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Drivers of portfolio flows into Chinese debt securities amidst China's bond market development

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Abstract

The paper focuses on China's onshore bond market and the drivers of non-resident net portfolio flows into Chinese debt securities. Building on a theoretical model of push and pull factors as a foundation for the empirical analysis on drivers of bond flows into China, static and time-varying models are estimated to explain the importance of various push and pull factors in the context of China's bond market development. While China-specific pull factors, such as domestic economic growth prospects and asset returns, are important drivers of bond flows, the results reveal that global push factors, such as US interest rates and investor risk aversion, have recently gained significance as drivers of flows into China. This shift goes hand in hand with China's gradual bond market liberalization measures. The findings confirm China's continued bond market deepening and integration with the rest of the world.

Keywords: capital flows, portfolio flows, push factors, pull factors, financial openness
JEL: F32, F34, F36, F41, G11, G28

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Non-technical summary

FOCUS

The paper focuses on China's onshore bond market and the drivers of non-resident net portfolio flows into Chinese debt securities. Even with its relative isolation and a small foreign investor base, China's onshore bond market is already the second largest in the world. It continues to develop and open up gradually, despite concerns about de-globalization and persistent tensions between China and many advanced economies. It is therefore important to understand the key factors impacting capital flows in and out of China.

CONTRIBUTION

The research contributes to the literature on capital flows by providing a China-focused study on the drivers of bond flows. Using a comprehensive approach to studying bond flow drivers, we derive a simple small open economy model to highlight the advantages of the push-pull framework to be used. This model serves as a theoretical foundation for the empirical analysis. In addition to estimating static drivers, we allow for time-varying coefficients for both push and pull factors. The model uses unique monthly data on net non-resident portfolio investment into Chinese debt securities provided by the Institute of International Finance. The paper also complements the existing literature with a review of the main characteristics of China's onshore bond market, key liberalization steps, and bond market developments, as well as identification of recent trends in debt portfolio inflows into China by non-resident investors.

FINDINGS

While China-specific pull factors such as domestic economic growth prospects and asset returns remain the important drivers of net non-resident purchases of Chinese debt securities, global push factors such as changes in US interest rates and international investor risk aversion have recently gained significance as drivers of portfolio investment flows. This shift goes hand in hand with China's gradual bond market liberalization measures. The findings confirm the Chinese bond market's ongoing deepening and integration with the rest of the world.

1 Introduction

The Chinese economy is expected to remain on a path of gradual structural transformation and reform over the coming years. With the ongoing development of the Chinese financial market, China's significance in the global financial system should continue to increase, despite persisting tensions between China and many advanced economies. This interconnectedness with the rest of the world warrants the interest of market participants, policymakers, and academia. A globally relevant aspect of China's reform process is the cautious and controlled liberalization of the country's capital account. While progress in this area has been slow, this study is motivated by the potential impact on the structure of global capital markets from reduced restrictions on movement of investment flows between China and the rest of the world.

This paper focuses on China's onshore bond market and the drivers of non-resident net portfolio flows into Chinese debt securities. Even with its relative isolation and a small foreign investor base, China's onshore bond market is already the second largest in the world. As China's global economic might solidifies and investing in China becomes easier, global investors will likely continue to reallocate the country exposure of their portfolios in favour of China. Easier access, combined with the fact that China's bond market is developing rapidly, has already triggered significant net portfolio investment flows into Chinese debt securities. This trend should continue over the longer term, regardless of notable short-term volatility. On the other hand, the Chinese government's recent intervention into private sector affairs together with ongoing diplomatic disputes between several advanced economies could delay market deepening and financial integration. Thus, a more nuanced understanding of the key factors impacting capital flows in the Chinese context is important.

The drivers of capital flows to emerging markets (EM) have received considerable academic attention in recent decades.[1] Calvo, Leiderman, and Reinhart (1993) and Fernández-Arias (1996) were the frontrunners in creating the push-pull framework in which external "push factors", such as US interest rates, and country-specific "pull factors", such as domestic asset returns, explain capital flows between countries. Existing empirical results show that low US interest rates and high investor risk appetite "push" capital into emerging markets (e.g., Ghosh et al., 2014; Byrne & Fiess, 2016; Koepke, 2018; Koepke 2018b), while attractive conditions in the destination country such as

[1] The related Literature chapter in Section 3.1 discusses main findings of recent related research.

high economic growth or elevated asset returns "pull" capital in (e.g., Ghosh & Ostry, 1993; Chuhan et al., 1998; Mercado & Park, 2011; Giordani et al., 2017).

The motivation of the academic focus on the push and pull factors of capital flows arise from the need to fine-tune domestic policies according to global and domestic circumstances. If push factors dominate as the drivers of portfolio flows into an emerging market economy, the country's policymakers need to face the fact that domestic policymaking can only have a limited impact on capital flow movements, and that domestic financial resiliency needs to be underpinned to weather the volatility of capital flows. Such countries may be interested in using capital controls as a form of protection against market volatility. When pull factors are more relevant for the economy, domestic policies can be used to influence capital flows in terms of their volatility, composition, and size. As existing literature lacks studies on push and pull factors solely in the Chinese context, this paper aims to fill the gap for the benefit of policy analysis on China.

This paper contributes to the literature on capital flow drivers by addressing some of the weak points of existing research. First, the existing literature tends to group EM countries together under the assumption that capital flows are driven by similar factors regardless of the destination country.[2] A cursory glance reveals that portfolio flows into China are not correlated with the rest of the emerging market universe, implying that China-related investment decisions are based on different considerations than those related to emerging market economies more broadly. Indeed, these unique characteristics necessitate a separate analysis for China. Limited data availability likely precluded such research earlier.

Second, the push-pull literature focuses heavily on empirical analysis. This paper takes a more comprehensive approach. We derive a simple small open economy model to justify the push-pull framework, which then functions as a theoretical foundation for the subsequent empirical analysis.

Third, emerging markets are dynamic. They change continuously on the back of structural reforms and economic development. As such, limiting capital flow analysis on static push and pull factors seems ill-advised, even though simplicity has its own benefits. In addition to the common approach of estimating static drivers of portfolio flows, we take the analysis deeper by allowing for time-varying coefficients for push and pull factors. As such, the study takes into account China's bond market liberalization steps that have fundamentally changed the domestic bond market.

[2] See Koepke (2018b) for a comprehensive survey on the drivers of capital flows into emerging markets.

Fourth, due to scarce availability of monthly data, conducting a China-specific study has not been feasible before. In the empirical part of this paper, unique monthly data on net non-resident portfolio investment into Chinese debt securities provided by the Institute of International Finance (IIF) play a key role. As the data series for China is relatively new, starting in January 2015, it has not been widely used in empirical studies.

In addition to addressing the above-mentioned issues, this paper complements the existing literature by reviewing the main characteristics of China's onshore bond market, key liberalization steps, and bond market developments, as well as by identifying recent trends in debt portfolio inflows into China by non-resident investors.

Because of China's capital controls, the country's capital market has been somewhat insulated from international developments. In this context, an underlying assumption of this paper is that China-specific pull factors have played an integral role in driving portfolio flows into China. With China's bond market becoming more integrated into the world market, we further study the extent of push factors driving portfolio flows into Chinese debt securities in response to changing global conditions. We first estimate two static models explaining the drivers of China's bond flows using the robust least squares method. The results vary depending on the model selection method used. Results from one of the static models show that domestic pull factors such as economic growth prospects and domestic asset returns are still the dominant drivers of portfolio investment into China's bond market. The second model shows that global factors (specifically US interest rates and global risk aversion) are also significant in explaining China's net debt flows. Because of the partially mixed results, a static model is unlikely to be the best suited specification for China, given that the country's recent liberalization steps and other material bond market developments have likely changed the drivers of flows into China.

The subsequent part of the empirical work lays out an alternative specification of the model that allows for time-varying coefficients for China's push and pull factors. The estimations are performed with a rolling-window robust least squares regression. The results show that there is substantial variation in the push and pull factors' coefficients and their significance over time. It seems that such global developments as changes in the risk aversion of international investors and the level of interest rates in the US have increased their importance in explaining portfolio flows into China over the past couple of years. This time frame coincides with the launch of the Northbound Bond Connect and the inclusion of Chinese bonds into global benchmark indices.

This paper is structured as follows. Following this introduction, Section 2 describes the main features of China's bond market, and provides a review of the recent key events, including

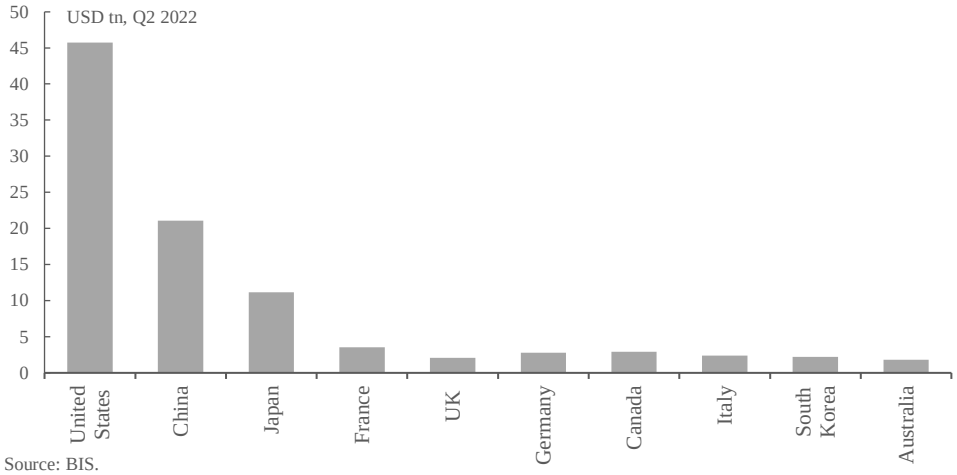
capital account liberalization steps, that have impacted China's bond market. It finishes with a description of the trends in non-resident portfolio inflows into Chinese debt securities. Section 3 provides an overview of recent literature on push and pull factors that drive portfolio flows to emerging markets. The section also lays out a theoretical framework for push and pull drivers, providing a foundation for the successive empirical analysis. Section 4 focuses on the empirical study in which two static models are first estimated to explain the drivers of debt flows into China. The model is then extended to allow for time-varying push and pull factors of Chinese portfolio debt flows. Section 5 concludes.

2 China's onshore bond market

2.1 Overview of the Chinese bond market

The Chinese domestic bond market is currently the second largest in the world after the US and ahead of Japan (Figure 1). According to data provided by the Asian Bond Market Initiative,[3] the size of the Chinese local currency bond market was CNY 127.4 trillion (USD 18.5 trillion) in December 2022, which was equivalent to 105 % of the country's nominal GDP (Figure 2). China's bond market has grown briskly in recent years. Over the five-year period ending in December 2022, the size of the market expanded annually by 16 % on average.

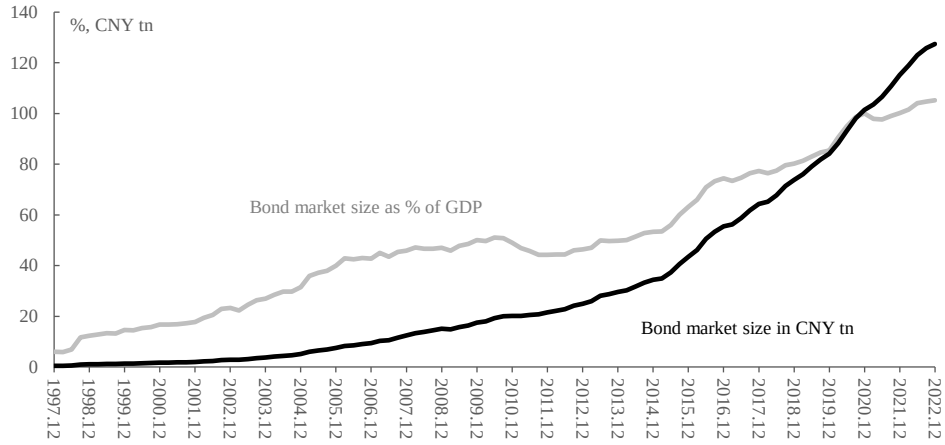
Figure 1 Largest Debt Securities Markets in the World (Domestic Debt)



Source: BIS.

[3] AsianBondsOnline, asianbondsonline.adb.org, is a one-stop clearinghouse for information on sovereign and corporate bonds. It is part of the Asian Bond Markets Initiative, an ASEAN+3 project supported by the Asian Development Bank. AsianBondsOnline is funded by Japan's Ministry of Finance through the Investment Climate Facilitation Fund.

