuances, while others maintain that government bonds provide valuable reference entities that improve the private sector's ability to issue its own bonds. We study the special case of China's 2017 issuance of two sovereign bonds denominated in U.S. dollars (USD). We find that USD-denominated Chinese corporate bonds experienced a decline in yield spreads, bid-ask spreads, and price volatility around the time of this sovereign issues' announcement. The yield spread changes are particularly large for corporate bonds with maturities similar to those of the USD sovereigns. We conclude that these new bonds serve as useful reference instruments, helping investors to price and hedge the risks impounded in Chinese corporate bonds.

Keywords: reference bond, China, corporate borrowing
JEL code: G12, G15, G18

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The authors have benefited greatly from comments and suggestions made by Yao Chen (discussant), Zhiguo He, Nitish Kumar, Andy Naranjo, Jun Pan, Dragon Tang (discussant), Yuehua Tang, Giorgio Valente, Zilong Zhang, and seminar participants from Chinese University of Hong Kong, CIFFP, Hong Kong Monetary Authority (HMIMR), SFS Cavalcade Asia-Pacific, and Singapore Management University. Wang acknowledges the support from HKIMR.

1. Introduction

We study the effect on Chinese corporate borrowing rates of the October 2017 issuance of two sovereign bonds denominated in USD: one billion dollars of principal due in five years and another billion dollars due in ten years. Nearly all of the government outstanding debt was denominated in RMB. By October 2017, only two small Chinese sovereign USD bonds were outstanding, with a total face amount of $0.2 billion and very limited trading. October 2017 marked the first USD bonds issued by the Chinese government since October 2004. Although the Ministry of Finance offered several reasons for issuing these new bonds, one prominent goal was to provide a "reference rate" that would reduce the required return on USD-denominated corporate debt.

The interaction between corporate and sovereign bond issuances has been studied quite extensively since Greenwood ***et al.*** (2010) concluded that "when the government lengthens the maturity profile of its debt, firms respond by doing the opposite." (page 1009). Because high-quality corporate bonds and sovereign bonds substitute for one another in private U.S. portfolios, high-quality firms can benefit from issuing bonds in maturities that are relatively ignored by sovereigns. In other words, substitutability leads to corporate "gap filling" when sovereigns do not offer bonds in all maturities gap (Greenwood ***et al.***, 2010; Graham ***et al.***, 2014, 2015; Badoer and James, 2016).

Alternatively, government and corporate debt may be complements in the sense that government debt makes the market more receptive to similar-maturity corporate bonds. The idea is that the government debt provides a "reference rate" that investors can use in evaluating corporate issues of similar maturity. The World Bank and International Monetary Fund (2001) have advised governments to foster the development of local corporate bond markets by establishing a benchmark sovereign yield curve. Some governments have explicitly followed this advice and issued reference bonds even when they have no fiscal deficit.[1] Bekkum ***et al.*** (2019) examine government and corporate debt issuances in 14 countries over the period 1991-2017. They "show that in addition to being a substitute for corporate bonds, sovereign bonds provide reference rates that facilitate the issuance of corporate bonds." (page 30). The reference rate effect derives from the value of country-specific information impounded into sovereign bond prices. Corporate bond prices reflect the country's systematic risk factors as well as the issuers' idiosyncratic risks. Establishing sovereign reference bonds may make the market more complete, reduce adverse selection costs, and improve liquidity by acting as hedging instruments (Subrahmanyam, 1991; Gorton and Pennacchi, 1993; Shiller, 1993; Yuan, 2005). These effects would all tend to reduce corporate borrowing costs.

The October 2017 issuance of two Chinese sovereign USD bonds provides a natural experiment for assessing the effect of sovereign bond issuance on corporate borrowing costs. First, the planned issuance was explicitly announced, permitting us to apply event study techniques to the problem. Second, these two bonds introduced a new influence to the market for USD Chinese debt: a visible, reliable reference rate for sovereign USD bonds. By October 2017, the two outstanding USD sovereign bonds (with face value of $100 million each) had been issued in 1996 and 1997. By 2017, their trading was very thin. Third, Chinese corporations had issued quite a large volume of marketable USD bonds without much in the way of government reference rates. By the end of 2017, USD corporate debt issued by Chinese firms amounted to about $400 billion. The effects of a reference bond's introduction could therefore be quite widespread.

[1] The Singapore Government issue Singapore Government Securities (SGS). They state explicitly that such borrowings are not for spending but "to build a liquid SGS market to provide a robust government yield curve for the pricing of private debt securities" (Ministry of Finance Singapore, 2019). The Hong Kong Special Administrative Region (HKSAR) Government has a similar program called the Government Bond (GB) Program. It says that, "Through implementing the GB Program, the HKSAR Government aims to increase the breadth and depth of the local bond market" (https://www.hkgb.gov.hk/en/overview/introduction.html). Neither of these two governments needs to borrow. The Singapore Government has a balanced fiscal policy and the HKSAR Government has a huge fiscal surplus.

Empirically, we find that corporate bonds' yield spreads decreased in response to the announced USD government bond issuance. Corporate yield spreads had been decreasing shortly before the announcement and continued to decrease afterwards (See Figure 2.) The average Chinese corporate yield spread decreased by 4 to 9 basis points in the days surrounding the announcement that a USD sovereign bond would be introduced (*t* value > 15). A similar decline is rare in the surrounding data. We find that corporate yield spreads declined only for USD corporate bonds: for firms that had both USD and RMB bonds outstanding, only the USD spreads fell when the new sovereign bonds were announced. We also find that corporate bond rates fell the most for bonds with maturities near five or ten years. Corporate yield spreads decreased by a smaller amount for bonds with maturities below (above) five (ten) years.[2] This V-shaped change in corporate yield spreads is consistent with the reference rate effect, and hard to explain by any other mechanisms. Finally, we find larger effects on riskier bonds, as predicted by Yuan (2005). We find larger spread decreases for bonds with lower credit rating, lower liquidity, and higher return volatility.

The remainder of this paper is organized as follows. Section 2 reviews the prior literature on corporate borrowings and sovereign reference rates.[3] Section 3 describes the Chinese bond market, the introduction of USD sovereign bonds in October 2017, and our data sources. Section 4 presents results. The final section summarizes our results and presents some thoughts about the role of government reference bonds in emerging economies.

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[2] This is consistent with the fact that it is customary to use the yield on a government bond of the same maturity as a reference rate (Duffie and Singleton, 2003).

[3] Index-linked securities such as stock index futures and Exchange Traded Funds (ETF) may also play a similar reference role to their underlying securities (Subramanyam, 1991; Gorton and Pennacchi, 1993). However, these index-linked securities do not change the net supply of the underlying securities and therefore has no substitution effect. In addition, the trading of the index-linked securities can have direct effect on their underlying (Ben-David *et al.*, 2018).

2. Literature review

Many authors have studied whether government and corporate bonds are substitutes or complements. Greenwood ***et al.*** (2010) and Badoer and James (2016) conclude that U.S. government bonds and high-quality corporate bonds broadly substitute for one another in private portfolios. Consequently, a change in the maturity distribution of government offerings elicits an offsetting change in the maturities offered by borrowing corporations. Graham ***et al.*** (2014) reach a similar conclusion: financially unconstrained firms are more likely to issue bonds with greater than one year maturity when the government's issuance in that maturity category is lower. They conclude that government issuances therefore reduce bond issuances and investment expenditures by financially healthy firms. In these studies, a private firm's "gap filling" reflects its realization that the government's withdrawal from certain maturity categories permits it to borrow more cheaply in the "under-used" categories.[4] In turn, this may imply that investors' maturity preferences are at least partially exogenous.

There is evidence for similar substitution effects outside the U.S. Demirci ***et al.*** (2017) evaluate 40 countries and conclude that firms in nations with higher government debt ratios operate with lower leverage. This effect is particularly apparent for larger firms and in economies with less bank debt, for which similar securities might substitute more elastically for one another. Agca and Celasun (2012) study corporate borrowing costs across a wide range of nations, and conclude that firms pay more for their debt when their national government has more outstanding debt in international markets.[5] This effect is particularly true for lower-quality firms. In another trans-national study of bond issuances, Bekkum ***et al.*** (2019) find that government and corporate bonds

[4] Bekkum ***et al.*** (2019, page 23) point out that "the strongest evidence of gap filling is found in the data from the Americas" when they evaluate 14 countries over the 1991-2017 time period.

[5] This type of phenomenon plays a prominent role in classical and Keynesian assessments of fiscal policy.

are complements: government bond issuances in a specific maturity range support corporate issuances in the same range by providing the market with a "reference rate" which helps corporate bond investors determine appropriate yields.

Yuan (2005) theoretically identifies three avenues through which a government reference bond might affect corporate bonds' trading and pricing. First, the reference bond might complete markets by providing a security tied to the country's systematic economic performance. This increased spanning should enhance trading and permit corporate bond investors to separate systematic from idiosyncratic credit risks in their portfolios (Shiller, 1993). Second, the ability to hedge macro risks using government bond positions may encourage investors to collect additional risk-related information, increasing the informativeness of corporate bonds' prices. Third, more informative prices are likely to increase liquidity for all bonds in the market (Subramanyam, 1991; Gorton and Pennacchi, 1993). Yuan (2005) argues that, in theory, riskier corporate bonds spreads should be more affected by the introduction of a government reference bond.

Dittmar and Yuan (2008) draw on the theoretical work of Yuan (2005) to study how introducing USD sovereign reference bonds affected corporate bonds' yields, liquidity, and information content in eight developing countries (Argentina, Brazil, Chile, Korea, Mexico, Philippines, Thailand and Venezuela). Their sample period (1996-2000) includes the Asian financial crisis, as well as some important regulatory changes within the issuing countries. Their study largely seeks to determine whether the presence of sovereign bonds enhances the price discovery process. They also examine the effect on yield spreads, as we do here. Data limitations limit their investigation of yield spread effects to only six countries (Chile and Thailand were excluded from this part of their analysis). Depending on the length of the event windows they evaluate, Dittmar and Yuan (2008) find significant reductions in corporate yield spreads and bond bid-ask spreads in three or four of their six sample countries. They argue that these effects result from the sovereign bond enhancing spanning and improving the price discovery process in corporate bond trading. They conclude that their "evidence suggests that sovereign bond issuances are essential for developing vibrant corporate bond markets in emerging economies."

While the Dittmar and Yuan (2008) paper includes some analysis that is similar (but not identical) to ours, we believe our Chinese evidence provides several advantages over the earlier paper. First, we know the date when Chinese plans to issue a reference bond were first announced, which theory indicates should be the time at which corporate yields are affected. Their multi-country data focusses on sovereign issuance decisions, which may be anticipated and may reflect endogenous events that affect both the issuance decision and equilibrium bond spreads. Second, we enrichen our analysis by controlling for value-relevant bond features such as maturity and credit quality, which were unavailable in the earlier paper. Our analysis of the heterogeneity across bonds also mitigates the possible effects of confounding factors such as other contemporaneous macroeconomic changes. Third, the Chinese market had previously been lacking a well-traded sovereign bond, while Dittmar and Yuan's sample countries often had prior reference bonds outstanding. We investigate whether the bonds issued by state-owned banks had previously served as imperfect benchmark securities. However, the state-owned bank bonds trade at substantially higher rates than sovereign bonds, despite their government guarantee. Finally, our sample is more recent and includes a larger number and par value of bonds from a dynamic and important economy.

3. The Chinese bond markets

The Chinese central government primarily borrows via RMB bonds sold either overseas ("offshore") or domestically ("onshore").[6] The offshore bonds – frequently called "dim sum"

[6] Amstad and He (2018) have an excellent survey on the Chinese onshore bond market.

bonds – were used to promote the internationalization of RMB. Chinese corporations issued bonds in the onshore and offshore RMB markets and in an offshore market for USD bonds. The onshore RMB and offshore RMB markets are somewhat isolated from one another because of China's strict capital controls. The exchange rates in these two markets are quite similar, but the interest rates can diverge by a significant amount.

