Foreign Ownership of Sovereign Debt and Bond Market Integration: The Case of China*

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Abstract

This paper examines how foreign ownership of local currency sovereign debt impacts the yield co-movement between domestic and global bond markets. Using China's 2017 bond market liberalization as a case study, I present new evidence showing that increased foreign participation in a country's sovereign debt enhances the co-movement of its long-term yields with those of global markets. Following the policy change, foreign ownership of local-currency Chinese government bonds nearly doubled as global bond investors shifted investments from developed markets to China. This shift significantly strengthened the co-movement between long-term yields of Chinese government bonds and those of developed markets, particularly the G7 countries, with an increase of 70%.

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1. Introduction

Over the past three decades, sovereign bond markets have become increasingly integrated globally, and the co-movement of long-term yields has intensified. From 1994 to 2023, the share of U.S. Treasuries held by foreign investors rose from 19% to 29%.[1] During this same period, the co-movement between daily changes in long-term U.S. Treasury yields and those of other G10 currencies increased threefold.[2] These patterns underscore the growing influence of global factors on domestic bond markets, highlighting the need to better understand the mechanisms driving this interdependence. By leveraging a policy shock that altered foreign ownership of Chinese government bonds, this paper examines whether the degree of foreign ownership of a country's sovereign debt is important for the co-movement of its long-term yields with the global bond market.

Figure 1 shows that there is a strong positive correlation between foreign ownership of a country's sovereign debt and its co-movement with the global bond market, observable across both developed and emerging markets. A country's co-movement with the global bond market is measured by the regression estimate of the sensitivity of weekly changes in its long-term yield to weekly changes in the long-term U.S. Treasury yields. For instance, in Germany, foreign investors owned an average of 52% of local currency government debt securities between 2010 and 2021. During the same period, the co-movement between the German and the global bond market was strong: a 1% increase in the 10-year U.S. Treasury yield was associated with a 0.66% increase in the 10-year German Bund yield. In contrast, Japan's foreign ownership share was about one-third of Germany's level, and its co-movement with the global bond market was similarly about one-third of Germany's co-movement level.

This association between foreign ownership and long-term yield co-movement is far from causal evidence. These two may be spuriously related due to other macroeconomic forces. For example, countries that are more financially developed tend to attract more foreign investors

[1] Foreign ownership data of Treasuries is from Tables OFS-1 and OFS-2 in the Treasury Bulletin (Department of the Treasury, 2024).

[2] Co-movement is measured by the regression estimate of the sensitivity of weekly changes in long-term U.S. Treasury yields to weekly changes in long-term G10 yields. See details in appendix Table H.1.

and are more integrated with global factors that influence long-term yields (Lustig, Stathopoulos, and Verdelhan, 2019). Establishing a causal link has been challenging due to the scarcity of large, exogenous shifts in foreign ownership. In 2017, China implemented a policy change that significantly expanded foreign access to its domestic bond market, providing a rare opportunity to address this challenge. In the years following the policy change, foreign ownership of Chinese government bonds denominated in local currency nearly doubled, and this rise was accompanied by a marked increase in the co-movement between China's bond market and global bond markets. Notably, the change in the coefficient of China's yields on U.S. yields closely tracks what is implied from that of the cross-country association. This suggests that foreign ownership may be important for the co-movement of local currency bond yields with global bond yields.

This paper presents new empirical evidence showing that an increase in foreign ownership of a country's sovereign debt enhances the co-movement of its domestic bond market with the global bond market. I investigate a policy change that increased foreign participation in China's bond market, where global investors substituted their investments in developed market bonds for local currency Chinese bonds. These substitution patterns of global bond investors coincide with the stronger co-movement observed between long-term Chinese yields and global bond yields.

The liberalization of China's bond market was a gradual process, but there was a discrete policy change in 2017 when foreign access increased sharply. Prior to 2017, foreign access to China's bond market was restrictive and selective.[3] On July 3, 2017, the Chinese government introduced a new program that opened its onshore bond market to all types of foreign institutional investors. Moreover, global bond indices responded to this important step of opening up by increasing China's index weight from zero percent in 2016 to as much as ten percent in 2024.