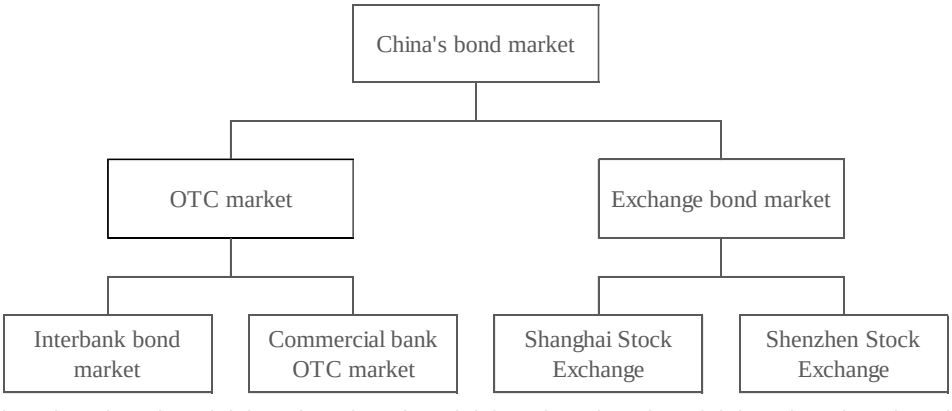
Figure 2 **Size of China's Local Currency Bond Market**



Source: AsianBondsOnline.

The Chinese bond market consists of an over-the-counter market and an exchange bond market (Figure 3). The former contains an interbank bond market and a commercial bank over-the-counter market, while the latter consists of the Shanghai Stock Exchange and the Shenzhen Stock Exchange. By providing a wholesale market for institutional investors, the interbank bond market is the most significant piece of the bond market. The over-the counter market of commercial banks and the exchange bond market are both smaller and more retail-focused.

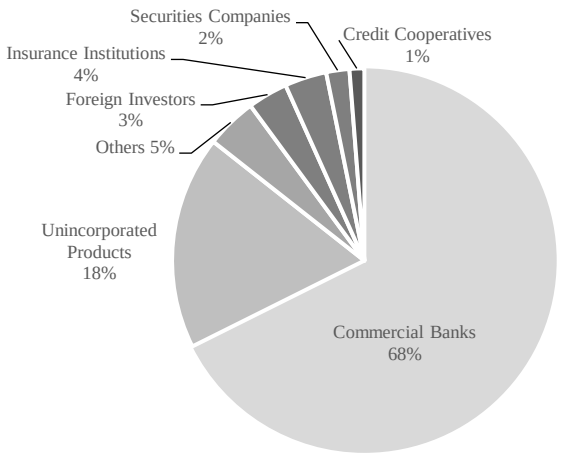
Figure 3 **Structure of China's Bond Market**



The different parts of the bond market are regulated separately by multiple entities: the People's Bank of China (PBOC), the Ministry of Finance, the China Banking and Insurance Regulatory Commission, the China Securities Regulatory Commission, the National Development and Reform Commission, and the National Association of Financial Market Institutional Investors. This fragmented regulatory framework reduces transparency and holds back bond market development. Accordingly, the PBOC is currently coordinating a harmonization of bond market regulations, yet it is unclear when the process will be completed.

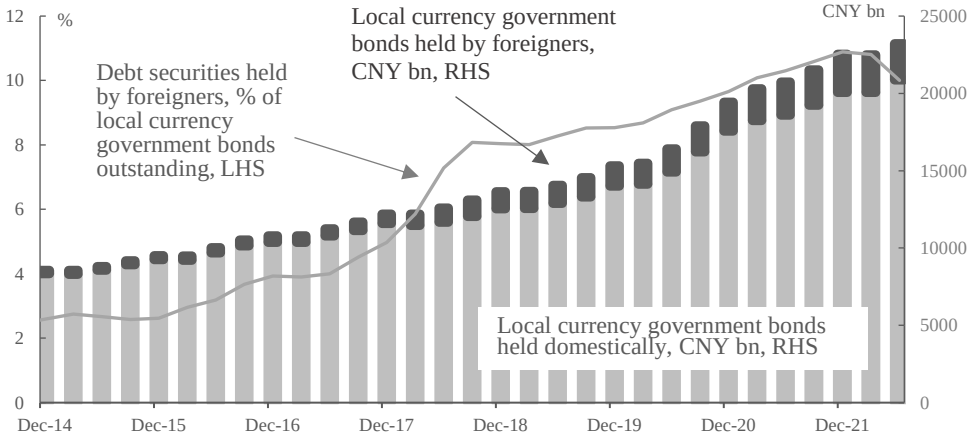
Public sector entities are the dominant issuers in the Chinese bond market. Since 2020, central and local governments, together with policy banks, have accounted for well over 80 % of local currency bond market issuance. On the investor side, commercial banks form the largest group of market participants. They represented 68 % of the investor base in the interbank bond market at the end of 20224 (Figure 4). Foreign investors accounted for just 3 % of the investor base in 2022, but their involvement should increase in the coming years as China continues to integrate with global financial markets. With respect to government bonds, the share of foreign ownership is somewhat higher – 10 % in Q2 2022 (Figure 5). Nevertheless, this share remains below that of other emerging Asian market economies such as Malaysia and Indonesia (24 % and 16 %, respectively).[5]

Figure 4 **China's Interbank Bond Market by Investor in 2022**



Sources: CEIC, ChinaBond.

Figure 5 **Foreign Investors' Participation in China's Government Bond Market**

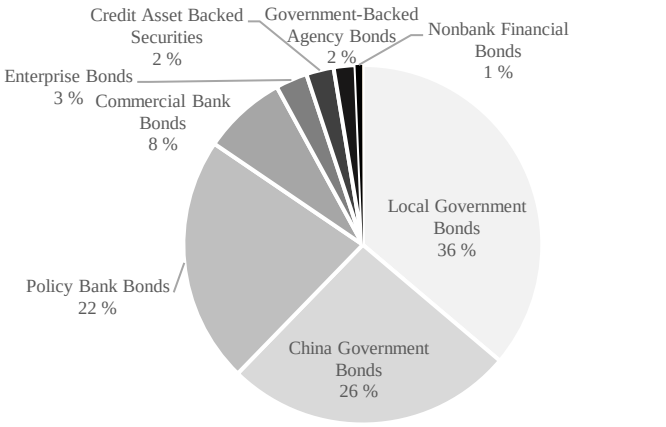


Sources: CEIC, AsianBondsOnline.

[4] CEIC, ChinaBond (China Central Depository & Clearing Co. Ltd.), chinabondindices.com.
[5] AsianBondsOnline, asianbondsonline.adb.org.

Types of instruments available in the Chinese bond market include government and quasi-government bonds (such as sovereign bonds, policy bank bonds, and local government bonds), credit bonds (enterprise bonds, corporate bonds, and medium-term notes), financial bonds, treasury futures, green bonds, as well as asset-backed securities (Figure 6). The maturities of Chinese onshore bonds range from three months to 50 years, although issuance in recent years has been dominated by relatively short maturities.

Figure 6 **China's Bond Market by Bonds Outstanding in 2022**



Source: CEIC.

China's bond market has gone through notable changes in recent years, yet there is still significant room for further development. Such issues as thin market liquidity, financial market instability, lack of sufficient hedging tools, skewed bond market ratings by domestic credit rating agencies, implicit government guarantees on certain instruments, a fragmented regulatory environment, and inadequate legal and accounting systems need to be addressed over the coming years as China gradually continues to open up its financial system and liberalize its capital account.[6]

2.2 Recent key steps in China's bond market development

This chapter discusses the key reforms and market developments we assess have the potential of significantly impacting China's bond market and associated portfolio inflows. They are summarized in Table A1 in the Appendix. The opening of China's capital account has largely followed the IMF's institutional view regarding suitable sequencing of the liberalization process (IMF, 2012; IMF, 2019). Following various actions to liberalize FDI flows, which tend to be longer-term and more

[6] For a detailed discussion on the characteristics and issues of China's bond market, see IMF (2019).

stable in nature, the Chinese government has lately focused on opening up portfolio investment, which is still the most restricted part of China's capital account. Moreover, inflows have generally been liberalized ahead of outflows. As portfolio flows are more volatile, China's approach to first relax restrictions on inflows promotes the development of the domestic financial market. China has only recently started to ease restrictions on portfolio outflows. The process overall has been characterized by gradual and carefully sequenced policy steps (IMF, 2019).

The Qualified Foreign Institutional Investor (QFII) program, introduced in November 2002, was the first step in the opening of Chinese capital markets. The program granted foreign investors access to a limited quota of onshore equities and bonds. For portfolio investment flows out of China, the Qualified Domestic Institutional Investor (QDII) program was launched in April 2006 for authorized onshore asset managers. In August 2010, foreign central banks and other qualified foreign institutions were given access to the China Interbank Bond Market (CIBM). In December 2011, China expanded the QFII scheme by launching the RMB Qualified Foreign Institutional Investor (RQFII) program, which allowed investment in mainland China in Chinese renminbi (RMB) obtained offshore. In 2013, China allowed QFIIs to participate in the CIBM and the access was enhanced by various initiatives in 2015 and 2016. Since February 2016, medium-term and long-term institutional investors, including commercial banks, insurance companies, securities firms, fund management companies, and other asset management institutions, have been permitted to invest in the CIBM. The central bank retains the ability to restrict investors considered short-term or speculative in nature. A highly significant reform step took place in July 2017 with the launch of the Northbound Bond Connect.[7] Bond Connect is a market access scheme that lets overseas investors trade in mainland China's bond markets via Hong Kong SAR without quota limits. Southbound Bond Connect,[8] launched on September 24, 2021, lets institutional investors in mainland China invest in overseas debt securities via Hong Kong subject to initial daily and annual quotas.

On the back of China's financial market and capital account reforms, the IMF in 2015 found that the Chinese renminbi met the criteria for the currency's inclusion into the special drawing rights (SDR) basket.[9] The SDR inclusion, effective October 2016, marked an important step in

[7] Northbound Bond Connect, www.chinabondconnect.com/en/Northbound/Rules-And-Policy/Overall-Scheme.html.
[8] Southbound Bond Connect, www.chinabondconnect.com/en/Southbound/Rules-And-Policy.html.
[9] Currencies included in the SDR basket must meet an *export criterion* and a *freely usable criterion*. A currency meets the export criterion if its issuer is an IMF member or a monetary union that includes IMF members, and is also one of the top five world exporters. For a currency to be determined "freely usable" by the IMF, it must

China's capital market integration. According to the IMF,[10] inclusion in the SDR improves the attractiveness of the RMB as an international reserve asset, thereby helping with the diversification of global reserves. As per the IMF's 2015 review,[11] the SDR basket consisted of five currencies, the US dollar (with a weight of 41.73 %), the euro (30.93 %), the RMB (10.92 %), the Japanese yen (8.33 %), and the British pound (8.09 %). On May 14, 2022, the IMF announced an adjustment to the composition of the SDR basket,[12] increasing the weights of the US dollar and the renminbi to 43.38 % and 12.28 %, respectively, to better reflect their roles in international trade and finance. At the same time, the weights of the euro, yen, and pound were reduced (to 29.31 %, 7.59 %, and 7.44 %, respectively). IMF data[13] show that RMB holdings by foreign central banks have increased by 230 % since the end of 2016, reaching USD 297.8 billion by Q3 2022. The RMB accounted for 2.8 % of total global foreign exchange reserves as of Q3 2022, relatively close to the shares in the Australian dollar (1.9 %) and the Canadian dollar (2.5%), yet notably below those of the British pound (4.6 %) and the Japanese yen (5.3 %). Considering that China is currently the second largest economy in the world (accounting for 18 % of world GDP in 2022[14]) and its capital market development is progressing rapidly, further inflows are likely as central banks globally increase their allocation of RMB-denominated assets, particularly sovereign debt securities.

As China's capital markets have liberalized and developed gradually, international bond index providers have recently concluded that Chinese bonds can be included into their global benchmark bond indices. In January 2019, Bloomberg announced its intention to include Chinese government and policy bank bonds in the Bloomberg-Barclays Global Aggregate Bond Index.[15] China's weight in the index was set to increase incrementally to 6.03 % over a 20-month period, starting in April 2019. Chinese bonds also became eligible for inclusion into Bloomberg's Global Treasury and EM Local Currency Government Indices.

In September 2019, JPMorgan Chase & Co announced that it would phase Chinese government bonds into its emerging market indices over a 10-month period starting at the end of

be widely used to make payments for international transactions and widely traded in the principal exchange markets.

[10] www.imf.org/en/News/Articles/2016/09/29/AM16-NA093016IMF-Adds-Chinese-Renminbi-to-Special-Drawing-Rights-Basket.

[11] www.imf.org/en/About/Factsheets/Sheets/2016/08/01/14/51/Special-Drawing-Right-SDR.