Table 1 reports the annual amount of all Chinese borrowers' bond issuance in each of these three markets from 2007 to 2017. (The table's RMB values are converted to USD at the issuance date's exchange rate.) Issuance quantities indicate that the Chinese government and corporations issue primarily in the onshore RMB market. Offshore, the government borrowed more in RMB than USD, while Chinese corporations preferred USD borrowings. The overall size of the offshore RMB market is much smaller than the other two markets. Over time, government bond issuances have remained relatively constant, while corporate bond issuances – and hence the overall market -- have increased. Between 2007 and 2017, onshore RMB bond issuances increased from $540 billion to $2,410 billion. Government issuance roughly doubled (from $309 billion to $593 billion) while corporate issuances in the onshore RMB market rose by 687% during the decade. The offshore USD market exhibits a similar pattern: government issuance remained at zero until the October 2017 issuances while corporate issuance rose from $5 billion to $275 billion.

We define "corporate" Chinese borrowers to include both private firms and state-owned enterprises (SOEs). The SOEs are typically fully or predominantly owned by the central government or local governments. At yearend 2017, private (non-SOE) firms had $49.59 billion (13.71%) of the bonds included in our sample, while SOEs accounted for $312.10 billion (86.29%). There are three groups of SOEs. The largest group contains diverse firms typically "corporatized" from their pre-reform predecessors. The second group includes two large policy banks (the China

Development Bank (CDB) and the Export-Import Bank of China (Chexim)), which were chartered to finance economic and trade development and state-investment projects, respectively. These two banks are fully owned by the Chinese central government and report directly to the State Council.[7] In 2017, the policy banks' bonds accounted for $16.8 billion (5.38%) of our SOE total. Third, some SOEs are owned by Local Government Financing Vehicles (LGFVs). Legally, an LGFV is solely or predominantly owned by a local government. (Usually ownership resides in the local government's State-Owned Assets Supervision and Administrative Committee.) Most LGFVs were created to finance local infrastructure projects to stimulate the economy during the 2007–2009 crisis.[8]

In our empirical analyses, we will group all the borrowers into four groups: policy banks, LGFVs, other SOEs, and non-SOEs.

3.1 The October 2017 issuance

On October 11, 2017, the Chinese Ministry of Finance announced that it would issue $2 billion USD-denominated sovereign bonds, split equally into a five-year and a ten-year maturity. The USD bonds would be issued in the offshore market and traded in Hong Kong.[9] Global investors welcomed the bonds' issuance two weeks later (on October 26, 2017) when the issue was oversubscribed by a factor of 11. Initial purchasers included central banks, sovereign wealth funds, mutual funds, insurance firms, and banks from Asia, Europe and the U.S. In short, the issue

[7] There is some ambiguity whether we should consider them as corporate or government borrowers. Before the two new government bonds in 2017, the USD bonds issued by these two policy banks were partially playing the benchmarking role, although we will show below that their benchmarking role is significantly worse than the USD government bonds.
[8] For more background on LGFVs, see Bai ***et al.*** (2016), and Chen, ***et al.*** (2019).
[9] There is no onshore USD market.

was a great success. At issuance, the five-year (ten-year) bond yielded 2.196% (2.687%), which was 12.6 (22.7) basis points above comparable U.S. Treasury bonds.[10]

Before this issuance, the USD-denominated Chinese sovereign bond market was negligible. The Chinese government had issued about a dozen USD bonds between early 1990 and October 2004, after which the trade surplus generated a surge of foreign currency reserves. By October 2017, only two USD sovereign bonds remained outstanding: one issued in 1996 (with initial maturity of 100 years) and one issued in 1997 (with initial maturity of 30 years). Each bond had $100 million outstanding. The October 2017 issues therefore raised the amount of outstanding USD Chinese sovereign debt from $200 million to $2.2 billion.

The Ministry of Finance gave four reasons for its decision to issue USD sovereign bonds in a press conference two days before their issuance: to continue opening the Chinese financial markets, to provide a pricing benchmark for other bonds issued by Chinese entities, to enhance the confidence of international investors in the Chinese economy, and to optimize the Chinese government's debt structure. A Bloomberg story on the announcement day focused on the potential reference rate effect:

> While China's government doesn't need to borrow offshore, … its bonds will provide a new benchmark for pricing the country's state-owned enterprises. A successful deal will pull down those borrowing costs, and may fuel further sales after what's been record issuance so far this year. (Bloomberg (2017)).

Some market participants also conjectured that this issue was meant to rebuke the rating agencies that had recently downgraded Chinese sovereign debt.

We focus here on the second item mentioned in the press conference: the potential for USD reference bonds to aid USD corporate borrowing.

[10] No plans for continuing USD issuances were announced in October 2017, but China did issue a further $3 billion of USD sovereign bonds in October 2018. Perhaps China will become a regularly issuer of such bonds.

3.2 Data

Our hypothesis tests require data on a variety of fixed-income securities. U.S. Treasury bond yield data for multiple maturities are taken from the Treasury's web site. CDS premia are provided by Markit. For the Chinese offshore bonds (including sovereigns), we collected coupon, amount outstanding, issuance date, maturity date, and daily measures of the closing bid, closing ask, and the mid-quote's implied yield. We also create an investment grade indicator based on Bloomberg's report of Moody's rating. If Moody's rating is missing, we use Standard & Poor's rating, and if both are missing, we use the rating by Fitch.

We follow other researchers (Longstaff ***et al.***, 2005; Chen ***et al.***, 2007; Bao ***et al.*** (2011) in collecting offshore bond data from Bloomberg Generic Quote (BGN), which provides executable and indicative daily bid and ask prices (as opposed to a model-based valuations).[11] Bloomberg provides very good coverage about all types of Chinese bonds in the offshore market. We collected the features of onshore RMB corporate bonds from the China Stock Market & Accounting Research (CSMAR) database. CSMAR data include primarily trades on the two domestic exchanges.[12] Many USD corporate bonds are issued by subsidiaries of a traded parent. As explained in Part A1 of the Appendix, we define these bonds' issuers to be the parent firms under the assumption that a strong parent will support its subsidiaries. In many cases, the parents provide explicit guarantee on the subsidiaries' borrowings. [13]

[11] Although the BGN data source has been most widely used in academic studies, some researchers have used another Bloomberg source – Composite Bloomberg Bond Trades (CBBT) – usually in conjunction with the BGN data (Schestag ***et al.***; Krishnamurthy ***et al.***, 2018). The CBBT data reports executable quotes from participating dealers, while BGN includes both executable and indicative quotes. Our sample size and results are very similar if we use CBBT data.

[12] From CSMAR, we obtain bond characteristics such as the closing price, yield implied by the closing price, amount outstanding, issuance and maturity dates. Besides the exchange market, China has an interbank bond market. See Amstad and He (2018) and Chen ***et al.*** (2018) for detailed discussions on these two markets.

[13] We obtain similar results if we define the subsidiary as issuer.

The corporate bonds included in our final sample must satisfy a relatively standard set of criteria. These filters are described below, along with the number of bonds remaining after each filter (in parentheses).

1. It is denominated in USD. (5,603,681)
2. It is a bullet bond and the coupon is either fixed or zero. (285,371)
3. The bond was issued before April 11, 2017 and will mature after April 11, 2018. (21,752)
4. It is issued by a Chinese issuer other than the central government. We include issuers or an issuers' ultimate parent whose "country of incorporation", "country of domicile" or "country of risk" is China.[14] Bonds issued by LGFVs and the two policy banks are included. (1,434)
5. It has more than $5 million outstanding as of the announcement date of the two USD government bonds. (1,411)
6. It has BGN data available for at least 75% of the trading days within the period from two months before to two months after the announcement date, to ensure our bonds have meaningful liquidity. In their analysis of U.S. bonds, Bao ***et al.*** (2011) have a similar requirement. (553)

After imposing data filters, we have complete information about 553 bonds issued by 284 issuers. Our final sample includes 15, 65, 381, and 92 bonds issued by policy banks, LGFVs, other SOEs, and non-SOEs, respectively.

Tables 2 indicates that the sample bonds are issued by firms in a wide variety of industries. Not surprisingly, many of the bonds are issued by financial firms, including the two Chinese policy banks. Table 3 reports summary statistics for the sample bonds' quantitative characteristics, and the correlations among those characteristics. The variable names are defined in Part A2 of the Appendix. We winsorize the continuous variables at 1% and 99% levels. The yield spreads average

[14] Bloomberg defines an issuer's "country of risk" according to a number of criteria, including its country of domicile, the primary stock exchange on which it trades, the location from which the majority of its revenue comes, and its reporting currency.

1.68%, with substantial variation about the mean. The inter-quartile range is 70 bps and the standard deviation is 1.14%. Panel B of Table 3 indicates that the bonds' properties are correlated with one another in the usual ways. For example, yield spread is lower for larger, older, better-rated and lower bid-ask spread bonds. Investment grade (*IG*) status is positively associated with the bond's age, amount, and maturity, and the bid-ask spread is negatively correlated with bond size and IG status. The bond's price volatility is highly positively correlated with bid-ask spread.

3.3 Existing securities which may also play a reference role

Our empirical conclusions would be most clear-cut if the new sovereign bonds brought entirely new features into the USD market for Chinese obligations. However, some existing securities might have served a reference role similar to the one we are investigating for the new sovereign bonds. Two small sovereign bonds denominated in USD remained outstanding in October 2017, although their trading volume had become quite small. We found the price data for the old bond maturing in 2027, but none for the 1996 bond maturing in 2096. Panel A of Figure 1 shows the yield spread (relative to interpolated US Treasury yields) of the 2027 sovereign USD bonds and the two nearly issued sovereign USD bonds for the period from 60 trading days before to 31 trading days after the announcement of the 2017 issuance. The vertical dotted line indicates the announcement date for the new USD sovereigns, and the solid vertical line marks their issuance date. Shortly before the new USD sovereign bonds were issued, the old bond was trading at about 80 bps over Treasury. The two new bonds came into the market with spreads of 20 – 25 bps. The old bond's spread fell between announcement and issuance of the 2017 bonds. Trading nearly disappeared in the old bond after the new bonds were issued, but the two data points we obtained (on days 18 and 19) had a very similar spread to the two new bonds'. In short, it seems that the new sovereign bonds largely displaced the older one.

Panel B of Figure 1 plots the yields of four Chinese government bonds denominated in RMB, which may have played a reference role for pricing USD corporate bonds. We illustrate two onshore and two offshore RMB sovereign bonds.[15] Although these bonds may have provided reference bond services for USD borrowings, the currency difference almost certainly limited their value in this regard (Du and Schreger, 2016). The CDS contract on Chinese government bonds might also provide systematic information about the Chinese economy. Duffie (1999) argues that the CDS premium should equal a bond's risk premium in a frictionless market. Panel C of Figure 1 indicates that the five-year CDS premium fell quite sharply after the new bonds are announced, but rose again after their issuance. We suspect this reflects various frictions in the CDS market that limit its ability to track perceived risk changes (Augustin ***et al.***, 2014).[16] For example, in the period from 13 days to 31 days after the announcement, the average daily corporate bond yield spread change is strongly correlated with the daily yield spread change of the two newly issued USD government bonds: correlation coefficients of 0.564 and 0.601 for the five and ten year USD government bonds, respectively. In contrast, the correlation coefficients are -0.130 and -0.027 between the new sovereigns' five (ten) year yield changes and changes in the five-year sovereign CDS premium.

Finally, we note that the two Chinese policy banks had been issuing USD bonds since 2010. In 2017, they issued new bonds worth more than seven times the sovereign's issuance of $2 billion.

[15] Missing values for days -8 through -2 reflect National Day holiday. The offshore USD bonds' trading was not affected.

[16] CDS contracts may not be triggered by all events that reduce an issuer's bond's value. The extent of such divergences is illustrated by the CDS premium on U.S. sovereign debt, which has traded as high as 40 bps (Chernov, Schmid, and Schneider, 2017). In an imperfect market, the CDS premium's behavior after announcement may reflect a need to draw new protection writers into the market with the increased supply of sovereign bonds in late October.

These government-guaranteed, USD bonds may have served a reference role for other corporate issuers. Panel D of Figure 1 indicates that the spreads on these 10-year bonds stood at about 90 bps at the announcement and fell quite sharply between the announcement and issuance dates, settling at about 80 bps. The sovereign bonds' much smaller spread (about 25 bps) suggests that the two policy banks have different economic properties despite their conjectural government guarantees.

The data in Figure 1 suggest that there were previously no close substitutes for the new USD sovereign bonds available to investors. However, to the extent that pre-existing bonds were providing reference services, our tests are biased against finding any further effect of the 2017 issues.