First, I document that global bond investors shifted their investments from developed markets to China in response to the policy change. These substitution patterns are important for identi-

[3]In 2010, only three types of overseas institutions were permitted entry into the Chinese domestic bond market under approval: foreign central banks, clearing banks for Renminbi business, and overseas participating banks for Renminbi settlement. From 2011 to 2016, additional foreign institutional investors who met certain criteria could apply to enter the market and trade under an assigned quota. Investors granted access during this period were typically medium- to long-term investors. As suggested in Clayton, Dos Santos, Maggiori, and Schreger (2024), the Chinese government facilitated stable foreign ownership during this stage.

fying the countries with which Chinese government bond yields may more strongly comove. I use Morningstar's security-level holdings data for non-U.S. mutual funds, focusing on a subset of funds specializing in local currency global bonds. To show how fund managers responded, I analyze changes in their portfolio weights in local versus foreign currency and by country group as their allocation to local currency Chinese bonds changes. Countries are categorized into four groups: the G7 countries (Canada, France, Germany, Italy, Japan, the United Kingdom, and the United States), other developed markets, emerging market countries excluding China, and the rest of the world. From July 2017 to December 2021, I find that for every 1% increase in the weight of local currency Chinese bonds, global bond funds reduced their allocation to local currency bonds from G7 countries by 0.37%. Similar to how fund managers rebalanced their portfolios, I show that investors also substituted toward funds invested in local currency Chinese bonds and away from funds invested in local currency G7 bonds.

Based on this, I investigate the co-movement between long-term yields on local currency government bonds from China and the long-term yields of developed markets. To measure this change in the co-momvement, I estimate the sensitivity of weekly changes in the 10-year yield on local currency Chinese government bonds to weekly changes in the 10-year yields of G7 countries. The empirical evidence shows that the comovement significantly strengthened after the policy change. From July 2010 to June 2017, a 1% increase in the average 10-year yield of G7 countries was associated with a 0.16% increase in the 10-year Chinese yield. After the policy change, over the period from July 2017 to December 2021, a 1% increase in G7 10-year yields was associated with a 0.27% increase in the 10-year Chinese government bond yield.[4] This 70% increase in co-movement for Chinese bonds is statistically significant and not present for other developed or emerging economies.

In addition to this cross-country comparison, I conduct a within-country comparison between Chinese government bonds and other local currency bonds. This comparison helps mitigate the possibility that contemporaneous changes in Chinese capital markets drove the stronger

[4]At the country level, the strengthened co-movement is both statistically and economically significant between China and the U.S., the U.K., Japan, and Germany. Specifically, a 1% increase in the 10-year U.S. yield was associated with a 0.11% increase in the 10-year Chinese yield before the policy change, and a 0.24% increase afterward.

co-movement. One immediate concern is the potential for an indirect effect due to domestic investors substituting away from government bonds. This policy change directly treated Chinese government bonds, and foreign investors largely refrained from purchasing non-government local currency Chinese bonds. However, domestic investors may have reallocated from government bonds to other bonds, introducing a potential indirect effect.

The ideal control group should be a close substitute for Chinese government bonds but not in demand by foreign investors. I use two types of non-government local currency Chinese bonds as control groups: railway bonds and corporate bonds. Chinese railway bonds are issued by the state-owned *China Railway Group Limited*, formerly part of the Chinese Ministry of Railways until 2000, with bond issuance fully guaranteed by the Chinese government. These features make Chinese railway bonds close substitutes for Chinese government bonds, while corporate bonds lack an explicit government guarantee. Both types of bonds saw little demand from foreign investors after the policy change. Because railway bonds are closer substitutes, the effect on Chinese government bonds may appear less pronounced when compared with railway bonds than with corporate bonds. The co-movement estimates confirm this: neither bond type experienced stronger co-movement after the policy change. Moreover, the policy change had a larger differential effect on Chinese government bonds relative to corporate bonds than when compared to railway bonds.