[12] www.imf.org/en/News/Articles/2022/05/14/pr22153-imf-board-concludes-sdr-valuation-review.

[13] data.imf.org/?sk=E6A5F467-C14B-4AA8-9F6D-5A09EC4E62A4.

[14] IMF WEO October 2022.

[15] www.bloomberg.com/company/press/bloomberg-confirms-china-inclusion-bloomberg-barclays-global-aggregate-indices.

February 2020, with China's index weight eventually reaching a maximum of 10% of the main index, JP Morgan Government Bond Index Emerging Markets Global Diversified.[16]

FTSE Russell confirmed in March 2021 that Chinese government bonds would be included in the FTSE World Government Bond Index.[17] The inclusion process, which commenced at the end of October 2021, transpires over a period of 36 months, and takes China's weight in the index to 5.25 %. The inclusion of Chinese bonds into global benchmark indices is expected to have a material impact on portfolio inflows into China as passive investors following a benchmark buy Chinese bonds. Indeed, Arslanalp et al. (2020) discuss the role of benchmark-driven investments in emerging market economies' local bond markets, pointing out that benchmarks are increasingly shaping global portfolio allocation dynamics.

2.3 Stylized facts about portfolio flows into Chinese debt securities

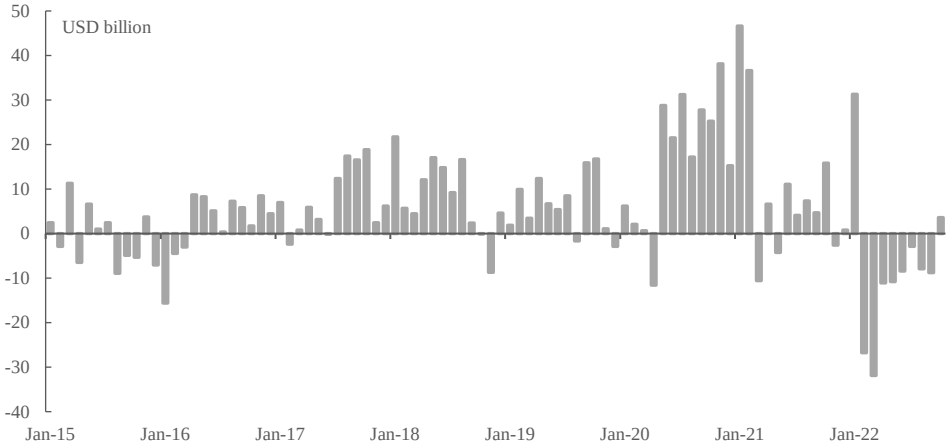
This section provides a brief overview of recent trends in purchases of China's onshore debt securities by non-resident investors. We utilize data compiled by the Institute of International Finance,[18] which provides unique monthly data on net non-resident purchases of emerging market bonds (and stocks) that are consistent with official balance of payments statistics from national authorities. The data set's EM universe encompasses 25 economies; data on net flows to China are available from January 2015 onwards.

Monthly net non-resident purchases of Chinese debt securities have increased in recent years (Figure 7). While flows have been quite volatile, inflows have significantly surpassed outflows. Indeed, China has attracted an average net investment inflow of USD 5.6 billion into its bond market every month since January 2015. Accordingly, accumulated portfolio flows into Chinese bonds reached USD 529 billion in October 2022, with China's share of total EM debt inflows accounting for 30 % (Figure 8). Scaling China's accumulated bond inflows since January 2015 with the country's GDP implies further growth potential over the coming years; China's inflows are equivalent to 2.9 % of the country's 2022 GDP, which is higher than the respective shares of Malaysia (1.5 % of GDP) and Indonesia (1.9 %), yet well behind South Korea's more developed bond market (9.6%).

[16] www.bloomberg.com/news/articles/2019-09-04/jpmorgan-says-china-bonds-to-be-included-in-benchmark-indexes-k052vhyo.
[17] www.lseg.com/content/dam/ftse-russell/en_us/documents/country-classification/fixed-income-country-classification-march-2021-results.pdf

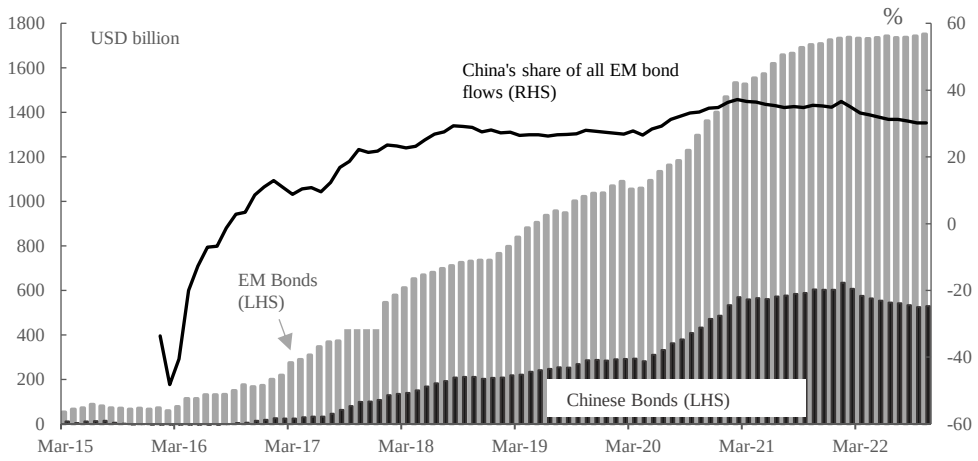
[18] The Institute of International Finance (IIF), www.iif.com.

Figure 7 **Net Non-Resident Purchases of Chinese Bonds**



Source: IIF.

Figure 8 **Cumulative Net Non-Resident Purchases of EM & Chinese Bonds**

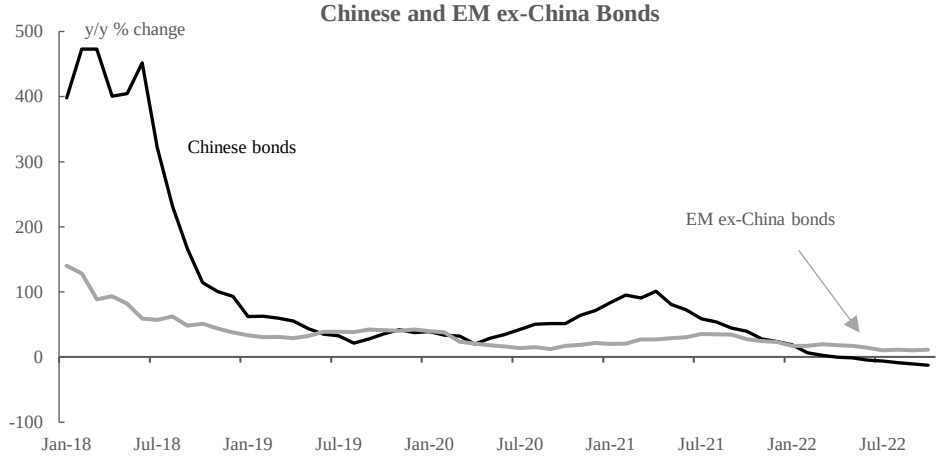


Sources: IIF, author's calculations.

Portfolio flows into EM bonds overall have risen rapidly in recent years, with the cumulative stock of investment into such debt securities (EM excluding China) increasing by 36 % year-over- year on average between January 2018 and October 2022 (Figure 9). Nevertheless, the pace of purchases of Chinese bonds significantly outperformed the EM peer group as non-resident investment stock into China's debt securities grew on average by 93 % year-over-year during the same period. Compared to the EM ex-China universe, the growth of debt investment into China was particularly strong in 2018, potentially reflecting the launch of the Northbound Bond Connect in mid-2017. In 2019, bond flow dynamics were relatively synchronized across the EM group with flows into China and its peers growing in tandem. From mid-2020 to late-2021, the growth of investment into Chinese debt securities outperformed the peer group again. China's rapid economic rebound from the COVID-19 pandemic in the second half of 2020 and the addition of Chinese bonds

to certain global bond indices that concluded at the end of 2020 appear to have triggered portfolio allocation adjustments by asset managers globally. Nonetheless, concerns regarding China's slowing economic growth momentum amidst the government's zero tolerance policies toward COVID-19 infections and the resultant lockdowns likely contributed to smaller bond inflows in 2022.

Figure 9 **Growth of Cumulative Portfolio Inflows into Chinese and EM ex-China Bonds**



Sources: IIF, author's calculations.

As indicated by notably higher z-scores of observations in the time series, debt flows into China became more volatile during the pandemic. The z-scores also reveal a clear outlier – the observation for January 2021, when China attracted USD 46.6 billion of net portfolio investment into its debt securities. The data point's z-score of 3.2 is above a standard cut-off value of ±3 standard deviations from the sample mean, which likely reflects China's addition to the global benchmark bond indices by Bloomberg and JPMorgan Chase & Co in the final months of 2020.

Demand for China's debt securities has been higher than demand for Chinese equities in recent years. The country on average attracted portfolio investment into equities valued at USD 3.1 billion a month between January 2015 and October 2022, or slightly more than half of the amount of flows into bonds. Between January 2015 and October 2022, China's cumulative stock of non-resident equity investments reached USD 293 billion.

Interestingly, international investors' monthly purchases of Chinese bonds and EM ex-China bonds do not seem to be correlated (correlation coefficient of -0.02 between January 2015 and October 2022), implying that flows into China are driven by other factors than those into the rest of the EM universe. For comparison purposes, the correlation between Chinese equity flows and EM ex-China equity flows is somewhat higher, 0.32. While these findings imply that the drivers

of portfolio investment into Chinese debt securities should be studied separately from other EM flows, most of the related literature assumes emerging market economies are all alike and are subject to similar drivers of portfolio flows. We break down the specific push and pull factors that drive international investments into China's bond market in Section 4.

3 The push and pull framework for capital flows

3.1 Related literature

A vast body of empirical literature exists regarding drivers of capital flows to emerging markets. Calvo, Leiderman and Reinhart (1993) and Fernández-Arias (1996) were the leaders in studying the contributions of external push factors and country-specific pull factors as drivers of international capital flows. The former analyzed flows in the Latin American context, while the latter focused on a sample of 13 countries (China not included). More recently, Koepke (2018b) reviewed and summarized key findings of subsequent studies that have found evidence on the significance of both factors in driving capital flows into emerging market economies. For debt flows particularly, there is strong evidence for the importance of push factors and mixed evidence for pull factors being significant drivers of flows. Yeyati and Zuñiga (2016) and Hannan (2018) also provide comprehensive reviews on the literature regarding push and pull drivers of capital flows. Nonetheless, as pointed out by Koepke (2018b), empirical results may differ across studies on the back of different country samples or definitions of which countries are classified as emerging markets. Therefore, comparing studies and drawing country-specific conclusions from the existing literature is difficult. Moreover, despite its size, China is often omitted from the EM group (likely due to data availability issues).

Push factors help determine the supply of capital seeking diversification opportunities abroad. They include such variables as interest rates in advanced economies, particularly the US, or corresponding rate expectations, international investors' risk appetite, and the output growth of mature economies. For instance, low advanced economy interest rates trigger search-for-yield behaviour, pushing portfolio flows into emerging markets and vice versa (Fernández-Arias, 1996; Ghosh et al., 2014; Byrne & Fiess, 2016; Koepke, 2018b; Li et al., 2018). Similarly, Koepke (2018) and Dahlhaus and Vasishtha (2020) show that international investor expectations of US Federal Reserve monetary policy were a significant driver of bond flows, especially during the 2013 "Taper Tantrum" episode that saw notable capital flight out of the EM universe, including China. Elevated international investors risk appetite is another push factor that drives portfolio investments into EMs,

while higher risk aversion triggers capital outflows from EMs (Baek, 2006; Milesi-Ferretti & Tille, 2011; Fratzscher, 2012; Ahmed & Zlate, 2014; Ghosh et al., 2014; Giordani et al., 2017; Mercado, 2018b).

Pull factors typically reflect economic activity in emerging markets, asset return prospects, and country risk indicators. Favourable conditions in the destination country (e.g., strong economic growth, sound domestic economic fundamentals, or higher country credit ratings) imply that an emerging economy is an appealing investment destination on the back of higher potential profits, pulling capital flows into its financial markets (Ghosh & Ostry, 1993; Chuhan et al., 1998; Mercado & Park, 2011; Giordani et al., 2017). In a closely related study focused on surges of inflows to emerging markets (including China) and their determinants, Ghosh et al. (2014) find that recipient countries' fundamental factors such as capital account openness, an exchange rate regime and external financing needs, influence the magnitude of capital flow surges. Meanwhile, Capolare et al. (2022) add to the push and pull factor literature, showing that news media coverage is an important determinant of cross-border portfolio flows, particularly for bond inflows and outflows into and from the US. Similarly, Choi et al. (2023) show that domestic uncertainty also functions as a local pull factor, with elevated uncertainty in the destination country (including China) reducing foreign capital inflows, particularly bank credit and portfolio bond inflows.