4. Empirical results

Our main hypotheses concern whether Chinese bonds' yields or liquidity changed with the introduction of the USD sovereign reference bonds in October 2017. Our sample period includes two potential information effects: the announcement that the Finance Ministry would issue a USD sovereign bond and the actual issuance. In an efficient market, bond prices should change (if at all) at the announcement date, and we analyze primarily this event. We also test whether bond prices changed with the actual issuance of the reference bond, and find much smaller and less significant effects (see Part A3 in the Appendix).

4.1 Univariate analysis

Effective reference bonds should reduce the spread on USD corporate bonds. Figure 2 plots the mean daily spread over similar-maturity Treasury bonds for all sample bonds from 60 days before the announcement of the USD sovereign bond issuance to 31 days after (which is 20 days after the actual issuance). Corporate bond spreads fell around the announcement. The yield spread decrease starts several days before the announcement and stabilizes after the actual issuance. Although the yield spread decreases over most of the sample period, the announcement period decrease is particularly sharp. On the announcement day and the following day (event period [0,1]) the spread falls a total of 4 basis points. Figure 2 shows that the change of yield happens essentially within the [-20, +12] period - from one month before the announcement to one day after the actual issuance. In the following analyses, we choose two windows to measure change in yields: a short window from one day before to one day after the announcement ([1] – [-1]) and a long window from one month before the announcement to one day after the actual issuance ([1, 12] – [-20, -1]). The longer window captures the overall effect, and the shorter window is less likely to be contaminated by other events. The two measures of change in yield have a correlation coefficient of 0.615 across 553 sample bonds, suggesting that they are driven by the same fundamental factor(s).

Table 4 reports tests of the hypothesis that the post-announcement yield spreads are smaller than the pre-announcement spreads. We average the yield spreads on several different categories of USD corporate bonds before vs. after the sovereign announcement on October 11, 2017, omitting the announcement day itself. T-tests of means and Wilcoxon tests of median differences between the two spread samples are reported, based on standard errors clustered at the issuer level.

Panel A of Table 4 reports the results for the average of all corporate bonds in our sample. Change in yield spread is calculated as the average daily yield spread in a post-event window minus that in a pre-event window. These univariate results indicate that the reference bonds' announcement significantly reduced the yield spread on corporate USD debt, by 4 to 9 bps.[17]

[17] Part A4 in the Appendix indicates that our results are robust if we calculate yield change between the first day of the pre-announcement window and the last day of the post-announcement window. For example, the spread on day +12 minus the spread on day -20 for the last row in each bond group.

Similarly, the median "before vs. after" difference in Panel A is significantly negative for all sample periods. The estimated mean spread declines are larger when measured over a longer-interval, which includes any issuance effect as well as the announcement effect.

Panels B through E in Table 4 report separate test statistics for the corporate sub-groups: policy banks, LGFVs, other SOEs, and non-SOEs. The median differences are all significantly negative; the mean differences are significantly negative except for the two shortest windows in Panel B.[18] For the 15 bonds issued by the two policy banks, Panel B indicates a 3 – 7 bps decline in yield spreads. Yield spreads also fell significantly – and by a slightly larger amount – for LGFV firms (Panel C), other SOEs (Panel D), and non-SOEs (Panel E). One possible reason that the policy bank bonds' yield spread decreases less is that they are the closest substitutes of Chinese government bonds. So the introduction of government bonds may have reduced their value as a reference security (Gorton and Pennacchi, 1993; Subrahmanyam, 1991).

Note that one possible, although unlikely, explanation for these spread changes at the announcement date would be a sudden improvement of the issuers' credit quality. We address this possibility next. We also address the possible effects of confounding factors such as contemporaneous macroeconomic fundamental changes in the following sections.

4.2 Differential effect on USD bonds

The reference rate effect associated with USD sovereign bond issuance should affect primarily the USD corporate bonds. RMB corporate bonds should be affected much less, if at all, because their most natural reference bonds would be the relatively plentiful RMB government bonds traded in the onshore market (Table 1). In this subsection, we examine whether RMB and

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[18] The comparatively low statistical significance of the policy banks' means test probably reflects the presence of only two bond issuers.

USD corporate bonds show a similar reaction. We identify firms that had outstanding both RMB and USD bonds. The RMB bond's yield spread is measured relative to the RMB sovereign bond. The matched sample is smaller than the one in Table 4, because not every firm issues both USD bonds and RMB bonds. We use the following model to compare the announcement's effect on bonds issued in different denominations.

$$\Delta YieldSpread_i = \alpha + \gamma USD_i + \beta' X_i + \varepsilon_i. \quad (1)$$

where *i* indexes bonds,

USD is a dummy variable equal to 1 for offshore USD bonds, and zero for onshore RMB bonds.[19]

X is set of control variables.

γ is the coefficient of interest, measuring the difference between USD bonds' yield spread changes and the spread changes on RMB bonds.

The results in Table 5 describe the changes in both a short window ([1] – [-1]) in columns (1) – (4) and long window ([1,12] - [-20,-1]) in columns (5) – (8). All eight of the estimated coefficients on the USD dummy are significantly negative, consistent with the hypothesis that the sovereign bond announcement reduced USD bond spreads more than the spreads on RMB bonds issued by the same firms. The simplest specification (in columns (1) and (5) indicates that RMB bond spreads changed by an insignificant amount (see the intercepts), while USD spreads for bonds issued by the same firm fell about 3 bps in the short window and 15 bps in the longer one. These USD effects are similar to those estimated for the full sample in Table 4. Columns (2) and (6) add parent issuer fixed effects to the specification (1) and have the same implications within issuers. The last two regression specifications add issuer and then bond characteristics to the regression,

[19] We focus on the onshore RMB corporate bonds because the offshore RMB corporate bond market is too small for a meaningful statistical analysis.

with little effect on the coefficients of interest. The persistent significance of the negative coefficients on USD in Table 5 indicates that USD bonds' yield spreads decreased more than RMB bonds from the same issuers, consistent with the USD sovereign having a reference rate effect on corporate debt. The results in columns (4) and (8) indicate that bond yields fell significantly less for non-SOE issuers.

These results rule out the possibility that our estimated effect on bond spreads reflects some broad change in Chinese corporations' credit risk.

4.3 Bonds with different maturities

Corporate bond yields are generally determined relative to the yield on a sovereign bond of the same maturity. Accordingly, a new sovereign bond can potentially benefit corporate bonds of the same maturity more than other corporate bonds (Bekkum ***et al.***, 2019). Given the 2017 Chinese sovereign bond issuances, we expect that corporate bonds with maturities closest to five or ten years will benefit the most. Figure 3 shows scatterplots between yield spread changes and maturity, together with non-parametric regression curves fitted using Epanechnikov kernel-weighted local polynomial smoothing (Fan and Gijbels, 1996). Panel A (B) presents the short window [1] – [-1] (long window [1,12] – [-20,-1]) results. The evidence from both panels confirms that the sovereign bond issuances affected similar-maturity corporate bonds most prominently. For each window, yield spreads decrease the most for bonds with about five to ten years' maturity. We confirm the implications of Figure 3 by estimating a piecewise linear regression of change in yield spreads on bond maturity in Table 6. The model assumes that the relation between change in yield spreads and log maturity is linear but the slopes differ with the bond's maturity: shorter than five years, between five and ten years, or longer than 10 years. We begin by constructing three dummy variables:

Short = 1 if the bond's remaining maturity is less than five years, else = 0.

Medium = 1 if the bond's remaining maturity is between five and ten years, else = 0.

Long = 1 if the bond's remaining maturity exceeds ten years, else = 0.

We then use these dummies to estimate the following model for each sample bond (*i*):

$$\Delta YieldSpread_i = Short_i[\alpha_{short} + \beta_{short}Log(Maturity_i)] + Medium_i[\alpha_{medium} + \beta_{medium}Log(Maturity_i)] + Long_i\left[\alpha_{long} + \beta_{long}Log(Maturity_i)\right] + \beta' X_i + \varepsilon_i \quad (2)$$

subject to two constraints that assure smoothness:

$$\alpha_{short} + \beta_{short}Log(5) = \alpha_{medium} + \beta_{medium}Log(5)$$
$$\alpha_{medium} + \beta_{medium}Log(10) = \alpha_{long} + \beta_{long}Log(10)$$

The dependent variable is change in yield spread, either over the short window or the long window. The control variables (X_i) include industry fixed effects, some bond characteristics, and three dummy variables identifying the bond's type of issuer. (The omitted issuer category is other SOEs, besides policy bank and LGFV bonds.)

Table 6 reports estimation results for (2) for the short time window in columns (1) – (3) and for the long time window in columns (4) – (6). The estimation results are quite uniform across specifications and the yield spread change window. β_{short} and β_{long} are significantly negative and positive respectively, confirming Figure 3's V-shaped relation between change in spread and bond maturity. β_{medium} is also significantly negative, indicating that yield spreads fell further for 5-10 year bonds than for shorter ones.[20] In other words, ten-year bonds benefited more from the

[20] The V-shaped yield spread change seems to rule out a macroeconomic shock as the cause of the bonds' spread changes, because macro shocks generally affect the entire term structure rather than one segment of it.

introduction of the reference bond, perhaps because longer-maturity bonds are more difficult to price.

4.4 Multiple Placebo Tests of Yield Spread Changes

We undertook multiple placebo tests to confirm the statistical significance of our univariate tests in Table 4 and the V-shaped maturity effect in Table 6. Specifically, we examine daily yield spread changes between one and 13 months before the announcement. For each day k belonging to [-272, -23], we identify all traded bonds satisfying all except one of the criteria we applied in our main analysis.[21] We calculate the mean change in yield from k-1 to k+1 across all corporate bonds.[22] We then test whether the mean change differs significantly from zero, and save the daily (placebo) t-statistic. We plot the distribution of these means and t-values, and compare them with the estimates we have for the actual announcement. We also run the piecewise linear regression using the specification in column (1) of Table 6 for each day k, to get a set of placebo coefficient estimates on the bond maturity dummies.

Figure 4 displays the results. Panels A and B report the placebo tests for the univariate analysis (compare to Table 4). Table 4 indicates that corporate yield spreads fell by 4 bps in the short window around the sovereign USD bond announcement (t = -19.69). The mean placebo estimate for the days between 271 and 22 days before announcement is -0.14 bp. Only two of the placebo days have a more negative t-value. More importantly, only five days among the 250 placebo days exhibit a larger decrease in yield spreads. These estimates imply that on any given day, the probability that the mean yield spread decreases by more than 4 bps is only 2.0% (= 5 /

[21] We did not impose the last requirement (#6), that all these bonds traded on 75% of trading days in the two months on either side of the announcement date.

[22] We run the placebo test analyses only for the short window, as our dataset does not include many non-overlapping time periods for the long window.

250). Panel B indicates that the probability that the *t*-value of the mean decrease is more negative than -19.69 is 0.8%. Panels C of Figure 4 plots the estimated coefficients on β_{long} and β_{short} for each day in our placebo period. The two large dots identify outliers in our placebo results. Clearly, our estimates for the announcement day are large outliers in the placebo distribution. Likewise, the estimated *t*-statistics on these two coefficients are clear outliers in Panel D. We conclude, again, that the probability that our average yield spread decrease and its relation to bond maturity are very unlikely due to chance alone.

4.5 Bonds with different risk levels

Yuan's (2005, page 1159) theoretical analysis predicts that the introduction of benchmark government bonds should have the larger effects on riskier corporate bonds. To test this hypothesis, we compare yield changes for bonds with different risks across two different event windows. We choose three proxies for bond risk: an investment grade bond indicator (*IG*), ***BidAsk***, and ***Volatility***. The latter two measures should be inversely related to a bond's credit quality. To avoid overlap between the calculation of yield spread change and the indicators of bond risk, we calculate ***BidAsk*** and ***Volatility*** in the window from 40 days to 21 days before the announcement. The results are presented in Table 7. The impact of bond maturity here is fully consistent with the estimates in Table 6. We also find, consistent with Yuan (2005), that corporate yield spreads decrease more for non-investment grade bonds (columns (1) and (4)) and for those with lower liquidity (proxied by ***BidAsk*** or ***Volatilty***).