Third, I examine how the positive shift in foreign demand for local currency long-term Chinese government bonds impacted yields. An empirical challenge is the presence of other contemporaneous changes that likely affected the level of Chinese government bond yields during this period, such as the rapid increase in the supply of Chinese government bonds. These domestic changes in supply and demand are less likely to impact the cross-country sensitivity of Chinese yields to global yields. However, they are likely to impact the level of Chinese yields.

My identification strategy relies on the yield spread between 10-year Chinese railway bonds and 10-year Chinese government bonds. I assume that, in the absence of the policy change, this yield spread would have remained unchanged. Since Chinese railway bonds are not included in global bond benchmarks and have minimal foreign ownership, they were not directly treated by

the policy change. Under this strong assumption, any change in the yield spread after the policy change reflects the impact of foreign demand on the level of Chinese government bond yields.

However, two main concerns arise with this identification strategy. First, domestic investors may have substituted Chinese government bonds with railway bonds in response to the increased foreign demand for long-term Chinese government bonds. This shift could lower the yield on railway bonds and underestimate the foreign demand effect. Second, the increasing issuance of railway bonds may have caused a supply shock, pushing yields higher and widening the spread, thus overestimating the effect. The gradual adjustment by foreign investors adds complexity to identifying the true impact on yields, making the estimation of this effect inherently challenging.

Given these biases, the true impact remains ambiguous. Empirically, I estimate that in the three years following the policy change, the spread increased by an average of 7 basis points. However, as shown in Figure 4, this increase was largely driven by a significant but temporary jump at the beginning of 2018, with the widened gap subsequently disappearing. Therefore, my cautious conclusion is that there is no compelling evidence of a shift in the level of the 10-year yield on Chinese government bonds attributable to the foreign demand shock.

1.1. Literature review and organization of the paper

My paper is closely related to Clayton et al. (2024). They study the internationalizing of the Chinese bond market by focusing on the selection of different types of foreign investors by the Chinese government at each stage of the liberalization, and suggest that the selection was aimed at establishing credibility and minimizing the risk of capital flight. They document that early access to China's domestic bond market was restricted to stable investors, while more flighty investors only entered after the introduction of Bond Connect (the policy change examined in this paper) and China's inclusion in key bond indices. My paper provides empirical evidence supporting their argument by showing that the co-movement effect only strengthened after these more flighty investors gained access. Other relevant studies on China's bond market include Cerutti and Obstfeld (2018) and Amstad and He (2019). Amstad and He (2019) review China's bond market development, focusing on the segmented OTC and exchange markets, regulatory

complexities, rising defaults, shadow banking reforms, and factors driving future internationalization. Cerutti and Obstfeld (2018) suggest that China has significant potential for further integration into global financial markets, particularly the bond market, with minimal costs to monetary autonomy if supported by strong macroeconomic policies. My contribution is to highlight the strengthened co-movement of long-term Chinese government yields with those of developed markets and link this fact to the rising foreign ownership of local currency Chinese sovereign debt.

This paper complements the empirical literature that studies the benchmark effects through mutual funds. Raddatz, Schmukler, and Williams (2017) find that mutual funds follow benchmarks closely and benchmarks have important effects on capital flows of mutual funds across countries. In particular, there is a strand of literature that focuses on flows from benchmark-driven investors to emerging market countries. For example, Arslanalp and Tsuda (2015) examine the size of benchmark-driven investors in emerging market local currency bond markets using security inclusion to the J.P. Morgan GBI-EM index. Using the security inclusion of Colombia, Peru, and Romania, they estimate that benchmark-driven investors account for at least one-third of total foreign holdings of local currency emerging market bonds in 2014. Arslanalp, Drakopoulos, Goel, and Koepke (2020) offer an overview of how emerging market bond indices affect the behavior of investment funds and discuss the benefits and risks for portfolio flows to these countries. My paper provides additional evidence by showing how mutual funds substitute between developed market bonds and Chinese government bonds. This substitution is informative about the underlying mechanism of how China's yield curve became more integrated with that of developed economy yield curves.