Push and pull factors are not static but tend to vary over time based on global and domestic economic conditions (Milesi-Ferretti & Tille, 2011; Fratzscher, 2012; Erduman & Kaya, 2016; and Lo Duca, 2012). Lo Duca (2012), for instance, studies a group of eight EM countries including China and shows that push and pull factors are subject to substantial time variation, with major changes in the importance of the drivers of flows coinciding with notable market events or shocks. The analysis by Fratzscher (2012) of portfolio flows to 50 advanced and emerging market economies (including China) similarly finds that push factors were more dominant than pull factors during the 2008–2009 global financial crisis, yet during the recovery period portfolio flows were driven more strongly by pull factors such as macroeconomic fundamentals, quality of institutions, and policies of recipient countries.

Another relevant strand of literature studies the connection between the drivers of capital flows and a destination country's capital account openness. Ghosh et al. (2018) provide a detailed discussion of the issues related to capital flow management and capital account liberalization that guide emerging market policymakers dealing with large and volatile flows. In this context, Cerdeiro and Komaromi (2021), who include China in their analysis, find that countries with a higher degree of financial openness are more susceptible to certain push and pull factors, including changes in US

interest rates in the case of equity flows and expected domestic returns in the case of debt flows. Interestingly, the authors find no robust evidence that higher financial openness leaves countries more exposed to fluctuations in global investor risk appetite.

3.2 Theoretical model for push and pull factors

The existing capital flow literature typically leans heavily on empirical studies without a solid backing of economic theory. Here, we take a more comprehensive approach, deriving a simple small open economy model to justify the push-pull framework that functions as the theoretical foundation for the subsequent empirical analysis. While model presented here is similar to the conceptual framework of Cerdeiro and Komaromi (2021), who study capital account restrictions and their impact on capital flows, it is more straightforward and focuses on justifying the inclusion of domestic economic growth, international interest rates, and risk aversion as explanatory variables in empirical estimations.

3.2.1 The small open economy

Consider the following two-period small open economy. The economy is populated by a continuum of households with logarithmic preferences over consumption. The period 1 endowment $y_1 > 0$ is deterministic, while output in period 2 is uncertain:

$$ln y_2 = \mu + \varepsilon, \ with \ \varepsilon \sim N(0, \sigma_\varepsilon^2). \quad (1)$$

Assume that $\mu = ln\, y_1 + g - 0.5\sigma_\varepsilon^2$, implying that the economy's expected growth rate is g. A household can trade shares in period-2 output (i.e., a GDP-linked bond) with risk averse international investors whose pricing kernel is described below. Let v_1 denote the period-1 value of period-2 output, while α is the fractional shares sold to international investors in period 1. The representative household maximizes:

$$U = ln\, c_1 + \boldsymbol{E}[ln\, c_2] \quad (2)$$

over α and faces the following budget constraints:

$$c_1 = y_1 + \alpha v_1 \quad (3)$$

$$c_2 = y_2(1-\alpha). \quad (4)$$

The first-order condition with respect to α can be written as:

$$\frac{\partial U}{\partial \alpha} \equiv \frac{v_1}{c_1} + \boldsymbol{E}\left[-\frac{y_2}{c_2}\right] = 0 \quad (5)$$

$$\frac{v_1}{c_1} = \boldsymbol{E}\left[\frac{y_2}{c_2}\right]. \quad (6)$$

Using the household's budget constraint, the expression can be rewritten as:

$$\frac{v_1}{y_1+\alpha v_1} = \frac{1}{1-\alpha}. \quad (7)$$

For a given share price v_1, this expression describes the economy's supply of shares, which allows for the endogenous variables to be solved. The above expression can be re-arranged to define net capital inflows as a share of GDP:

$$F \equiv \frac{\alpha v_1}{y_1} = \frac{v_1}{2y_1} - \frac{1}{2}. \quad (8)$$

3.2.2 International investors

In line with Cerdeiro and Komaromi (2021), we borrow from literature on sovereign default to introduce risk aversion in international capital markets (Arellano & Ramanarayanan, 2012), and assume that foreign investors set the price for the GDP-linked bond using the following stochastic discount factor:

$$m = e^{-r-(\lambda\varepsilon+0.5\lambda^2\sigma_\varepsilon^2)}, \ with\ \lambda \geq 0\ , \quad (9)$$

where r is the risk-free interest rate and λ determines the size of the risk premium. Bianchi, Hatchondo and Martinez (2018) explain that this formulation results in a positive risk premium because the payoff from the bond is more valuable to lenders when the economy experiences a negative shock (i.e., the income shock ε is low). The value of λ describes the lenders' underlying

level of risk aversion, as well as the small open economy's correlation with the lenders' income process or the degree of diversification of foreign lenders. If λ is 0, lenders are risk-neutral.

3.2.3 Equilibrium capital flows

Using the distributional assumptions about y_2, the price of the GDP-linked bond must satisfy:

$$\frac{v_1}{y_1} = \boldsymbol{E}\left[m\frac{y_2}{y_1}\right] = \boldsymbol{E}\left[e^{-r-(\lambda\varepsilon+0.5\lambda^2\sigma_\varepsilon^2)}e^{\mu+\varepsilon}\right] \tag{10}$$

$$= \frac{e^g}{e^{r+\lambda\sigma_\varepsilon^2}} \ . \tag{11}$$

The term $\lambda\sigma_\varepsilon^2$ measures the risk premium that risk-averse foreign lenders apply to the country's uncertain future income. Inserting this expression into (8), the solution for capital inflows as a share of GDP is obtained:

$$F = \frac{1}{2}\frac{e^g}{e^{r+\lambda\sigma_\varepsilon^2}} - \frac{1}{2}. \tag{12}$$

To compare this expression with typical regression specifications in empirical literature, a first order approximation[19] is taken at $(\bar{r}, \bar{g}, \bar{\lambda}) = (0,0,0)$, which simplifies the algebra. This yields:

$$F \approx -\frac{1}{2} + \underbrace{\frac{1}{2}g}_{(i)} - \underbrace{\frac{1}{2}r}_{(ii)} - \underbrace{\frac{1}{2}\sigma_\varepsilon^2\lambda}_{(iii)} . \tag{13}$$

The expression corresponds to existing empirical literature regarding the push and pull drivers of capital flows to emerging market economies: (i) higher domestic economic growth (g) results in larger capital inflows; (ii) higher interest rates in international financial markets (r) cause capital outflows; and (iii) higher risk aversion (λ) diminishes capital inflows to emerging markets. We use this theoretical model for push and pull factors of capital flows as the starting point for the following empirical study of drivers of debt portfolio flows into China discussed in Section 4.

[19] The first-order approximation is $L(x) = f(0) + f'(0)x$.

4 Push and pull factors of Chinese debt flows

We begin the empirical study of the drivers of portfolio debt flows to China by estimating two static models. These empirical models and their results are presented and discussed in Sections 4.1 and 4.2. As China has relaxed restrictions on its capital flows and become more integrated into the global financial markets, it would be naïve to assume that the coefficients of Chinese debt flows' push and pull factors have remained constant over time. To take such developments into account, we provide an extension to the static models in Section 4.3 to study time-varying push and pull factors of Chinese portfolio debt flows.

4.1 Empirical model and data

We estimate variants of the following general model for China's debt portfolio flows:

$$Flows_t = c + \alpha_1 Flows_{t-1} + \sum_{i=1}^{n} \beta_i \cdot Pull\ factors_{it} + \sum_{i=1}^{n} \gamma_i \cdot Push\ factors_{it} + \varepsilon_t, \qquad (14)$$

where $Flows_t$ are net non-resident purchases of bonds from balance of payments -consistent portfolio flows data. Pull factors are China-specific variables. Push factors are advanced economy (US) variables. All variables, except the lagged independent variable $Flows_{t-1}$, are measured in time *t*, reflecting the assumption that investment decisions are dynamic and respond to current events in financial markets. We have chosen robust least squares (RLS) regression (M-estimation) as the estimation method, given that it is less sensitive to outliers in the data set.[20] The COVID-19 pandemic, for instance, caused some extreme outcomes for emerging market capital flows. As such observations represent true outcomes, they cannot be justifiably removed from the sample, yet they are causing a violation of the assumption of normally distributed residuals in the ordinary least squares regression.

For the dependent variable $Flows_t$, we use monthly data on net non-resident purchases of Chinese bonds (i.e., portfolio debt flows) in billions of USD (Figure 7). As noted earlier, the data are provided by the IIF and collected from national sources such as central banks and national statistics agencies. The characteristics of the data set were discussed above in Section 2.3. The series is a proxy for portfolio flows as measured in the balance of payments, yet it has a higher frequency

[20] Estimations were first performed using ordinary least squares (OLS); however, as the condition of normality of the residuals was not met, a robust estimator was chosen instead.

and a shorter publication lag than official quarterly balance of payments data, allowing for a timelier analysis of capital flow movements. The data set includes 94 observations, covering the period from January 2015 to October 2022. Table A2 in the Appendix provides descriptive statistics of the data series.

For the independent variables in the estimation exercise, we consider various alternatives for push and pull factors. Table A3 in the Appendix summarizes the explanatory variable options, and their descriptive statistics are provided in Table A2. Data are obtained via Bloomberg, except in the case of the China policy uncertainty index (see discussion below). The functional forms for all variables are based on standard stationarity tests (Augmented Dickey-Fuller tests).

In line with the literature on common push variables, we choose a US-based variable to represent advanced economy interest rates.[21] The interest rate variable options considered are monthly percentage point changes in the US Federal Reserve's Effective Federal Funds Rate and in the US 10-year Treasury yield, as well as three variables that capture monthly changes (in %-points) in expectations for US policy interest rates, calculated from US Federal Funds futures contracts for the subsequent one, two, and three years ahead. For a push variable capturing global risk aversion, we use a monthly percentage point change in the BBB-rated US corporate bond spread over US Treasuries. As an alternative risk aversion variable, we use a monthly percentage change in the VIX index, which is calculated from options contracts to measure expected volatility in the S&P 500 equity index over the following 30 days. Both risk aversion metrics are commonly used in literature studying push variables for portfolio flows into emerging markets.[22] Figures A1–A7 in the Appendix depict the global push factor options studied.

For the pull variables capturing China's economic performance, we use a monthly percentage point change in Bloomberg's consensus forecast for China's real GDP growth for the following 12 months. As consensus surveys focus on the current and subsequent year's economic growth, we use a weighting to capture a growth estimate for the next 12 months.[23] An alternative pull factor measuring economic performance is a monthly average of the Citigroup's Economic Surprise Index for China. It is a quantitative measure of surprises triggered by economic data

[21] See Koepke (2018) and Koepke (2018b).
[22] See Keopke (2018b).
[23] Consensus surveys on economic growth forecasts cover time periods that change once a year. For example, from January to December 2021 the survey provides a forecast for annual real GDP growth in 2021 and 2022. In January 2022, the periods are shifted by one year to 2022 and 2023. To have a stable forecasting period, we use a weighted average of the current and next years' mean forecasts, letting m denote the month (m = 1, . . . , 12) and $f_c(m)$ and $f_n(m)$ denote analysts' mean real GDP growth forecast for the current year and next year, respectively. The economic growth forecast for month m is defined as $x(m) \equiv \frac{12-m}{12} f_c(m) + \frac{m}{12} f_n(m)$.

releases; when published data exceed analyst expectations surveyed by Bloomberg, the index increases and vice versa. Given the US-China trade conflict of recent years, we also consider a variable that measures economic policy uncertainty in China, as changes in the policy environment may contribute to investors' willingness to invest in Chinese securities. The Economic Policy Uncertainty Index for China,[24] developed by Baker, Bloom, and Davis (2016), is a news-based indicator that tracks policy-uncertainty-related key words in the South China Morning Post, Hong Kong's leading English-language newspaper. To our knowledge, this data series has not been previously utilized in the literature on push-pull factors. The variable we use is a monthly percentage change of the index; an increase implies higher policy uncertainty.

In addition, we consider three different Chinese asset return indicators. The first is a monthly percentage change in the MSCI China Index,[25] which measures Chinese equity returns. The second is a debt return indicator based on monthly percentage changes in an index by JPMorgan Chase & Co that tracks Chinese government and policy bank bonds.[26] The third is a monthly percentage point change in the yield of the Chinese government's benchmark 10-year bond. The aforementioned Chinese pull factor options are portrayed in Figures A8-A13 in the Appendix.