4.6 Liquidity and volatility changes

Yuan (2005) also predicts that an effective reference bond should improve the liquidity and pricing efficiency of risky corporate bonds. This may be reflected in lower ***Bid/Ask*** or lower ***Volatility***. We calculate pre- and post-announcement liquidity and volatility over the periods [-40,

-21] and [13, 31], respectively. We omit data from the period immediately after the announcement, when yield spreads were changing most, to avoid any temporary effects reflecting one-time portfolio rebalancing in response to the USD government bond issuance.

Table 8 reports the estimated piecewise linear regression (2) with the dependent variable specified as the change in either ***Bid/Ask*** or ***Volatility***. In addition to the three specifications shown in Table 6, we add an additional specification in columns (1) and (5) to test whether the average change is significantly different from zero. The specifications reported in Columns (1) and (5) of Table 8 indicate that both bid-ask spread and volatility decrease significantly after the announcement of the Chinese sovereign USD issuance. The average bid ask spread falls from 0.375 to 0.360, yielding the coefficient of -0.015 in column (1), with a *t*-value (clustered at the issuer level) of 4.97. Bond volatility decreases from 0.036 to 0.030, yielding the coefficient of -0.005 in column (5), with a *t*-value of 6.75. The change in volatility also exhibits a V-shape around bonds with a 10-year maturity, similar to the effect of yield spread changes in Table 6. We see no V-shape for the effect of bond maturity on ***BidAsk***.

5. Conclusion

The interaction between corporate and sovereign bond issuances has been studied quite extensively. Some studies find that high-quality corporate bonds and sovereign bonds substitute for one another in private U.S. portfolios and term the resulting corporate borrowing behavior "gap filling" (Greenwood ***et al.***, 2010). Other researchers find that government and corporate bonds can be complementary if government bonds reduce the risk of corporate bond investing by providing a reference (benchmark) security (Bekkum ***et al.***, 2019; Dittmar and Yuan, 2008).

In this paper, we use the Chinese government's sale of two USD-denominated bonds in October 2017 as a natural experiment to identify the effect of this issuance on corporate borrowing rates. We have a specific announcement date, and we know that the new bonds added very substantially to the pre-existing stock of sovereign debt outstanding. The announcement of these two USD-denominated Chinese sovereign bonds (one billion dollars of principal due in five years and another billion dollars due in ten years) provides a unique opportunity to study the effect of sovereign bond issuance on corporate bond pricing in a developing financial sector.

In particular, we have evaluated the effect of this event on outstanding Chinese corporate bonds' yield spread, liquidity and return volatility. In response to the announcement that the Chinese government would issue USD bonds, USD corporate bond yield spreads (relative to interpolated U.S. Treasury yields) decreased by 4 bps over three days around the announcement and by 9 bps from one month before the announcement to one day after the issuance. Although USD-denominated corporate bond yields fell, RMB-denominated spreads did not change significantly, consistent with the hypothesis that the event is not associated with reduced credit risk in the Chinese corporate sector. Corporate yield spreads decreased the most for bonds with maturity closest to the five or ten year maturities of the new sovereign bonds. In both these ways, the sovereign bond effect is consistent with a reference bond making it easier for investors to value corporate debt. We also find that the bond characteristics change more for riskier bonds, as predicted in Yuan's (2005) evaluation of benchmark securities.

Our conclusion that government and corporate bonds are complements stands in contrast to the substitutions documented in more developed economies by Greenwood ***et al.*** (2010), Graham ***et al.*** (2014) and Badoer and James (2016). For the case of China, at least, the reference rate effect dominates the gap-filling effect. It thus seems that the relative importance of the reference rate effect and the gap filling effect may depend on the size of the sovereign bond market. Perhaps the reference rate effect dominates when the sovereign bond market is small (as in China's market for USD bonds), but the gap filling effect dominates when the sovereign bond market is large.

It is not obvious that emerging market firms should be encouraged to issue bonds denominated in a foreign currency. However, if foreign capital constitutes the best way to finance a country's real investment, the government can aid the process by establishing one or more benchmark bonds. We leave a more careful analysis of this policy advice for future research.

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Table 1. Annual bond issuance – corporate and government

This table reports the annual amount of issuance (all in billion USD) for all corporate bonds and Chinese government bonds. Corporate issuers include policy banks, local government financing vehicles (LGFVs), other state-owned enterprises (SOEs), and non-SOEs. The offshore RMB and USD bonds data are from Bloomberg, and the onshore RMB bonds data are from Wind. The offshore bonds data are in USD. For onshore RMB bonds, we use the dollar value provided by Bloomberg, which converts RMB to USD at the prevailing exchange rate.

	Onshore RMB bonds		Offshore RMB bonds		Offshore USD bonds	
Year	Government	Corporate	Government	Corporate	Government	Corporate
2007	308.83	230.87	0	1.33	0	4.69
2008	123.23	311.59	0	1.76	0	0.54
2009	237.58	445.59	0.88	1.17	0	1.85
2010	262.62	463.52	1.2	3.27	0	13.94
2011	238.4	724.66	3.13	15.8	0	36.68
2012	227.52	1015.74	3.62	22.81	0	69.77
2013	273.59	1039.26	3.76	37.22	0	109.02
2014	288.91	1483.49	4.52	61.77	0	184.62
2015	338.38	1914.68	4.44	42.9	0	175.47
2016	461.55	2140.98	4.59	28.83	0	219.01
2017	593.05	1816.98	2.08	17.8	2	275.24

Table 2. Industry distribution of issuers

This table shows the number of bonds, number of issuers, and total amount of bonds in our sample, by industry. All data are from Bloomberg.

Industry	# Bonds	# Issuers	Amount ($Mil)
Metals & Mining	24	16	11,350
Communications	17	5	17,500
Consumer Discretionary	30	24	11,645
Diversified	14	6	8,273
Energy	96	27	83,305
Financials	253	138	159,797
Government	12	2	12,250
Industrial	54	43	23,205
Technology	5	3	3,685
Utilities	48	20	30,690
Total	553	284	361,700

Table 3. Summary statistics and correlations

This table presents the summary statistics for USD-denominated Chinese corporate bonds. For each variable, we report the number of observations, mean, median, the 25th percentile (Q1), the 75th percentile (Q3), and standard deviation (STD) in Panel A. Panel B reports the correlation matrix. Variables are defined in Appendix Table 1. All continuous variables are winsorized at 1% and 99% tails.

Panel A. Summary statistics

Variable	N	Mean	Median	Q1	Q3	STD
Yldspread	553	1.676	1.320	1.022	1.718	1.137
Log(Amount)	553	20.138	20.030	19.807	20.436	0.546
Log(Age)	553	2.996	3.088	2.509	3.528	0.663
Log(Maturity)	553	3.348	3.240	2.822	3.883	0.829
ListedIssuer	553	0.550	1.000	0.000	1.000	0.498
IG	533	0.817	1.000	1.000	1.000	0.387
BidAsk	553	0.375	0.266	0.184	0.453	0.307
Volatility	553	0.036	0.005	0.001	0.034	0.069

Panel B. Correlation matrix

	Yldspread	***Log(Amount)***	***Log(Age)***	***Log(Maturity)***	***ListedIssuer***	***IG***	***BidAsk***	***Volatility***
Yldspread	1							
Log(Amount)	-0.422	1						
Log(Age)	-0.303	0.215	1					
Log(Maturity)	-0.116	0.182	0.109	1				
ListedIssuer	-0.094	0.076	0.192	-0.041	1			
IG	-0.761	0.312	0.233	0.217	0.061	1		
BidAsk	0.469	-0.235	0.203	0.636	-0.059	-0.286	1	
Volatility	0.038	0.009	0.235	0.756	-0.046	0.025	0.800	1

Table 4. Announcement effects

This table reports summary statistics for the change in yield spreads on USD corporate bonds for various windows around the announcement date of the new, sovereign reference bond. Subsequent panels report yield spread changes for the corporate sub-groups: policy banks (Panel B), LGFVs (Panel C), other SOEs (Panel D), and non-SOEs (Panel E). Yield spreads are expressed in percentage points. "[1] – [-1]" denotes the short window change in yield spread, calculated as the yield spread on day t = +1 minus the yield spread on day t = -1, where the event date (t=0) is October 11, 2017. For longer windows, change in average yield spread is calculated as the average daily yield spread in a post-event window minus that in a pre-event window. For example, for window "[1, 12] – [-20, -1]", the change in yield is measured as the average yield spread for the twelve trading days after the announcement minus the average yield spread for the twenty trading days before the announcement. The t-values test the null hypothesis that the mean spread change is zero and are adjusted by clustering the standard errors at the issuer level. The p-value reports the Wilcoxon signed-rank test for the null hypothesis that the median spread change is zero. *, **, and *** denote significance at 10%, 5% and 1% levels, respectively.

Panel A: All bonds

Window	N	Mean	Median	Q1	Q3	*t*-value	*p*-value
[1] – [-1]	553	-0.039	-0.034	-0.056	-0.015	(19.69)***	<0.000***
[1, 5] – [-5, -1]	553	-0.060	-0.045	-0.074	-0.026	(16.20)***	<0.000***
[1, 12] – [-12, -1]	553	-0.083	-0.071	-0.104	-0.038	(15.87)***	<0.000***
[1, 12] – [-20, -1]	553	-0.091	-0.080	-0.119	-0.041	(16.17)***	<0.000***

Panel B: Policy Banks

Window	N	Mean	Median	Q1	Q3	*t*-value	*p*-value
[1] – [-1]	15	-0.027	-0.031	-0.039	-0.019	(5.92)	<0.001***
[1, 5] – [-5, -1]	15	-0.038	-0.030	-0.043	-0.024	(3.95)	<0.001***
[1, 12] – [-12, -1]	15	-0.062	-0.056	-0.087	-0.028	(7.47)*	<0.001***
[1, 12] – [-20, -1]	15	-0.067	-0.070	-0.100	-0.023	(10.44)*	<0.001***

Panel C: LGFVs

Window	N	Mean	Median	Q1	Q3	*t*-value	*p*-value
[1] – [-1]	65	-0.025	-0.017	-0.036	-0.008	(7.25)***	<0.000***
[1, 5] – [-5, -1]	65	-0.052	-0.037	-0.074	-0.023	(8.02)***	<0.000***
[1, 12] – [-12, -1]	65	-0.084	-0.063	-0.099	-0.037	(8.73)***	<0.000***
[1, 12] – [-20, -1]	65	-0.098	-0.083	-0.130	-0.041	(8.74)***	<0.000***

Panel D: Other SOEs

Window	N	Mean	Median	Q1	Q3	*t*-value	*p*-value
[1] – [-1]	381	-0.040	-0.037	-0.057	-0.018	(16.26)***	<0.000***
[1, 5] – [-5, -1]	381	-0.057	-0.046	-0.069	-0.028	(13.74)***	<0.000***
[1, 12] – [-12, -1]	381	-0.081	-0.069	-0.102	-0.040	(13.79)***	<0.000***
[1, 12] – [-20, -1]	381	-0.088	-0.077	-0.113	-0.043	(14.40)***	<0.000***

Panel E: Non-SOEs

Window	N	Mean	Median	Q1	Q3	*t*-value	*p*-value
[1] – [-1]	92	-0.050	-0.036	-0.067	-0.012	(8.81)***	<0.000***
[1, 5] – [-5, -1]	92	-0.081	-0.068	-0.123	-0.022	(6.15)***	<0.000***
[1, 12] – [-12, -1]	92	-0.094	-0.089	-0.159	-0.031	(5.02)***	<0.000***
[1, 12] – [-20, -1]	92	-0.104	-0.101	-0.175	-0.028	(4.93)***	<0.000***

Table 5. Yield spread changes for RMB and USD bonds of the same issuer

This table reports the results comparing the changed yield spreads between USD corporate bonds and RMB corporate bonds issued by the same issuers. Specifically, we report the results for the below model

$$\Delta YieldSpread_i = \alpha + \gamma USD_i + \beta' X_i + \varepsilon_i, \quad (1)$$

for bonds issued by Chinese corporations with both RMB and USD bonds outstanding. $\Delta YieldSpread_i$ is change of yield spread for bond *i*. Yield spreads of USD bonds are over the US Treasury securities, and yield spreads of RMB bonds are over the RMB sovereign bonds issued by the Chinese government. USD is a dummy variable that equals one if the bond is denominated in USD. The independent variables are defined as in Table 3. Industry fixed effects are included when indicated. We include dummy variables identifying the issuer type (*PolicyBank*, *LGFV*, *Non-SOEs*); the omitted category is Other SOEs. The left panel shows the regression estimates for change in yield spread in the short window "[1] – [-1]". The right Panel shows the regression estimates for change in average daily yield spread in the long window "[1, 12] – [-20, -1]". Standard errors are clustered at the issuer level. *, **, and *** denote significance at 10%, 5% and 1% levels, respectively.