My paper contributes to the rich literature on the effect of indexing, including Barberis, Shleifer, and Wurgler (2005), Greenwood (2005), and Wurgler (2010). Much of the literature has focused on the stock market or the co-movement between stocks and bonds. My findings of the enhanced co-movement between the long-term Chinese government yield and the long-term developed market yields shed light on the co-movement in the global sovereign debt market.

My estimate of the change in the level of the long-term Chinese government yield due to

increased foreign demand is related to the broader literature on intermediary asset pricing. Vayanos and Vila (2021) and Greenwood and Vayanos (2014) examine how demand shocks from preferred-habitat investors shape the term structure of government bonds theoretically and empirically. Greenwood, Hanson, Stein, and Sunderam (2023) extend the framework from Vayanos and Vila (2021) to a two-country setting and demonstrate how global bond investors determine the exchange rate and long-term yields in both markets simultaneously. There is also a strand of empirical literature that studies the importance of capital flows from global investors in determining prices in the sovereign bond market and FX market(Pandolfi and Williams (2019); Broner, Martin, Pandolfi, and Williams (2021)).

The rest of the paper is organized as follows. Section 2 provides institutional knowledge on the Chinese domestic bond market and introduces the event of China's opening up. Section 3 introduces the data used and some basic facts on foreign ownership of local currency Chinese bonds. Section 4 illustrates the substitution patterns of global bond funds. Section 5 provides empirical evidence on long-term yield integration between China and developed markets. Section 6 discusses impacts on the level of Chinese government yield. Section 7 concludes.

2. Opening up of the Chinese Domestic Bond Market

China's bond market comprises three sub-markets: the interbank bond market, the exchange market, and the over-the-counter market. The interbank bond market is the dominant segment, accounting for almost 90% of the outstanding market value, and its opening up is the focus of this paper. For the remainder of the paper, I will refer to the interbank bond market as the Chinese domestic bond market.

2.1. Overview of China's bond market

By the end of 2022, China has become the world's second-largest bond market and the second-largest government bond market, led by the U.S. China's bond market consists of three sub-markets: the interbank bond market, the exchange market, and the over-the-counter market.

The interbank bond market is the primary bond trading venue in China, accounting for almost 86.8% of the outstanding volume at the end of 2023. It is a wholesale market that serves all domestic institutional investors including commercial banks, mutual funds, insurance companies, securities companies, and others.

The exchange market is an electronic trading platform that accounts for 13.2% of the outstanding volume in 2023. The exchange market excludes commercial banks, which are the largest participants in China's bond market. It is open to other financial institutional investors (such as mutual funds, insurance companies, securities companies) as well as retail investors.

The over-the-counter market is the smallest sub-market, accounting for less than 4 basis points of the outstanding volume in 2023. It is an extension of the interbank bond market that serves as a retail market. The over-the-counter market is available through 30 commercial banks nationwide and mainly focuses on trading government bonds, local government bonds, and policy financial bonds to retail investors.

Although growing rapidly, foreign ownership of China's bond market remains low compared to other large bond markets. In 2022, the size of China's domestic bond market reached $20.93 trillion, equivalent to 39% of the U.S. bond market's size at that time. The outstanding bonds

issued by the Chinese general government rose to $8.76 trillion in the same year, amounting to 33% of the value of outstanding U.S. general government bonds.

Nevertheless, foreign investors held only 9% of local currency bonds issued by the Chinese central government, according to estimates from Arslanalp and Tsuda (2014). In contrast, foreign ownership of U.S. government bonds and Japanese government bonds was 23% and 17%, respectively, in the same year. Why has foreign ownership been so low for such a large and continuously growing market?

2.2. *Gradual opening of the interbank bond market*

Foreign access to China's domestic bond market was restrictive before 2017. From 2010 to 2016, the Central Bank of China, *People's Bank of China (PBC)*, piloted several schemes that allowed certain foreign institutional investors to enter the interbank bond market. The launch of *Bond Connect* was a significant policy change that marked the opening up of the Chinese domestic bond market.

In August 2010, three types of overseas institutions were allowed to invest in the interbank bond market, under the investment quota approved by the People's Bank of China. These three types included foreign central banks, clearing banks for RMB business in Hong Kong and Macau, and overseas participating banks for RMB settlement of cross-broader trade.