4.2 Static coefficient of push and pull factors in China's debt flows

We begin the process of configuring China's empirical bond flow model with the theoretical version presented above. The variables included in the estimation of Model 1 are:

- Pull variable: China's real GDP growth forecast, $GDP\ forecast_t$ (a monthly percentage point change in month t in Bloomberg's analyst consensus forecast for China's real GDP growth for the next 12-month period);
- Push variable: the US Federal Reserve's benchmark interest rate, $EFFR_t$ (a percentage point change in the Effective Federal Funds Rate in month t from the prior month, calculated based on a monthly average of daily data);

[24] Economic Policy Uncertainty, policyuncertainty.com
[25] The MSCI China Index is a free-float weighted equity index that captures large and mid-cap representation across Chinese equity listings.
[26] The J.P. Morgan China Government + Policy Bank 20% Capped 1-10 Year Index tracks performance of eligible fixed-rate, bullet, CNY-denominated government and policy bank bonds maturing within the next 1 to 10 years. The securities must be listed on the China Interbank Market to be eligible. The index exposure to each of China's three policy bank issuers is capped at 20 %, with the excess market value redistributed across the index on a pro-rata basis.

- Push variable: International investor risk aversion, *BBB spread*$_t$ (a percentage point change in the BBB-rated US corporate bond yield spread over US Treasury securities in month *t* from the prior month, calculated based on a monthly average of daily data).

In addition, a lagged independent variable is included in the model on the back of first-order autocorrelation. The RLS regression results for Model 1 are reported in Table 1 below.

Table 1. Regression Results

This table reports the results of RLS regressions (M-estimation). The dependent variable is monthly net non-resident purchases of Chinese bonds (i.e., *Flows*) in USD billions. The explanatory variables are defined in Table A3 in the Appendix. Asterisks denote significance at the 10%, 5% and 1% level for 1, 2, and 3 asterisks, respectively. Heteroscedasticity consistent standard errors are in parentheses.

	Model 1	Model 2
$Flows_{t-1}$	0.270***	0.384***
	(0.086)	(0.080)
GDP Forecast	17.212***	13.373***
	(5.229)	(4.573)
MSCI China		0.513***
		(0.172)
Fed EFFR	-13.302**	
	(6.026)	
BBB Spread	-16.402**	
	(7.792)	
Constant	4.867***	3.822***
	(1.147)	(1.060)
Number of Observations: 94		
Adjusted R^2	0.276	0.289
Adjusted Rw^2	0.471	0.492
Akaike Info Criterion	98.438	90.834
Schwarz Criterion	113.787	103.480

Estimation M settings: weight=Bisquare, tuning=4.685, scale=MAD (median centered), Huber Type I Standard Errors & Covariance

In line with expectations and the theoretical model, the variable on China's real GDP growth has a positive sign and the variables on US interest rates and risk aversion have negative signs. A percentage-point increase in China's economic growth forecast attracts around USD 17 billion monthly portfolio flows into Chinese debt securities. Meanwhile, a percentage-point rise in the US Federal Reserve's interest rates triggers USD 13 billion in monthly outflows from China. Similarly, a percentage-point increase in the US corporate yield spread prompts an outflow of USD 16 billion of capital from China.

To find an alternative specification for the model, we use forward stepwise robust regression. We consider all the variables that were discussed in Section 4.1 and presented in Table A3 in the Appendix to determine which work best in explaining China's debt flow movements. In

the stepwise procedure we perform a series of RLS estimations, starting with a version with a constant and the lagged independent variable. At each step, all candidate variables are evaluated based on their z-statistic. The most significant variable is added to the model until none proves significant at at least the 10 % level. The resultant Model 2 includes the following explanatory variables (in addition to a constant and the lagged explanatory variable):

- Pull variable: China's real GDP growth forecast for the proceeding 12 months in month *t*, $GDP\ forecast_t$;
- Pull variable: Chinese equity return, $MSCI\ China_t$ (a percentage monthly change in month t in the Chinese equity index, MSCI China, calculated based on a monthly average on daily data).

The estimation result for Model 2 is reported in Table 1 above. Interestingly, the stepwise estimation results suggest that China's bond flows are only driven by China-specific pull factors, as none of the push factors are significant enough. Model 2 suggests that a percentage-point increase in China's economic growth forecast would attract around USD 13 billion in monthly portfolio flows into Chinese debt securities. The performance of the MSCI China equity index has a smaller impact on debt flows; one-percent increase in the index attracts flows of USD 0.5 billion into Chinese debt instruments.

The importance of China-specific pull drivers in the form of Model 2 are likely to reflect the fact that China's capital account is still relatively closed. The China-exposure of global investors may be a result of their longer-term asset allocation decisions that are made based on China-specific assessments and are therefore less responsive to short-term developments in global markets. Moreover, as China restricts outbound portfolio flows more than inbound flows, it is unlikely that global factors are properly represented in the model. Nevertheless, Model 1 provides evidence that US interest rates and global risk aversion have an impact on driving portfolio flows in and out of China. Based on model comparison and selection criteria for RLS (adjusted R^2, Akaike information criterion, and Schwarz criterion), Model 2 outperforms Model 1.[27] The robust statistics are presented in Table 1 above. Model 1 emphasizes the importance of push variables and Model 2 highlights pull variables. Further discussion is provided in Section 4.3.

[27] The Akaike information criterion and the Schwarz criterion suggest that there is strong evidence of Model 2 outperforming Model 1. For guidelines on statistically significant model selection criterion, see Appendix E in Fabozzi et. al. (2014).

Given that both models show that changes in China's real GDP growth forecasts trigger significant portfolio flows moves, an important variant to the models is a specification that tests whether the impact of changes in economic growth forecasts is symmetric. For this, we modify both Model 1 and Model 2 by including a dummy variable D1 that is equal to 1 for months that saw economic growth forecasts revised higher, and another dummy variable D2 that is equal to 1 for months when growth forecasts were revised down:

$$Flows_t = c + \alpha_1 Flows_{t-1} + \beta_1 \cdot D_1 \cdot GDP\ forecast_t + \beta_2 \cdot D_2 \cdot GDP\ forecast_t + \sum_{i=1}^{n} \gamma_i \cdot Pull\ factors_{it} + \sum_{i=1}^{n} \delta_i \cdot Push\ factors_{it} + \varepsilon_t. \quad (15)$$

The augmented model's estimation results are reported in Table 2 below. They suggest that the positive impact of upward revision to China's economic growth forecast is much more notable than the effect of a downward revision (with coefficients of 22.9 and 14.1, respectively, for Model 1, and 19.1 and 10.3 for Model 2). When economic growth forecasts are revised down, China still attracts net debt inflows, yet on a much smaller scale than after positive revisions. Further study of such dynamics may show that China's restrictions on capital outflows lessen the impact of negative news. Another possibility is that negative economic news dampens intentions of international investors to increase their portfolios' China exposure. In the augmented Model 1 and Model 2, the variable capturing upward revisions remains highly significant, while the downward counterpart remains significant at 0.10 level in Model 1 and becomes insignificant in Model 2. Robust statistics (presented in Table 2) imply that the outperformance of the augmented Model 2 is statistically significant.

Table 2. Asymmetric Model Regression Results

This table reports the results of RLS regressions (M-estimation). The dependent variable is monthly net non-resident purchases of Chinese bonds (i.e., *Flows*) in USD billions. The explanatory variables are defined in Table A3 in the Appendix. Asterisks denote significance at the 10%, 5% and 1% level for 1, 2, and 3 asterisks, respectively. Heteroscedasticity consistent standard errors are in parentheses.

	Model 1	Model 2
$Flows_{t-1}$	0.232***	0.354***
	(0.088)	(0.085)
GDP Forecast Revised Up	22.884***	19.084***
	(7.712)	(7.490)
GDP Forecast Revised Down	14.092*	10.265
	(7.581)	(6.535)
MSCI China		0.486***
		(0.173)
Fed EFFR	-12.287**	
	(6.338)	
BBB Spread	-16.062**	
	(7.795)	
Constant	4.522***	3.451***
	(1.302)	(1.158)
Number of Observations: 94		
Adjusted R^2	0.266	0.278
Adjusted Rw^2	0.480	0.504
Akaike Info Criterion	106.814	102.105
Schwarz Criterion	124.693	117.119

Estimation M settings: weight=Bisquare, tuning=4.685, scale=MAD (median centered), Huber Type I Standard Errors & Covariance

4.3 Extending the models with time-varying coefficients of push and pull factors

Theory and existing empirical literature on push and pull drives of capital flows to emerging market economies suggest that both push and pull factors should be included in China's bond flow model. Nevertheless, Models 1 and 2 result in partially contradicting results regarding the drivers of flows. This likely reflects the fact that China has incrementally relaxed capital controls in recent years, particularly for inbound flows, that triggered changes in the significance of capital flow drivers. Increasing financial openness likely makes Chinese bond flows more susceptible to global push factors. Accordingly, when it is assumed that the drivers remained constant through the entire sample period from 2015 to 2022, the results are sensitive to the chosen variable selection techniques. Financial openness is likely to impact the significance and magnitude of the push and pull factors.

To better understand the dynamics of China's debt flows and their push and pull factors, we extend the study to time-varying coefficients. We study whether the global push factors show signs of becoming more significant as time goes on. Accordingly, we run Model 1 with rolling RLS.

The window size is 40,[28] and the step size is one month. Figures A14–A19 in the Appendix present the time-varying rolling coefficients with their 95 % confidence bands and rolling R^2. The results show that the determinants of debt flows change considerably over time. All variable coefficients display time variation and the notable changes in them coincide with significant global developments.

Throughout 2018–2019, the model exhibits volatility in the form of changing parameter estimates. Thereafter, a noteworthy stabilization occurs. The coefficient of China's real GDP growth variable was high in 2019 but steadies at a lower level starting in early 2020. The coefficient of the risk aversion variable remains consistently in negative territory, even if it displayed large swings at the beginning of the estimation period. The coefficient of the Fed's interest rate variable was positive at the start of the period, then turned negative in early 2020. The *p*-values of the coefficient estimates reflect similar dynamics, with their significance levels improving considerably in the final years of the estimation period. Meanwhile, the model's explanatory power improves significantly after early 2020, and hovers around 0.40 at the end of the sample period.

The global events of 2018–2020 were exceptional, and likely contributed to the instability in the regression model implied by the behavior of the regression's rolling coefficients, *p*-values, and R^2-values. In 2018, the US-China trade war commenced with the US imposing tariffs on Chinese imports and China responding with corresponding measures. The conflict, which escalated over the course of 2018 and the most of 2019, raised concerns regarding the global trade outlook and the dispute's impact on the Chinese economy. Simultaneously, the US Federal Reserve continued to tighten monetary conditions through 2018. Increasing financial market volatility led to portfolio outflows from emerging market economies. The Chinese renminbi, along with its emerging market currency peers, depreciated against the US dollar. The beginning of the COVID-19 pandemic in early-2020 triggered another burst of volatility. After the initial shock, the model performance improves, and the coefficients of the explanatory variables become more logical. Since 2020, the real GDP variable has been a notable and stable driver of flows, while the coefficients of the US interest rate and risk aversion variables have become more negative, implying that global push factor have recently become more important drivers of debt flows.

While we note that unique global events in the early years of the sample likely reduced the model's explanatory power and caused significant variation in the coefficients of the explanatory

[28] Due to the brevity of the time series, a relatively small window size is used. Nonetheless, a longer window size of 60 months maintains the estimation outcome virtually unchanged for the resultant, yet shorter, time period.

variables, the recent improvements could also reflect China's capital account opening measures and bond market developments of recent years. The Northbound Bond Connect has made the drivers of flows somewhat more global in nature since its launch in July 2017, and given the 40-month rolling window, the impact of the Bond Connect program is fully accounted for in the estimation from November 2020 onwards. Similarly, the inclusion of Chinese bonds in Bloomberg's and JP Morgan Chase & Co.'s bond indices began in April 2019 and February 2020, respectively, and were concluded in November-December 2020, after which the negative coefficients of the global push factors have been larger and statistically more significant.

The RLS regression results with time-varying coefficients of the independent variables show a significant improvement in the model stability and explanatory power since early 2020. The timing implies that the launch of the Northbound Bond Connect in July 2017 is a relevant factor explaining the results. China's real GDP forecast variable has since become highly significant, yet its importance as a driver of flows has decreased. The risk aversion and the Fed's interest rate variables become statistically more significant following to the trade war and the first wave of the COVID-19 pandemic, with their coefficients shifting deeper into negative territory.