	Change in yield spread, [1] – [-1]				Change in yield spread, [1, 12] – [-20, -1]			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
USD	-0.027	-0.029	-0.027	-0.034	-0.152	-0.173	-0.164	-0.159
	(3.49)***	(2.79)***	(2.79)***	(3.12)***	(3.67)***	(3.06)***	(3.19)***	(4.06)***
PolicyBank			0.011	0.016			0.068	0.061
			(1.72)*	(0.92)			(2.63)**	(0.76)
LGFV			0.006	-0.006			0.148	0.084
			(0.84)	(0.64)			(2.40)**	(1.55)
Non-SOEs			0.013	0.033			0.053	0.141
			(2.11)**	(2.81)***			(1.44)	(2.67)**
Log(*Amount*)				-0.016				-0.058
				(1.68)				(1.34)
Log(*Age*)				-0.011				0.046
				(0.90)				(1.42)
Log(*Maturity*)				-0.013				-0.096
				(2.78)***				(4.78)***
ListedIssuer				-0.012				-0.118
				(1.18)				(1.62)
Intercept	-0.007				0.049			
	(1.27)				(1.59)			
Industry FE	N	N	Y	Y	N	N	Y	Y
Issuer FE	N	Y	N	N	N	Y	N	N
Adj R^2	0.021	-0.156	-0.013	-0.018	0.055	0.105	0.051	0.148
N	175	175	175	164	175	175	175	164

Table 6. Bonds with different maturities

This table reports the piecewise linear regression of change in yield spreads on the maturity of dollar-denominated bonds. The model assumes that the relation between change in yield spreads and log maturity is linear but the slopes differ depending on the range of maturity: shorter than 5 years, between 5 and 10 years, or longer than 10 years. Specifically, we estimate the following model to explain the yield change on the i[th] sample bond:

$$\Delta YieldSpread_i = Short_i[\alpha_{short} + \beta_{short} Log(Maturity_i)] + Medium_i[\alpha_{medium} + \beta_{medium} Log(Maturity_i)] + Long_i\left[\alpha_{long} + \beta_{long} Log(Maturity_i)\right] + \beta' X_l + \varepsilon_i \quad (2)$$

subject to two constraints that assure smoothness:

$$\alpha_{short} + \beta_{short} Log(5) = \alpha_{medium} + \beta_{medium} Log(5)$$

$$\alpha_{medium} + \beta_{medium} Log(10) = \alpha_{long} + \beta_{long} Log(10)$$

The dependent variable is change in average yield spread for the short window "[1] – [-1]" in the left panel and for the long window "[1, 12] - [-20, -1]" the right panel. *Maturity* is log maturity of bond ***i***. *Short*, *Medium*, and *Long* are three dummy variables indicating the three ranges of bond maturity, respectively. *PolicyBank, LGFV, Non-SOEs* are dummy variables indicating bonds issued by a particular group of firms. Other independent variables are defined as in Table 3. We include industry fixed effects. The standard errors are clustered at the issuer level. *, **, and *** denote significance at 10%, 5% and 1% levels, respectively.

	Change in yield spread, [1] – [-1]			Change in yield spread, [1, 12] - [-20, -1]		
	(1)	(2)	(3)	(4)	(5)	(6)
β_{short}	-0.014	-0.016	-0.015	-0.035	-0.038	-0.036
	(3.97)***	(4.65)***	(4.39)***	(4.04)***	(4.56)***	(4.29)***
β_{medium}	-0.042	-0.045	-0.046	-0.084	-0.095	-0.092
	(3.38)***	(3.65)***	(3.58)***	(3.58)***	(4.06)***	(3.59)***
β_{long}	0.036	0.036	0.033	0.096	0.099	0.090
	(4.13)***	(4.19)***	(4.05)***	(4.26)***	(4.42)***	(4.37)***
PolicyBank		0.019	0.024		0.041	0.052
		(2.78)***	(3.16)***		(2.82)***	(2.72)***
LGFV		0.001	-0.000		-0.029	-0.019
		(0.13)	(0.09)		(2.15)**	(1.21)
Non-SOEs		0.023	0.025		0.045	0.041
		(3.13)***	(3.19)***		(2.21)**	(2.01)**
Log(*Amount*)			-0.006			-0.000
			(1.28)			(0.01)
Log(*Age*)			0.002			0.011
			(0.72)			(1.52)
ListedIssuer			0.003			0.012
			(0.59)			(0.96)
Industry FE	Y	Y	Y	Y	Y	Y
Adj R^2	0.162	0.206	0.209	0.092	0.118	0.124
N	553	553	553	553	553	553

Table 7. Bonds with different risk levels

We add controls for firm quality and bond trading properties to the full regression specification in Table 6, which defines the dependent and most independent variables. We add additional controls of *IG*, a dummy variable that equals one if the bond belongs to investment grade; *BidAsk*, the average daily bid-ask spread of the bond in the pre-event window [-40, -21]; *Volatility*, the variance of a bond's daily return in the pre-event window [-40, -21]. The left panel shows the results for dependent variable change in yield spread for the short window "[1] – [-1]", and the right panel shows the average daily yield spread for the long window "[1, 12] - [-20, -1]". We include industry fixed effects. The standard errors are clustered at the issuer level. *, **, and *** denote significance at 10%, 5% and 1% levels, respectively.

	Change in yield spread, [1] – [-1]			Change in yield spread, [1, 12] - [-20, -1]		
	(1)	(2)	(3)	(4)	(5)	(6)
β_{short}	-0.015	-0.012	-0.012	-0.041	-0.020	-0.031
	(4.70)***	(2.98)***	(3.74)***	(4.96)***	(1.81)*	(3.27)***
β_{medium}	-0.047	-0.039	-0.028	-0.097	-0.052	-0.040
	(3.62)***	(2.90)***	(1.95)*	(3.79)***	(1.79)*	(1.21)
β_{long}	0.033	0.051	0.063	0.092	0.191	0.177
	(4.02)***	(4.05)***	(3.27)***	(4.22)***	(4.75)***	(3.49)***
PolicyBank	0.024	0.024	0.021	0.048	0.051	0.043
	(3.26)***	(3.43)***	(2.99)***	(3.09)***	(3.37)***	(2.45)**
LGFV	0.000	0.000	-0.002	-0.016	-0.016	-0.024
	(0.03)	(0.04)	(0.39)	(1.12)	(1.00)	(1.55)
Non-SOEs	0.018	0.021	0.024	0.002	0.020	0.039
	(2.46)**	(2.89)***	(3.20)***	(0.11)	(1.03)	(1.98)**
Log(*Amount*)	-0.008	-0.009	-0.006	-0.009	-0.016	-0.001
	(1.60)	(1.78)*	(1.34)	(0.93)	(1.47)	(0.11)
Log(*Age*)	0.001	0.003	0.002	0.005	0.019	0.011
	(0.35)	(1.16)	(0.70)	(0.72)	(2.33)**	(1.50)
ListedIssuer	0.002	0.002	0.002	0.008	0.008	0.009
	(0.46)	(0.47)	(0.40)	(0.78)	(0.75)	(0.81)
IG	0.015			0.094		
	(2.55)**			(4.61)***		
BidAsk		-0.024			-0.135	
		(1.97)**			(3.17)***	
Volatility			-0.165			-0.473
			(1.73)*			(1.91)*
Industry FE	Y	Y	Y	Y	Y	Y
Adj R^2	0.228	0.219	0.219	0.236	0.176	0.137
N	533	553	553	533	553	553

Table 8. Liquidity and volatility changes

This table reports the piecewise linear regression of change in bid-ask spread and volatility on the maturity of dollar-denominated bonds. The model assumes that the relation between change in bid-ask spread (and volatility) and log maturity is linear but the slopes differ depending on the range of maturity: shorter than 5 years, between 5 and 10 years, or longer than 10 years. Specifically, we estimate the following model to explain the yield change on the i^{th} sample bond:

$$\Delta BidAsk_i(\Delta Volatility_i) = Short_i[\alpha_{short} + \beta_{short} Log(Maturity_i)] + Medium_i[\alpha_{medium} + \beta_{medium} Log(Maturity_i)] + Long_i\left[\alpha_{long} + \beta_{long} Log(Maturity_i)\right] + \beta' X_l + \varepsilon_i \quad (2)$$

subject to two constraints that assure smoothness:

$$\alpha_{short} + \beta_{short} Log(5) = \alpha_{medium} + \beta_{medium} Log(5)$$

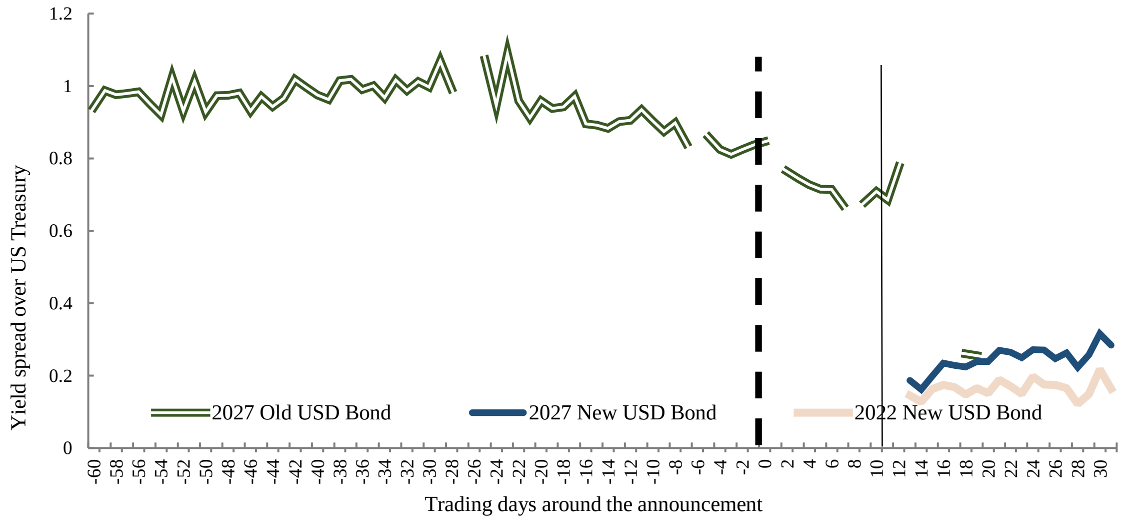
$\alpha_{medium} + \beta_{medium} Log(10) = \alpha_{long} + \beta_{long} Log(10)$The dependent variable is a bond's change in average *BidAsk* or *Volatility* between the period [13, 31} after the announcement and [-40, -21] before the announcement. *Log(Maturity)* is natural logarithm of maturity of bond *i*. *Short*, *Medium*, and *Long* are three dummy variables indicating the three ranges of bond maturity, respectively. *X* represents other factors. *PolicyBank*, *LGFV*, *Non-SOEs* are three dummy variables indicating bonds issued by a particular group of firms. Other independent variables are defined as in Table 3. Industry fixed effects are included when indicated. The standard errors are clustered at the issuer level. *, **, and *** denote significance at 10%, 5% and 1% levels, respectively.