In December 2011, the *Renminbi Qualified Foreign Institutional Investors (RQFII)* program was launched, allowing eligible foreign institutional investors to invest in the interbank bond market under an investment quota. The program required foreign institutional investors to meet certain qualifying criteria, including but not limited to assets under management, capital requirements, and a minimum number of years of experience. Foreign institutional investors had to first seek approval from the PBC to access the interbank bond market then apply for an investment quota from the State Administration of Foreign Exchange (SAFE). Additionally, there were further restrictions on currency settlements and fund repatriations that limited the investment behaviors of these investors.

In July 2012, foreign investors under another program, *Qualified Foreign Institutional Investors*

(QFII), were permitted to invest in interbank bond market. *QFII* was launched in 2002 and initially allowed certain foreign institutional investors to invest through the Chinese stock exchange. The regulatory relaxation in July 2012 expanded the scope of investment to include the interbank bond market and private placement bonds issued by small and medium enterprises.

In 2015 and 2016, the opening of the Chinese domestic bond market accelerated. In May 2015, qualified foreign banks were allowed to trade in the interbank repo market. In July 2015, investment quota were lifted for foreign central banks, international financial institutions, and sovereign wealth funds. In March 2016, medium- to long-term investors such as insurance companies, securities companies, fund management companies, pension funds, charity funds and endowment funds approved by the PBC were allowed to enter the interbank bond market.

An important change occured in July 2017 with the launch of a new initiative, *Bond Connect*. This program allows all types of overseas institutional investors to trade in the Chinese domestic bond market through Hong Kong accounts and exempts them from quota restrictions. It significantly lowered the barrier and eased the process of entering the market. On October 31, 2017, the program first reported that the number of registered international investors had reached 200. Moreover, the overall foreign holdings of the Chinese domestic debt securities increased by 30% since the launch. This suggests that *Bond Connect* was well received by foreign institutional investors who previously did not have access to the Chinese domestic bond market.

Foreign ownership of local currency Chinese government debt doubled within four years following the opening of the Chinese domestic bond market. Figure 2 illustrates the total stock of the local currency debt securities issued by the Chinese central government and their share of foreign ownership from March 2004 to December 2022. The share of local currency Chinese central government debt owned by foreigners increased by 5% (266 billion dollars) from June 2017 to December 2021. Additionally, there was a sharp increase in the growth rate of foreign ownership immediately after the 2017 policy change, in contrast to the slow and gradual increase observed between 2012 to 2016.

Another milestone in the opening-up of the Chinese bond market was the entrance of international rating agencies in 2019. Before then, Standard & Poor's, Fitch, and Moody's Investor

Service were restricted to monitoring only Chinese government bonds in the domestic bond market. Investors had to rely on domestic monitoring agencies for assessments of locally issued debt. For foreign investors, the differences in the monitoring processes and rating scales between international and the Chinese domestic agencies could be confusing. In January 2019, S&P became the first international rating agency to receive approval to rate all types of bonds in the Chinese domestic bond market. This was followed by the entry of Fitch and Moody's Investor Service.

Due to the gradual liberalization of the Chinese domestic bond market and the entrance of international rating agencies, global investment benchmark producers have begun to include local currency Chinese bonds in their indices. In March 2018, Bloomberg announced that it would add Chinese RMB-denominated government and policy bank bonds to the Bloomberg Global Aggregate Index. The addition of these securities was phased in over 20 months, starting in April 2019. As a result, local currency Chinese bonds became the fourth-largest currency component in the index, following the US dollar, euro, and Japanese yen. In September 2019, JP Morgan announced that it would include Chinese government bonds in its *Government Bond Index Emerging Markets (GBI-EM)* suite from February 2020, with a phased inclusion over 10 months. This index is one of the most widely tracked for emerging market government bonds, and Chinese government bonds received the highest weight allowed (10%) in the index. In March 2021, FTSE Russel confirmed that Chinese government bonds would be incorporated into the FTSE Russell World government bond index (WGBI) from October 2021, with an expected weight of 5.6% by September 2024. The inclusion of local currency Chinese government bonds into these three popular benchmarks has the potential to attract huges inflow into the Chinese domestic bond market.