While these results provide evidence of China's integration into global financial markets and global factors becoming more important drivers of bond flows into China, we note that the estimations face certain challenges. The time period under examination is rather short, given that the data series starts in January 2015. To circumvent the lack of an extensive monthly data set, one could use daily data to validate the results. Daily proprietary data provided by Emerging Portfolio Fund Research (EPFR) Global, which captures flows reported by emerging market-oriented mutual funds and exchange-traded funds, could potentially be used as a high-frequency proxy for non-resident debt flows. Another challenge arises from the fact that China's Southbound Bond Connect was launched as recently as at the end of September 2021, and is therefore only captured in the final year of the dataset. Therefore, two-way portfolio flows have been restricted. It is likely that global push factors, such as increased risk aversion and higher US interest rates, did not result in notable bond outflows in the early years of the sample as they were subject to Chinese capital controls. Against this backdrop, further study is welcome once a longer data series becomes available.

To our knowledge, studies on both static and time-varying models for China's bond flow drivers are non-existent, most likely due to lack of adequate data. Instead of country-specific studies, existing research tends to assess emerging market economies as a group, and the country grouping varies from one study to another. While differences in results arise based on regions or the type of portfolio flow (e.g., equity or debt), the existing literature on static drivers (as summarized in

Koepke, 2018b), generally finds that domestic economic performance is an important driver of emerging market portfolio flows. Based on the analysis here, the result also applies to China. Meanwhile, literature shows robust evidence of risk aversion and external interest rates having a negative impact on portfolio flows into emerging markets, while some evidence exists on local asset returns serving as pull factors. In the case of China, the results are not as straightforward. Model 1 shows that risk aversion and US interest rates are also relevant, while Model 2 highlights the importance of domestic equity returns.

Studies on time-varying push and pull factors are generally rather limited – and non-existent for solely China-focused analysis – and have mostly been conducted in the context of economic shocks over time to assess how crisis episodes and subsequent recovery periods have impacted emerging markets' capital flow drivers. For example, both Lo Duca (2012) and Fratzcher (2012) show that the trauma of the market panic following the Lehman Brothers bankruptcy made risk aversion a bigger driver and local conditions of recipient countries matter less. Accordingly, this paper expands such literature, shifting the focus away from global events to domestic developments, and specifically China's economic liberalization process.

5 Conclusions

This paper studied China's rapid bond market development by reviewing the main characteristics of the onshore market and important liberalization steps. It also described recent trends in debt portfolio investment flows into China by non-resident investors. The simple theoretical framework for push and pull factors functioned as a starting point for the empirical analysis on the drivers of China's bond flows. The findings in this paper point to China's continued bond market deepening, development, and integration with the rest of the world. Global investors should pay increased attention to China as investing in the country should become easier and more mainstream in coming years.

The empirical analysis found that China-specific pull factors such as economic growth prospects and domestic asset returns still play a large role in driving non-resident portfolio investments into the country. This likely reflects the fact that the Chinese onshore bond market is still relatively isolated. Therefore, the investment decisions of non-resident investors are likely to be long-term in nature and premised on China's increasing global economic might – not responses to short-term developments in global markets. Moreover, capital flows out of China face tighter government restrictions that likely limit the impact of global factors that typically trigger portfolio outflows from emerging markets.

The significance of global factors in driving investment into Chinese bonds appears to be a recent phenomenon. While the rolling RLS estimations show that there is substantial time variation in the importance of push and pull factors, global risk aversion and US interest rates have become more significant debt flow drivers, particularly since the launch of the Northbound Bond Connect in mid-2017 and the more recent inclusion of Chinese bonds to certain global benchmark indices. Against this backdrop, China's foreign investor base is likely to grow over the foreseeable future, especially if the Chinese government takes further steps to liberalize capital outflows. Indeed, a restricted exit may have been a notable deterrent for global investors to invest in China's onshore bond market.

The findings in this paper require careful interpretation by those researching China's capital flow dynamics. The brief observation period (January 2015 to October 2022) is a key challenge. Revisiting the study once more data are available, verifying the results with higher frequency data such as the EPFR funds flow data, or both, seems logical next step in future research. Moreover, expanding the study and amending the model with additional or alternative explanatory variables might prove insightful. Potential additions could include the average real GDP growth in major advanced economies (e.g., the US, euro area, UK, and Japan), the slope of the US yield curve, inflation expectations in China, or the real effective exchange rate. In any case, a model specification with a variable capturing China's gradually opening capital account might shed light into China's low sensitivity to global push factors. Another potential research frontier could involve inclusion of emerging market economies such as Brazil that have also imposed capital controls on portfolio flows.

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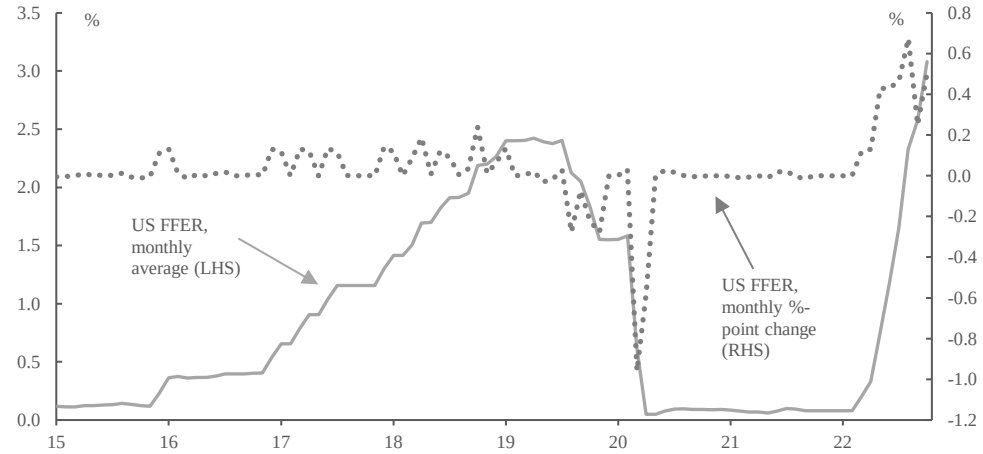
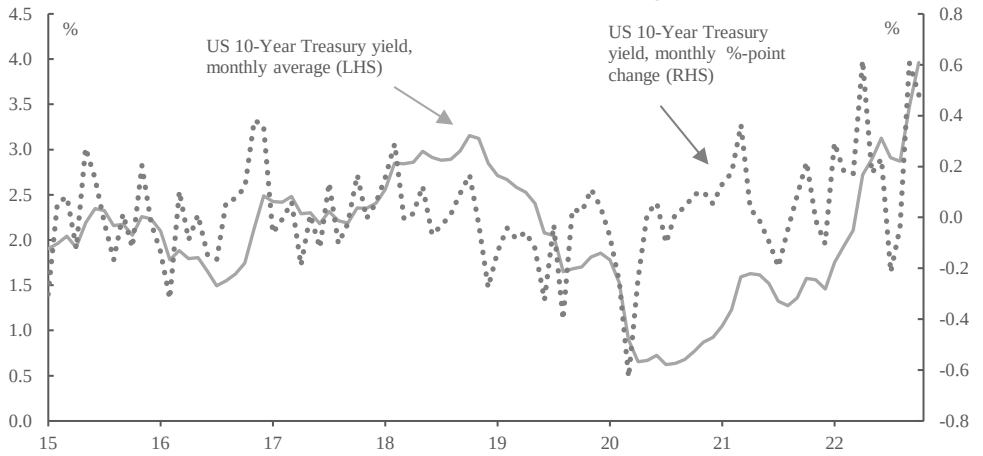
Appendix: Figures and tables

Figure A1 **US Interest Rate – Fed Funds Effective Rate**



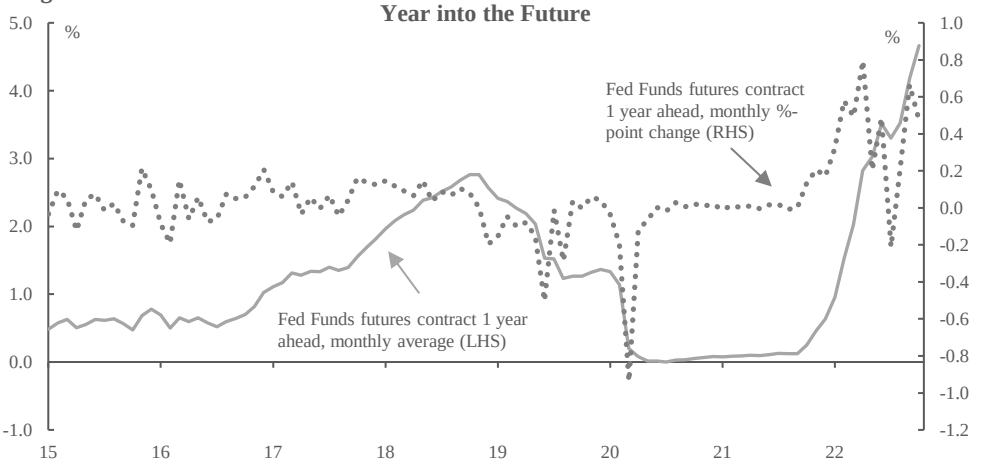
Sources: The Federal Reserve, author's calculations.

Figure A2 **US Interest Rate – US 10-Year Treasury Yield**



Sources: Bloomberg, author's calculations.

Figure A3 **US Interest Rate – Fed Funds Futures Contract One Year into the Future**

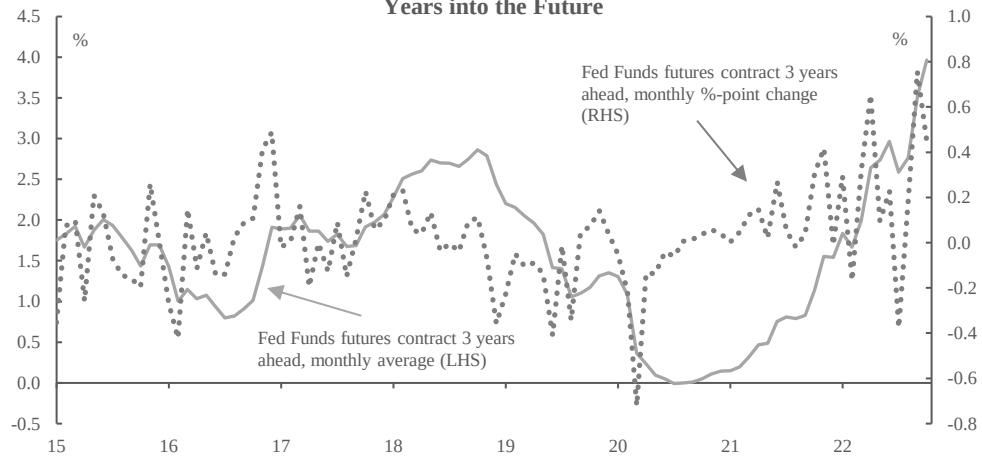


Sources: Bloomberg, author's calculations.

Figure A4 **US Interest Rate – Fed Funds Futures Contract Two Years into the Future**

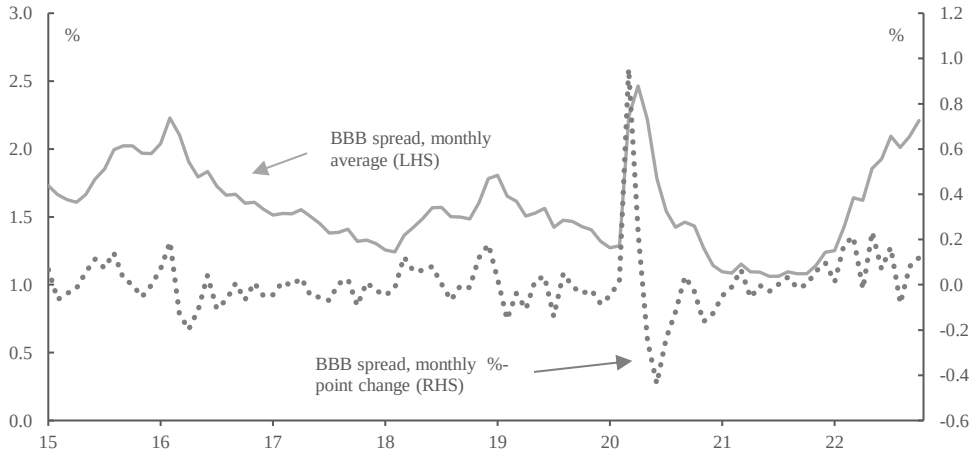
Sources: Bloomberg, author's calculations.