	Change in *BidAsk*				Change in *Volatility*			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Intercept	-0.015				-0.006			
	(4.97)***				(6.75)***			
β_{short}		0.006	0.005	0.003		-0.005	-0.005	-0.006
		(1.30)	(0.99)	(0.53)		(4.77)***	(4.66)***	(4.54)***
β_{medium}		0.040	0.036	0.040		-0.033	-0.033	-0.033
		(2.46)**	(2.22)**	(2.41)**		(4.12)***	(4.10)***	(4.17)***
β_{long}		-0.022	-0.021	-0.016		0.035	0.035	0.036
		(0.74)	(0.70)	(0.54)		(3.95)***	(3.93)***	(3.93)***
PolicyBank			-0.005	-0.005			0.012	0.012
			(0.79)	(0.54)			(8.05)***	(5.80)***
LGFV			-0.016	-0.011			0.003	0.004
			(1.45)	(0.88)			(1.64)	(1.47)
Non-SOEs			0.018	0.019			0.000	0.002
			(1.93)*	(1.83)*			(0.17)	(0.58)
Log(*Amount*)				0.006				-0.000
				(0.94)				(0.03)
Log(*Age*)				-0.006				-0.002
				(0.92)				(1.42)
ListedIssuer				0.010				0.003
				(1.44)				(1.42)
Industry FE	N	Y	Y	Y	N	Y	Y	Y
Adj R^2	0.00	0.047	0.053	0.056	0.00	0.199	0.205	0.210
N	553	553	553	553	553	553	553	553

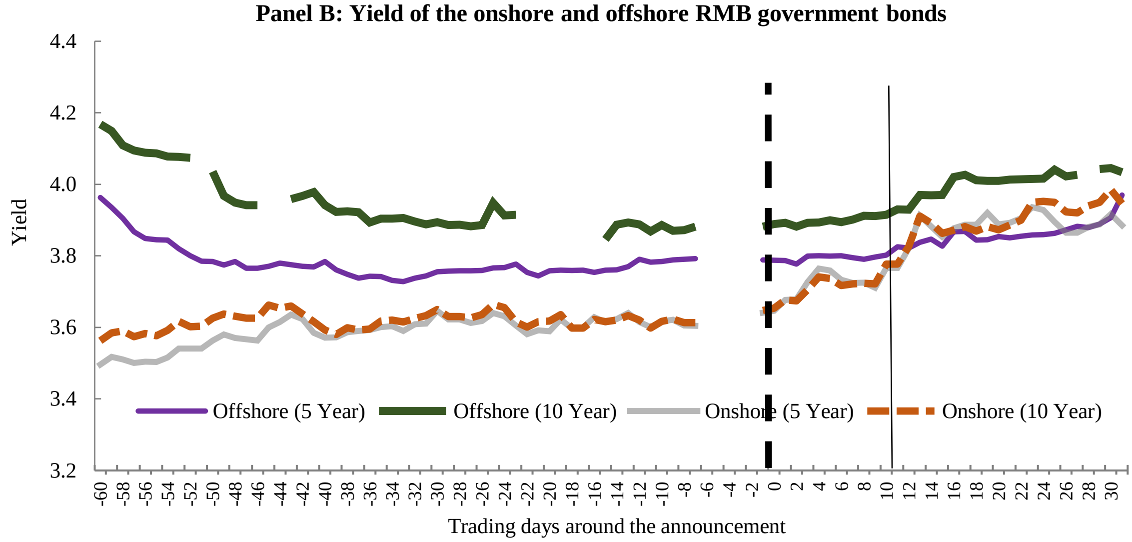
Figure 1. Existing securities that may also play a reference role

Panel A shows the yield spread of USD-denominated Chinese government bonds around the announcement date. The dotted vertical line marks the announcement date and the vertical solid line marks the issuance date. The three lines denote the old USD government bond that was issued in 1997 and will mature in 2027 (2027 Old USD Bond), the newly issued five-year (2022 New USD Bond) and ten-year USD government bonds (2027 New USD Bond). Panel B shows the yield spread over US Treasury rates on similar-maturity bonds for Chinese RMB government bonds traded onshore and offshore. For onshore bonds, we use the five-year and ten-year constant maturity yields from Government Securities Depository Trust & Clearing Co. Ltd (chinabond.com). For offshore bonds, we get the offshore RMB bonds with the maturity closest to five years or ten years. Panel C presents the yield spread (relative to U.S. Treasury) for two USD bonds issued by the two policy banks, with a remaining maturity closest to ten years. Panel D shows the China sovereign CDS spread around the announcement of the USD government bond issuance. Event day 0 (October 11, 2017) denotes the announcement day for the issuance of USD-denominated government bonds. The plots include the window starting from 60 trading days before the announcement day to 31 trading days after the announcement (20 trading days after the actual issuance date).

Panel A: Yield Spread of offshore USD-denominated sovereign bonds

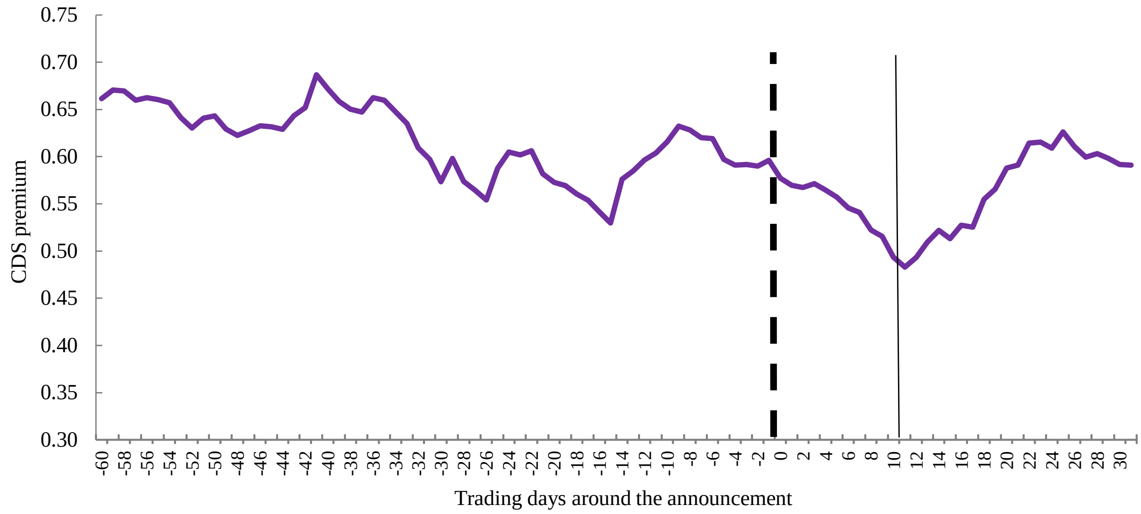


Panel B: Yield of the onshore and offshore RMB government bonds



Note: The data are missing from day -6 to day -2, because that was the National Day holiday.

Panel C: Five-year sovereign CDS



Panel D. Yield spread of the two policy banks

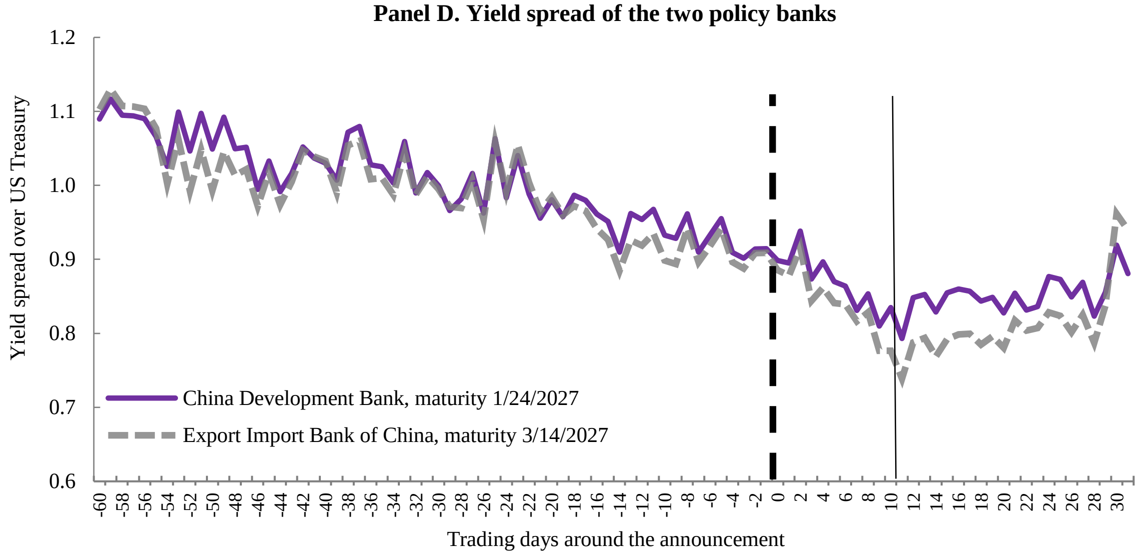


Figure 2. Yield spread changes on Chinese corporate bonds

This figure shows the yield spread for the USD-denominated Chinese corporate bonds around the announcement of the USD government bond issuance. The announcement date is October 11, 2017 and is denoted as day 0 and marked by the dotted vertical line. The figure includes the window starting from 60 trading days before the announcement day to 31 days after the announcement (20 trading days after the actual issuance date). Solid vertical line marks the issuance date. The solid line represents the average yield spread change (in percentage) and the dotted lines represent the 95% confidence interval.

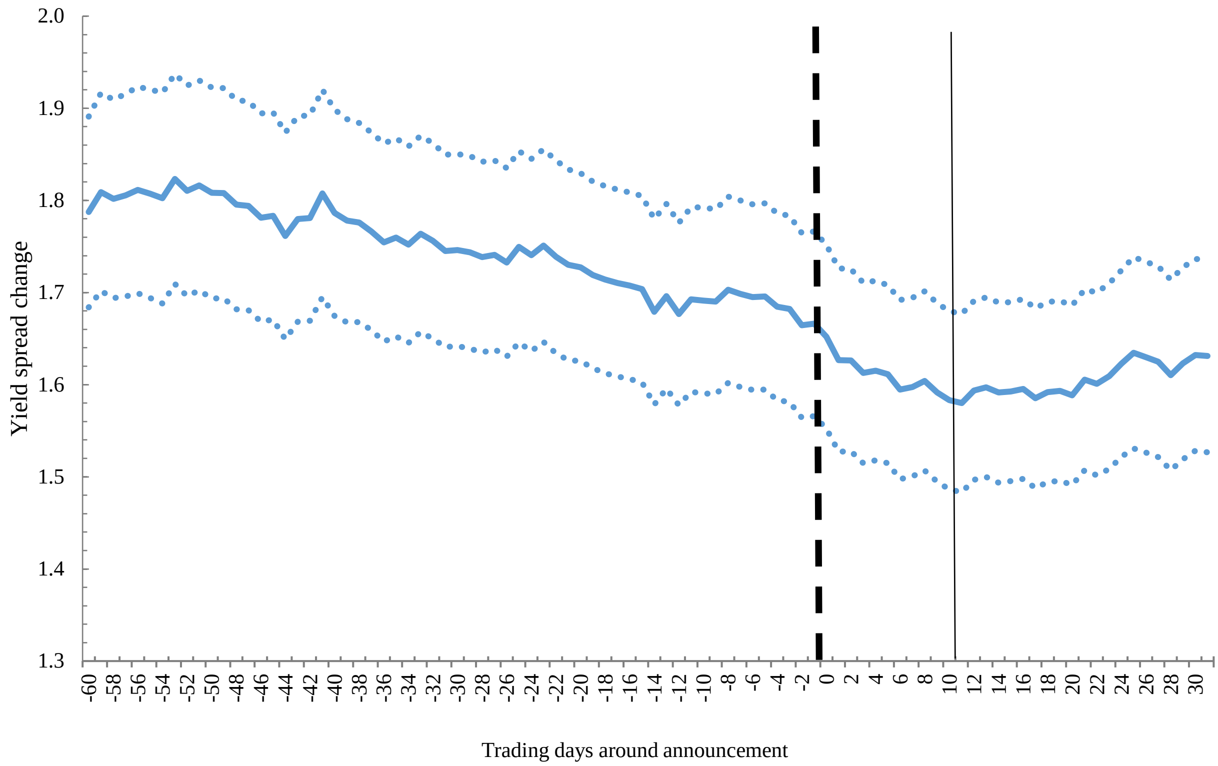
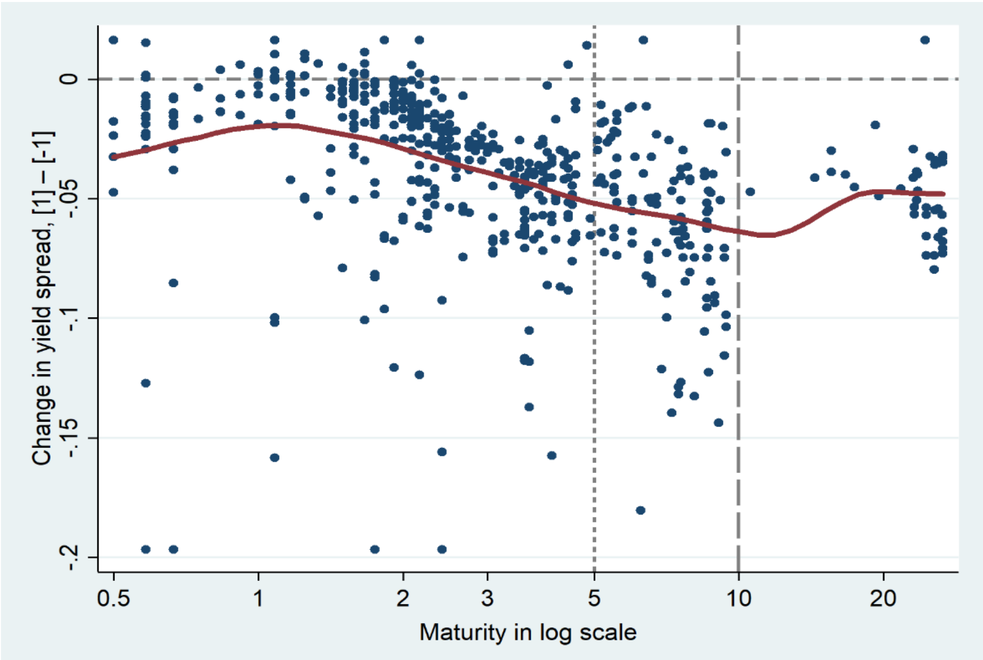


Figure 3. Yield spread change and maturity

This figure presents the non-parametric plots for bonds' change in yield spread with respect to maturity. The horizontal axis measures bond maturity in log scale. The y-axis is the change in yield spread. Panel A and B are the two panels with the results for change in yield: one for the window "[1] – [1]" and one for "[1, 12] - [-20, -1]".