3. Data and Basic Facts

Data from Arslanalp and Tsuda (2012) and Arslanalp and Tsuda (2014) are used to estimate foreign ownership of central government debt in advanced and emerging economies. To analyze how global bond investors have reacted to the opening of the Chinese domestic bond market, I

use security-level holdings data on mutual funds from Morningstar. The detailed monthly data allow me to dynamically examine the substitution patterns of global bond funds.

3.1. Data on foreign ownership of general government debt

Arslanalp and Tsuda (2012) and Arslanalp and Tsuda (2014) estimate the investor base composition of general government debt annually for advanced markets and quarterly for emerging markets. General government debt includes both debt securities and loans, covering the debt of the central government, state and local governments, and, where applicable, social security funds. In most countries in their data, general government debt predominantly consists of central government debt. Investors are divided into six sectors: domestic central bank, domestic banks, domestic nonbanks, foreign official sector, foreign banks, and foreign nonbanks. The foreign official sector includes foreign official loans and government debt securities held by foreign central banks as reserve assets. Foreign banks comprise depository institutions other than central banks. The foreign nonbank sector includes all other investors, ranging from insurance companies, pension funds, and investment funds to household investors and nonfinancial corporations.

For each advanced market country, the authors report the face value of the total debt stock and the aggregate foreign holdings of two items in the country's local currency: total general government debt and general government securities. Additionally, they report holdings of general government debt by each foreign sector, with separate reporting for holdings of general government securities by foreign officials.

For each emerging market country, the authors report the face value of the total debt stock and the aggregate foreign holdings of four items in the country's local currency: total general government debt, general government securities, central government securities in local currency, and central government securities in foreign currency. Similarly, they report holdings of general government debt by each foreign sector, with separate reporting for holdings of general government securities by foreign officials.

3.1.1. *Facts on foreign ownership of China's general government debt*

The stock of local currency securities issued by the central government is around 3652 billion dollars in 2022, 9.1% of which is held by foreigners. The outstanding general government securities, 8742 billion dollars, is more than twice the size of central government securities, however, the foreign ownership is only 4.43%. This suggests that foreign ownership of Chinese government securities is concentrated in those issued by the central government.

3.1.2. *Estimates of foreign ownership of central government debt securities*

Based on the investor base of general government debt reported by Arslanalp and Tsuda (2012) and Arslanalp and Tsuda (2014), I make a few assumptions to estimate foreign holdings of Chinese central government debt securities in both local and foreign currencies. The assumptions and estimation method can also be applied to other countries in the data.

From 2004 to 2022, an average of 98.85% of foreign holdings of China's loans are held by foreign officials. I assume that the remaining portion of the loans is entirely held by foreign banks, meaning foreign nonbanks do not hold any Chinese loans. Additionally, I assume that all three investor sectors maintain the same weight ratio between local currency central government securities and foreign currency central government securities:

$$\begin{aligned}
&\frac{\text{Foreign officials' holdings of central government securities in LC}}{\text{Foreign officials' holdings of central government securities in FC}} \\
&= \frac{\text{Foreign banks' holdings of central government securities in LC}}{\text{Foreign banks' holdings of central government securities in FC}} \\
&= \frac{\text{Foreign nonbanks' holdings of central government securities in LC}}{\text{Foreign nonbanks' holdings of central government securities in FC}}
\end{aligned}$$

Similarly, I assume that all three investor sectors maintain the same weight ratio between general government securities and central government securities. With these assumptions, I can estimate holdings of China's central government securities by each foreign sector, in both local and foreign currencies. From 2017 to 2021, foreign banks' holdings of Chinese central government securities increased by 1.78 billion dollars, while foreign nonbanks' holdings more than quintupled.

3.2. *Data on mutual fund holdings*

To provide a detailed analysis of foreign investors' response to the opening of the Chinese domestic bond market, I use a granular dataset on a subset of foreign nonbank investors: Morningstar non-US mutual funds. Morningstar offers security-level holdings data of mutual funds, as well as the characteristics of these funds. This dataset was also used in Maggiori, Neiman, and Schreger (2020) and Coppola, Maggiori, Neiman, and Schreger (2021).