Figure A5 **US Interest Rate – Fed Funds Futures Contract Three Years into the Future**



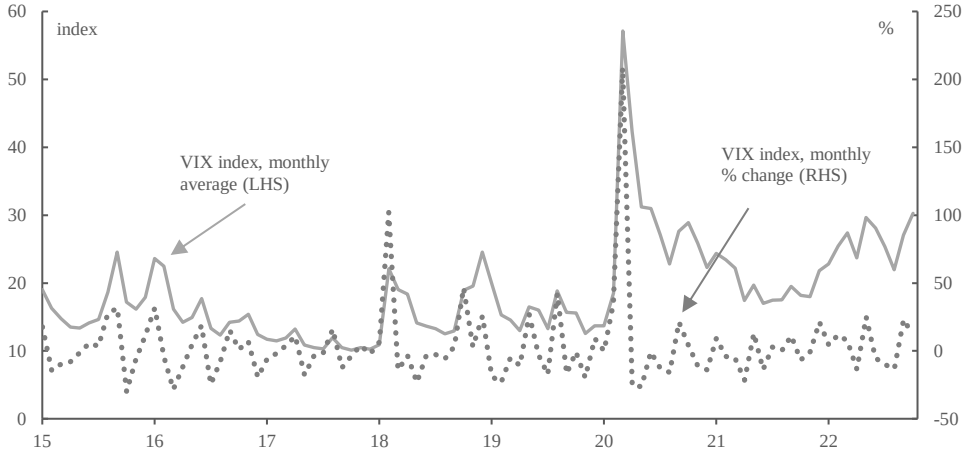
Sources: Bloomberg, author's calculations.

Figure A6 **Risk Aversion – US Corporate BBB Spread over UST**



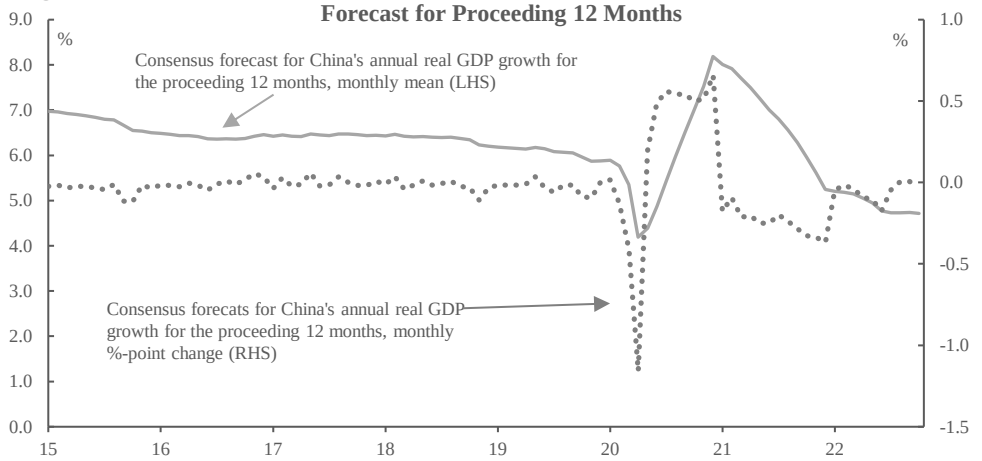
Sources: Bloomberg, author's calculations.

Figure A7 **Risk Aversion – VIX**



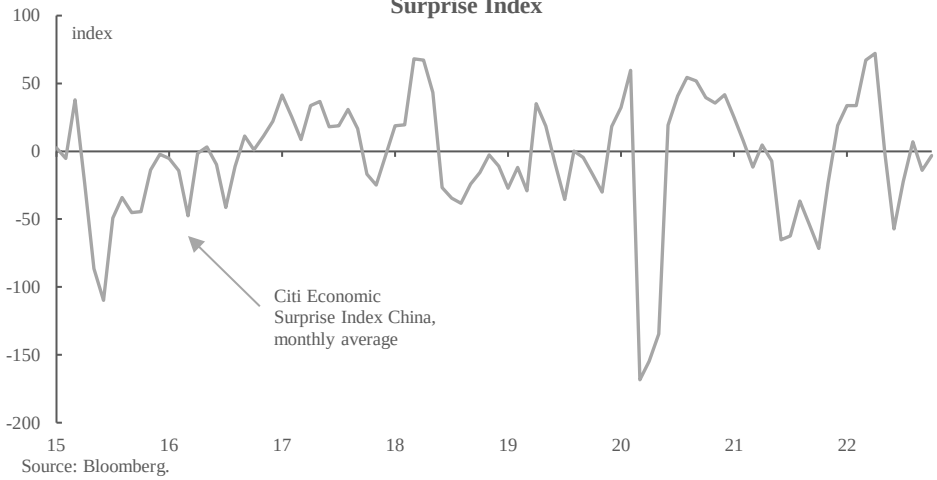
Sources: Bloomberg, author's calculations.

Figure A8 **China's Economic Performance – Real GDP Growth Forecast for Proceeding 12 Months**



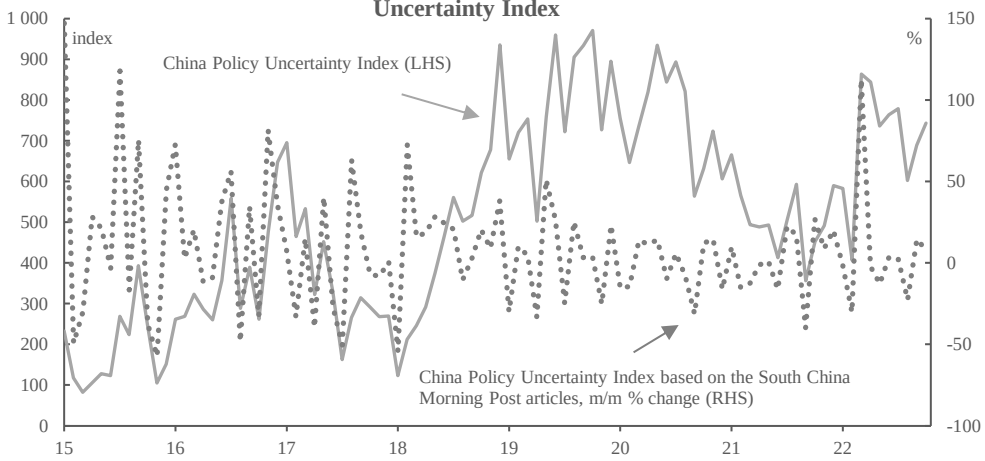
Sources: Bloomberg, author's calculations.

Figure A9 **China's Economic Performance – Citi Economic Surprise Index**



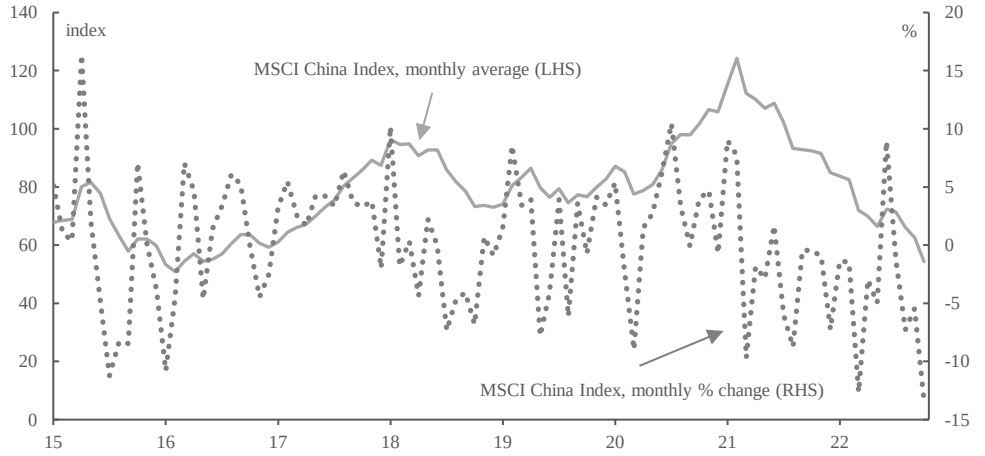
Source: Bloomberg.

Figure A10 China's Economic Performance – Policy Uncertainty Index



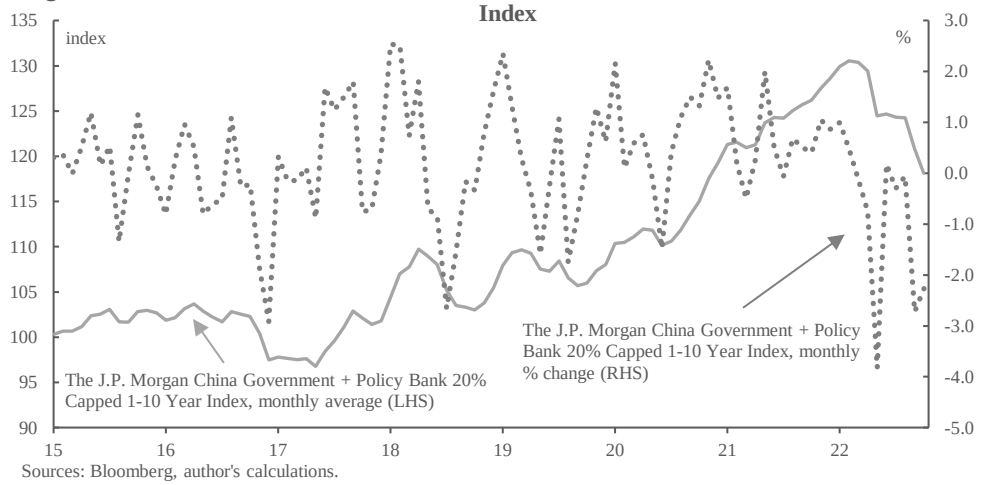
Sources: Policyuncertainty.com, author's calculations.

Figure A11 Chinese Asset Return – MSCI China Index



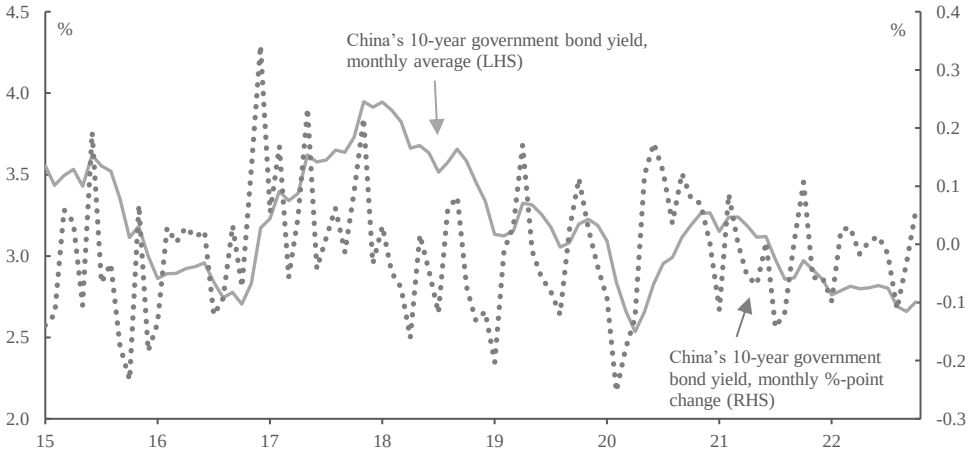
Sources: Bloomberg, author's calculations.

Figure A12 Chinese Asset Return – JPMorgan Chase China Bond Index



Sources: Bloomberg, author's calculations.

Figure A13 **Chinese Asset Return – 10-Year Government Bond Yield**



Sources: Bloomberg, author's calculations.