Panel A. [1] vs. [-1]



Panel B. [1, 12] vs. [-20, -1]

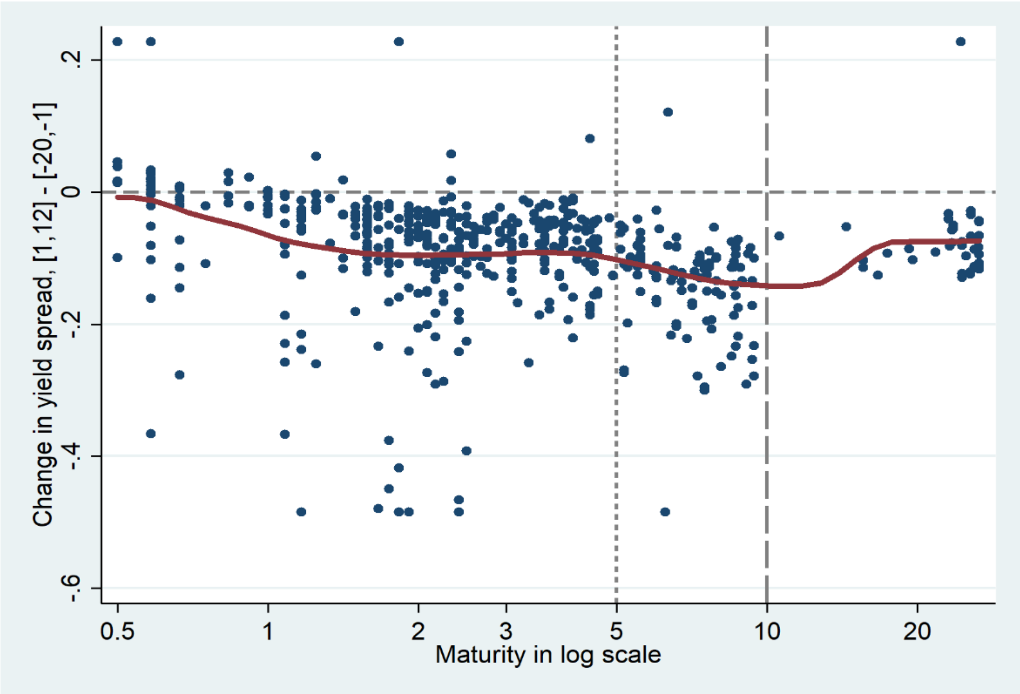
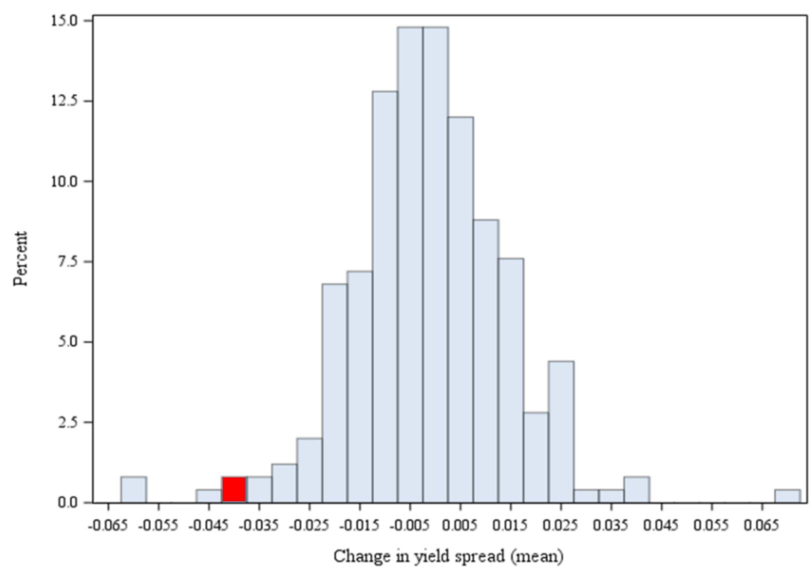


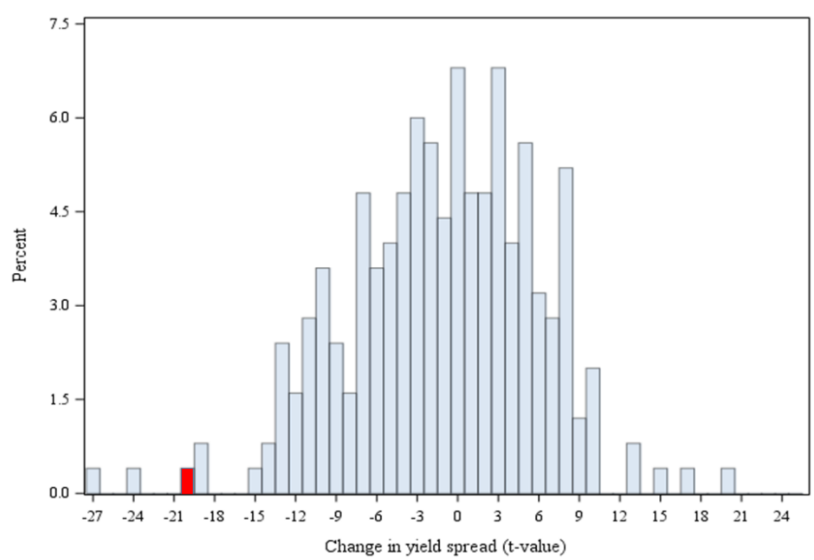
Figure 4. Multiple placebo tests for regression coefficients

This figure shows the results of the multiple placebo tests. We create placebo event window using the trading days between one and 13 months before the announcement of the USD government bond issuance. Specifically, the yield spread change is calculated for every window [k-1, k+1], where k belongs to [-272, -23]. Panels A and B show the mean and t-value distributions of the change in yield spreads for the placebo events. The dark red bar indicates the estimates of the actual announcement. Panels C and D report the distribution of the piecewise linear regression results, estimated using placebo events. The dotted lines indicate the estimates of the actual announcement. We estimate the model specification (1) in Table 6 for each placebo event and show the scatter plots of estimated β_{short} and β_{long}. β_{short} captures the relation between change in yield spreads and log maturity for bonds with maturities shorter than five years and β_{long} captures the relation for bonds with maturities longer than ten years. The standard errors are clustered at the issuer level.

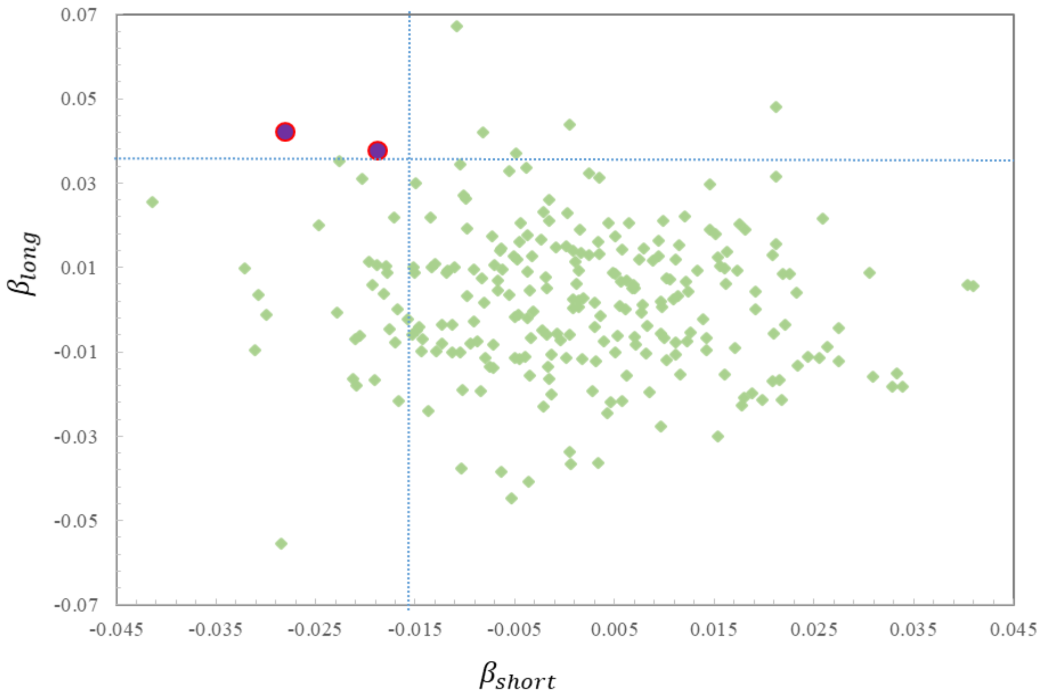
Panel A. Mean distribution



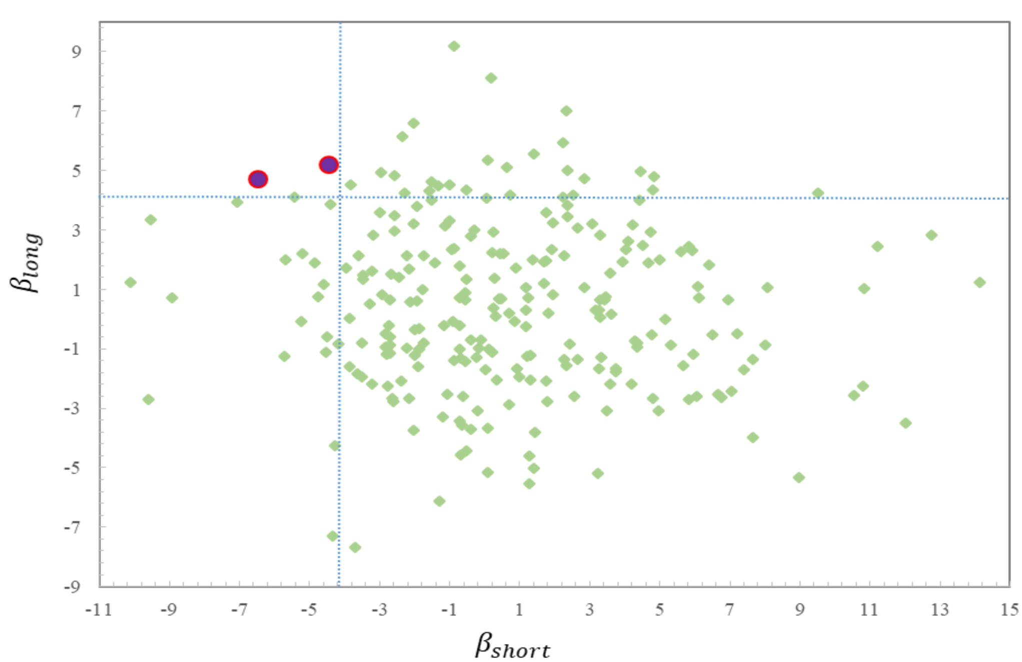
Panel B. *t*-value distribution



Panel C: Scatter plot for β_{short} and β_{long}



Panel D: Scatter plot for *t*-value of β_{short} and β_{long}



Appendix

Part A1. Identifying issuers

Bloomberg reports that many of the USD bonds in our sample are issued by (untraded) subsidiaries of traded companies. For these issuers, we define their parents as the actual issuers, under the assumption that solvent parents would honor the debts of their subsidiaries. To better reflect the credit risk the bondholders faces, we first collect, for each bond in our sample, the issuer name, issuer parent, and ultimate issuer parent information from Bloomberg. Our identification of actual issuer follows a four-step procedure:

1. If the issuer listed by Bloomberg is a listed firm or its ultimate parent is the same as the issuer, we take the issuer itself as our actual issuer.
2. Else, if the issuer is not listed, but the immediate parent is listed, or when the ultimate parent is the same as the immediate parent, then we take the immediate parent as our actual issuer.
3. Else, if the ultimate parent is "People's Republic of China", then we use the immediate issuer parent as our actual issuer.
4. Else, we use the ultimate parent as our actual issuer.