Figure A14 **Rolling Constant with 95% Confidence Intervals**

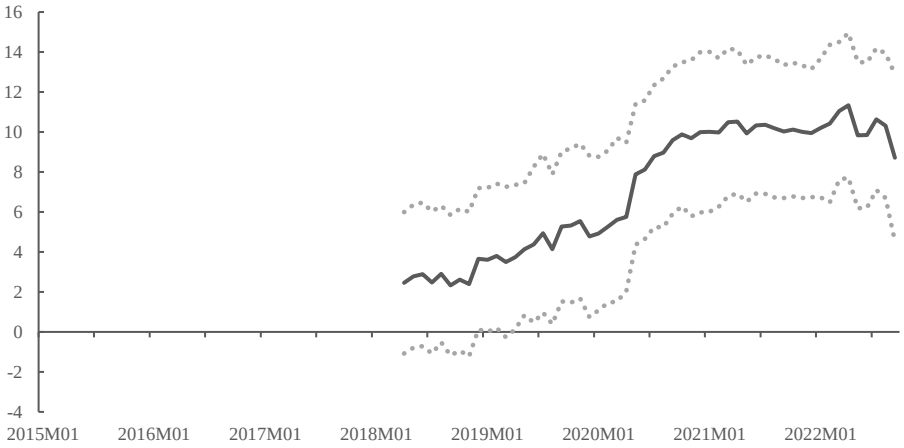


Figure A15 **Rolling Lagged Explanatory Variable with 95% Confidence Intervals**

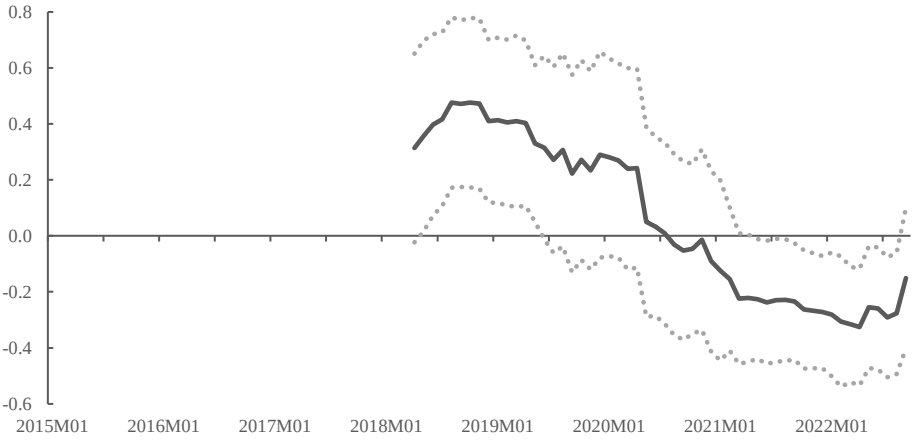


Figure A16 **Rolling Coefficient of China's Real GDP Forecast Variable with 95% Confidence Intervals**

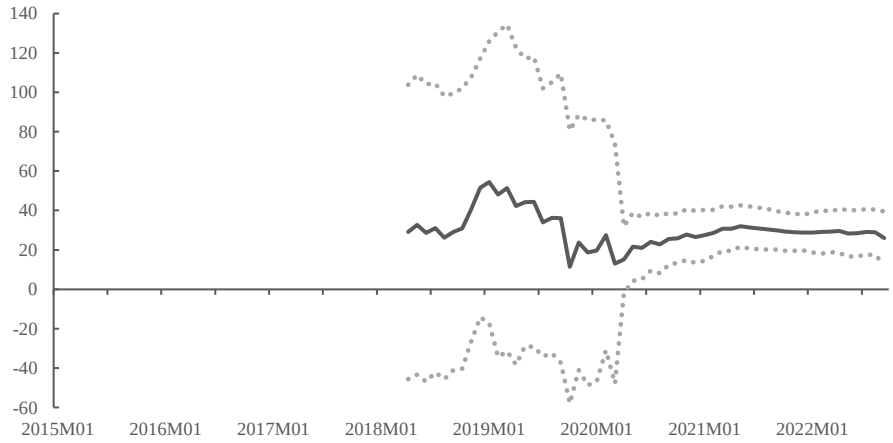


Figure A17 **Rolling Coefficient of the Risk Aversion Variable with 95% Confidence Intervals**

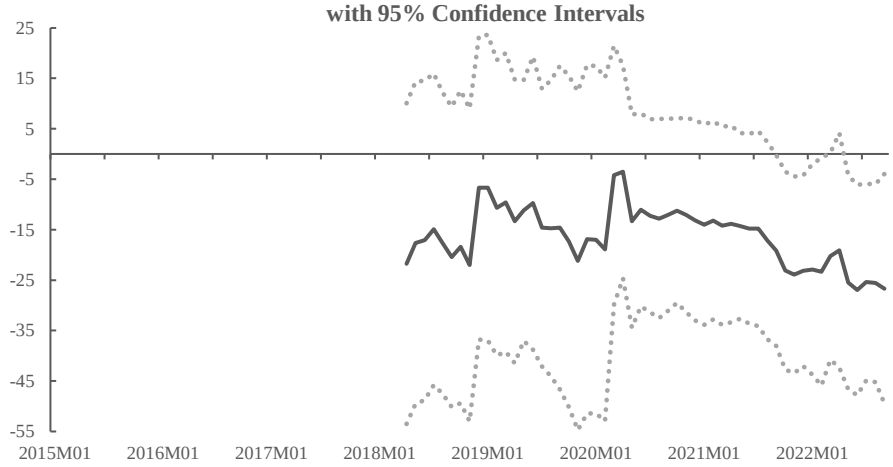


Figure A18 **Rolling Coefficient of the US Fed's Interest Rate Variable with 95% Confidence Intervals**

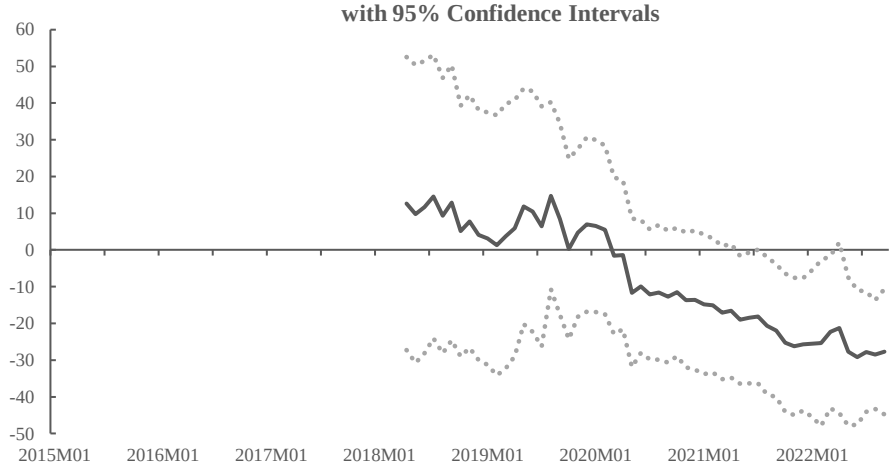


Figure A19

Rolling R-Squares

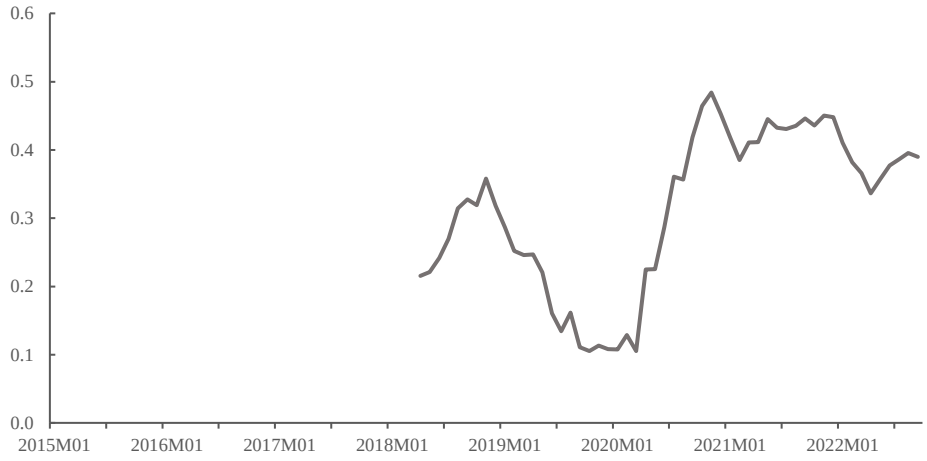


Table A1. Key Steps in China's Recent Bond Market Development

June 1997	The China Interbank Bond Market (CIBM) was set up by the PBOC as a traditional interbank market between commercial banks and the PBOC.
November 2002	The Qualified Foreign Institutional Investor (QFII) program was introduced, allowing certain licensed international investors to invest in China's stock exchanges. The initial quota was USD4 bn, which was increased to USD10 bn in 2005, USD30 bn in 2007, USD80 bn in 2012, USD150 bn in 2013, and USD300 bn in 2019.
February 2005	The Panda Bond market was launhced; international development institutions were given permission to issue RMB denominated bonds. The Asian Development Bank issued the first Panda Bond in October 2005.
April 2006	The Qualified Domestic Institutional Investor (QDII) program was launched, allowing licenced domestic institutional investors to invest in overseas markets.
August 2010	Foreign central banks and certain overseas participating banks banks were granted access to the CIBM under the CIBM Direct scheme. The initial approval and quota requirements were dropped in July 2015.
December 2011	The QFII scheme was expanded by launching the RMB Qualified Foreign Institutional Investor (RQFII) program, which relaxed restrictions on currency settlement, asset classes, and investor eligibility.
March 2013	QFIIs were allowed to participate in the CIBM and the access was enhanced by various initiatives in 2015 and 2016.
October 2016	The RMB was included in the SDR basket.
July 2017	The Northbound Bond Connect was launched to allow international investors to trade in the CIBM.
April 2019	Chinese government and policy bank bonds were included into Bloomberg-Barclays Global Aggregate Bond Index over a 20-month period.
February 2020	Chinese government bonds were included into JPMorgan Chase & Co. bond indices over a 10-month period.
September 2020	All quotas for both QFII and RQFII schemes were removed. QFII and RQFII schemes were merged into a single Qualified Foreign Investor (QFI) scheme; eligibility requirements were substantially relaxed.
September 2021	Southbound Bond Connect was launched, allowing Mainland institutional investors to invest in Hong Kong and the global bond market.
October 2021	Chinese government bonds were included into FTSE Russell's World Government Bond Index over a 36-month period.

Table A2. Descriptive Statistics of Variables

	Mean	Median	Max	Min	Std. Dev.	Skewness	Kurtosis	JB	Prob.
Net non-resident purchases of Chinese bonds	5.629	4.513	46.612	-31.870	12.741	0.413	4.391	10.248	0.006
US Federal Reserve's Effective Fed Funds rate	0.031	0.002	0.676	-0.958	0.182	-1.192	14.327	524.782	0.000
The US 10-Year Treasury yield	0.019	0.012	0.617	-0.628	0.196	0.235	4.745	12.782	0.002
US monetary policy expectations, 1 year ahead	0.044	0.032	0.796	-0.938	0.210	-0.137	9.602	171.024	0.000
US monetary policy expectations, 2 years ahead	0.028	0.035	0.716	-0.795	0.216	-0.107	5.816	31.245	0.000
US monetary policy expectations, 3 years ahead	0.020	0.022	0.756	-0.721	0.224	0.175	4.831	13.611	0.001
BBB-rated US corporate bond spread over UST	0.006	-0.003	0.954	-0.437	0.143	2.797	22.486	1609.685	0.000
The VIX index	3.258	-1.782	208.633	-29.906	28.722	4.386	30.227	3204.876	0.000
China's real GDP growth forecast, 12 months	-0.024	-0.019	0.659	-1.159	0.221	-0.375	11.428	280.401	0.000
Citigroup's Economic Surprise Index for China	-5.753	-2.634	72.181	-168.336	44.495	-1.127	5.327	41.110	0.000
China Economic Policy Uncertainty Index	7.955	5.239	147.140	-57.222	36.577	1.084	5.200	37.360	0.000
The MSCI China Index	-0.024	0.226	16.352	-13.287	5.668	-0.098	2.867	0.221	0.895
The J.P. Morgan China Bond Index	0.185	0.282	2.538	-3.826	1.217	-0.640	3.820	9.055	0.011
China's 10-year government bond yield	-0.010	-0.004	0.342	-0.253	0.107	0.371	3.431	2.882	0.237

Sample 2015M01 2022M09
Observations 94

Table A3. Explanatory Variable Options

Push variables:	
US Federal Reserve's Effective Fed Fund's rate	Change (in %-points) from the prior month's average rate.
US 10-Year Treasury yield	Change (in %-points) from the prior month's average yield.
US monetary policy expectations for one year into the future	Change (in %-points) from the prior month's average in the Fed Funds futures contract one year into the future.
US monetary policy expectations for two years into the future	Change (in %-points) from the prior month's average in the Fed Funds futures contract two years into the future.
US monetary policy expectations for three years into the future	Change (in %-points) from the prior month's average in the Fed Funds futures contract three years into the future.
BBB-rated US corporate bond spread over US Treasuries	Change (in %-points) from from the prior month's average yield spread.
The VIX index	Percentage change from the prior month's average index level.
Pull variables:	
China's real GDP growth forecast for the following 12 months	Monthly %-point change in Bloomberg's consensus forecast for China's economic growth.
The Citigroup's Economic Surprise Index for China	Monthly average index level.
China Economic Policy Uncertainty Index based on the South China Morning Post	Percentage change from the prior month's index level.
The MSCI China Index	Percentage change from the prior month's average index level.
The J.P. Morgan China Government + Policy Bank 20% Capped 1-10 Year Index	Percentage change from the prior month's average index level.
China's 10-year government bond yield	Change (in %-points) from the prior month's average yield.

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