For example, CITIC International Financial issued a bond via its subsidiary China CITIC Bank International Ltd on June 24, 2010. In Bloomberg, China CITIC Bank International Ltd is listed as the issuer, CITIC International Financial as the immediate issuer, and People's Republic of China as the ultimate issuer. People's Republic of China is listed as the ultimate issuer because CITIC International Financial is a state-owned enterprise. We classify CITIC International Financial, instead of People's Republic of China, as the issuer, because there is ambiguity on whether there is implicit guarantee from the government for SOE borrowings.

Part A2. Definitions of variables

This table discusses the definitions of the main variables used in the paper. All continuous variables are winsorized at 1% and 99% tails. Data for USD bonds are from Bloomberg, and data for RMB bonds are from CSMAR.

Variable	Description
Log(Amount)	Natural logarithm of bond amount issued (in USD).
Log(Age)	Natural logarithm of the number of years from a bond's issuance to the sovereign USD bond issuance date.
Log(Maturity)	Natural logarithm of the number of years from the sovereign USD bond issuance date to a bond's maturity date.
ListedIssuer	A dummy variable which is equal to one if the bond's issuer is listed on any exchange, and zero otherwise. Listed exchanges for bonds in our sample include Shanghai Stock Exchange, Shenzhen Stock Exchange, Hong Kong Stock exchange, NASDAQ, and NYSE.
IG	A dummy variable which is equal to one if the bond carries an investment grade rating at the sovereign USD bond issuance date, and zero otherwise. We classify bonds into investment grade using Moody's rating from Bloomberg. If Moody's rating is missing, we use rating by Standard & Poor's, and if both are missing, we use the rating by Fitch. IG is zero for unrated bonds.
BidAsk	The dollar difference between bid and ask prices in the secondary market, computed over the period 21 to 40 trading days prior to the announcement date of the new USD government bond issuance.
Δ*BidAsk*	Change in bid-ask spread calculated as post-announcement bid-ask spread minus pre-announcement bid-ask spread. The pre-announcement bid-ask spread is calculated as the average in window [-40, -21], and the post-announcement bid-ask spread is calculated as the average in window [13, 31], where t=0 is the announcement day.
Yldspread	Average daily yield spread in the window [-20,-1] before the announcement. Yield spread is the yield of USD bonds relative to interpolated U.S. Treasury yields, in percentage points.
DailyReturn	Daily returns are calculated as percentage change in clean price. For days with missing price, we use the last available price.
Volatility	The variance of daily bond returns over the period 21 to 40 trading days prior to the announcement date of the new USD government bond issuance. Daily returns are calculated as percentage change in clean price (mid-quote). For days with missing price, we use the last available price.
Δ*Volatility*	Change in variance of daily bond returns, calculated as post-announcement variance minus pre-announcement variance. The pre-announcement variance is calculated using [-40, -21] daily returns, and the post-announcement variance is calculated using [13, 31] daily returns, where t=0 is the announcement day.
PolicyBank	A dummy variable which is equal to one if the bond is issued by the China Development Bank or the Export-Import Bank of China, and zero otherwise.
LGFV	A dummy variable which is equal to one if the bond is issued by the Local Government Financing Vehicles, and zero otherwise.
Other SOE	A dummy variable which is equal to one if the bond is issued by SOEs other than the two policy banks or the Local Government Financing Vehicles, and zero otherwise.
Non-SOE	A dummy variable which is equal to one if the bond is issued by non-SOE firms, and zero otherwise.
Yield spread on RMB bonds	Yield of RMB bonds relative to interpolated China RMB government bond yields, in percentage points.
Yield spread on USD bonds	Yield of USD bonds relative to interpolated U.S. Treasury yields, in percentage points.

Short	A dummy variable which is equal to one if the bond's remaining maturity is less than five years, and zero otherwise.
Medium	A dummy variable which is equal to one if the bond's remaining maturity is between 5 and 10 years, and zero otherwise.
Long	A dummy variable which is equal to one if the bond's remaining maturity exceeds ten years, and zero otherwise.

Part A3. Corporate bond yield spread around the actual issuance date

This table reports the mean, median, the 25th percentile (Q1), the 75th percentile (Q3), and *t*-value of the change in average yield spreads of USD-denominated corporate bonds for various windows around the actual issuance date of the USD government bond. Panel A reports the results for all the bonds. Other panels report for different subsamples: bonds issued by the two policy banks (Panel B), by local government financing vehicles (LGFVs, Panel C), by SOEs other than LGFVs or the two policy banks (Panel D), and non-SOEs (Panel E). Yield spreads are expressed in percentage points. "[1] – [-1]" denotes the short window change in yield spread, calculated as the yield spread on day *t*=1 minus the yield spread on day *t*=-1, where the event date (*t*=0) is issuance date (October 26, 2017). For window "[1, 3] – [-3, -1]", the change in yield is measured as the average yield spread for the three trading days after the issuance minus the average yield spread for the three trading days before the issuance. The *t*-values test the null hypothesis that the mean spread change is zero and are adjusted by clustering the standard errors at the issuer level. The *p*-value reports the Wilcoxon signed-rank test for the null hypothesis that the median spread change is zero. The low statistical significance of the tests on the policy banks is because low degree of freedom. *, **, and *** denote significance at 10%, 5% and 1% levels, respectively.

Panel A. All bonds

Label	N	Mean	Median	Q1	Q3	*t*-value	*p*-value
[1] – [-1]	553	0.011	0.012	-0.002	0.025	(6.84)***	<0.000***
[1, 3] – [-3, -1]	553	0.002	0.004	-0.011	0.014	(1.01)	<0.011**
[1, 5] – [-5, -1]	553	0.000	0.003	-0.014	0.015	(0.19)	<0.137

Panel B. Policy Banks

Label	N	Mean	Median	Q1	Q3	*t*-value	*p*-value
[1] – [-1]	15	0.015	0.022	0.011	0.030	(3.77)	<0.027**
[1, 3] – [-3, -1]	15	-0.003	0.003	-0.010	0.008	(0.50)	<0.776
[1, 5] – [-5, -1]	15	-0.005	-0.003	-0.008	0.009	(0.77)	<0.733

Panel C: LGFVs

Label	N	Mean	Median	Q1	Q3	*t*-value	*p*-value
[1] – [-1]	65	0.019	0.018	0.007	0.032	(6.61)***	<0.000***
[1, 3] – [-3, -1]	65	0.008	0.010	0.001	0.017	(2.87*)**	<0.000***
[1, 5] – [-5, -1]	65	0.007	0.010	-0.001	0.021	(1.84)*	<0.003***

Panel D. Other SOEs

Label	N	Mean	Median	Q1	Q3	*t*-value	*p*-value
[1] – [-1]	381	0.008	0.011	-0.005	0.023	(4.05)***	<0.000***
[1, 3] – [-3, -1]	381	-0.002	0.001	-0.013	0.012	(0.97)	<0.466
[1, 5] – [-5, -1]	381	-0.003	0.001	-0.016	0.012	(1.44)	<0.296

Panel E. Non-SOEs

Label	N	Mean	Median	Q1	Q3	*t*-value	*p*-value
[1] – [-1]	92	0.014	0.015	0.000	0.026	(4.46)***	<0.000***
[1, 3] – [-3, -1]	92	0.011	0.012	-0.004	0.025	(2.70)***	<0.000***
[1, 5] – [-5, -1]	92	0.010	0.013	-0.010	0.024	(1.94)*	<0.003***

Part A4. Yield spread change from the first to the last day of each window

This table reports the mean, median, the 25th percentile (Q1), the 75th percentile (Q3), and *t*-value of the change in average yield spreads of USD-denominated corporate bonds for various windows around the announcement date of the USD government bond issuance. Panel A reports the results for all the bonds. Other panels report for different subsamples: bonds issued by the two policy banks (Panel B), by local government financing vehicles (LGFVs, Panel C), by SOEs other than LGFVs or the two policy banks (Panel D), and non-SOEs (Panel E). Yield spreads are expressed in percentage points and are calculated as the yield spread for the last day of each window minus that of the first day of each window. For example, "[1] – [-1]" denotes the change in yield spread, calculated as the yield spread on day t=1 minus the yield spread on day t=-1, where the event date (t=0) is announcement date (October 11, 2017). The *t*-values test the null hypothesis that the mean spread change is zero and are adjusted by clustering the standard errors at the issuer level. The *p*-value reports the Wilcoxon signed-rank test for the null hypothesis that the median spread change is zero. The low statistical significance of the tests on the policy banks is because low degree of freedom. *, **, and *** denote significance at 10%, 5% and 1% levels, respectively.

Panel A: All bonds

Label	N	Mean	Median	Q1	Q3	*t*-value	*p*-value
[1] – [-1]	553	-0.039	-0.034	-0.056	-0.015	(19.69)***	<0.000***
[5] – [-5]	553	-0.083	-0.066	-0.101	-0.042	(18.22)***	<0.000***
[12] – [-20]	553	-0.134	-0.122	-0.199	-0.044	(15.55)***	<0.000***
[12] – [-12]	553	-0.090	-0.076	-0.135	-0.024	(13.95)***	<0.000***

Panel B: Policy Banks

Label	N	Mean	Median	Q1	Q3	*t*-value	*p*-value
[1] – [-1]	15	-0.027	-0.031	-0.039	-0.019	(5.92)	<0.001***
[5] – [-5]	15	-0.080	-0.072	-0.111	-0.045	(6.06)	<0.001***
[12] – [-20]	15	-0.092	-0.129	-0.161	-0.012	(9.24)*	<0.003***
[12] – [-12]	15	-0.061	-0.054	-0.121	0.009	(8.28)*	<0.011**

Panel C: LGFVs

Label	N	Mean	Median	Q1	Q3	*t*-value	*p*-value
[1] – [-1]	65	-0.025	-0.017	-0.036	-0.008	(7.25)***	<0.000***
[5] – [-5]	65	-0.084	-0.068	-0.104	-0.048	(8.61)***	<0.000***
[12] – [-20]	65	-0.143	-0.126	-0.225	-0.038	(6.95)***	<0.000***
[12] – [-12]	65	-0.091	-0.073	-0.143	-0.007	(5.63)***	<0.000***

Panel D: Other SOEs

Label	N	Mean	Median	Q1	Q3	*t*-value	*p*-value
[1] – [-1]	381	-0.040	-0.037	-0.057	-0.018	(16.26)***	<0.000***
[5] – [-5]	381	-0.074	-0.063	-0.090	-0.041	(14.18)***	<0.000***
[12] – [-20]	381	-0.127	-0.116	-0.190	-0.050	(12.74)***	<0.000***
[12] – [-12]	381	-0.091	-0.077	-0.132	-0.027	(12.45)***	<0.000***

Panel E: Non-SOEs

Label	N	Mean	Median	Q1	Q3	*t*-value	*p*-value
[1] – [-1]	92	-0.050	-0.036	-0.067	-0.012	(8.81)***	<0.000***
[5] – [-5]	92	-0.121	-0.090	-0.168	-0.047	(8.04)***	<0.000***
[12] – [-20]	92	-0.161	-0.141	-0.289	-0.030	(5.89)***	<0.000***
[12] – [-12]	92	-0.086	-0.078	-0.180	0.000	(4.14)***	<0.000***