The holdings data spans from January 2002 to December 2021. To study the opening of the Chinese domestic bond market, I primarily use holdings data from January 2017 to December 2021. Most funds report their holdings monthly, though some report quarterly. In December 2021, the sample includes 26235 funds domiciled in countries outside the United States, with an aggregate of 15.25 trillion dollars in assets under management (AUM). Among these assets, 6.63 trillion dollars are in equities, while 4.68 trillion dollars are in credit.

3.2.1. *Selecting global bond funds*

To better examine mutual funds' investment behavior in China and their substitution patterns between China and other countries, I focus on a smaller set of global bond funds. For a fund to be categorized as a global bond fund, it must satisfy the following criteria:

1. Its average weight in bond positions is at least 80%;
2. Its average assets under management (AUM) from June 2017 to December 2021 is at least 10 million dollars;
3. It has been active for at least three years;
4. It invests in local currency bonds from at least two continents.

In December 2021, 3462 funds met these criteria and reported holdings. These funds held around 60 percent of all local currency Chinese bond positions held by the non-US Morningstar mutual funds. The total AUM of the global bond funds in December 2021 was 1.97 trillion dollars. To have a balanced panel of monthly holdings and return data from June 2017 to December 2021,

the sample is further reduced to 1144 funds. Table 1 presents the characteristics of the balanced subsample.

3.2.2. Facts on holdings of global bond funds

To study the substitution patterns of global bond funds, I group their bond holdings by country and by whether the bond is issued in local or foreign currency. Countries other than China are categorized into four groups:

1. G7 countries: Canada, France, Germany, Italy, Japan, the United Kingdom, and the United States;
2. Other DMs: the rest developed market countries.
3. EMs: emerging market countries excluding China;
4. Rest of the world.

With China as an additional, separate group, I have five country groups. Table 2 reports, in aggregate, how global bond funds' weights in different country groups have changed, by local or foreign currency, from June 2017 to December 2021. Their weight in local currency Chinese bonds increased by 1.18% over the period. The majority of their portfolio weight is in local currency bonds issued by the G7 countries, standing at 45.77%.

4. Investment Habitat of Global Bond Investors

Using mutual fund holdings data, I find that the policy change prompted global bond funds to shift their investments from developed and emerging market countries to China. Among local currency bonds, the substitution was most pronounced from G7 countries to China. The allocation and substitution patterns of global bond investors highlight a subset of countries whose bonds are more likely to be held alongside local currency Chinese bonds. This investment habitat suggests that bonds from these countries are likely to exhibit stronger co-movements with local currency Chinese government bonds, driven by increased foreign ownership resulting from the policy change.

The inclusion of local currency Chinese government bonds in major global bond indices is an expansion of the habitat of benchmark-driven investors. From 2019 to 2020, local currency Chinese government bonds were added to the Bloomberg Barclays Global Aggregate Index and the JPM Government Bond Index Emerging Markets (GBI-EM). These bonds are also being phased into the FTSE Russell World Government Bond Index (WGBI) from 2021 to 2024. The mutual fund sector, which is representative of benchmark-driven investors, provides a useful lens to investigate how global bond investors react to these index inclusion events following China's opening up. I use monthly holdings data of 1144 global bond funds at month-end from June 2017 to December 2021. This covers 55 month-end reporting dates, allowing for up to 54 monthly changes for each fund.

4.1. How fund managers responded

Over a longer horizon, I find that global bond investors increasingly shifted from both developed and emerging market countries to China. To analyze this trend, I examine the cumulative substitution effect, averaged across funds. Specifically, I run a cross-sectional regression on the overall weight changes observed between June 2017 and December 2021. For each country group and local/foreign currency combination, I regress the fund-level percentage point weight change in that category on the fund-level percentage point weight change in local currency Chinese bonds as follows:

$$\Delta w_i^{c,k} = \alpha + \beta \cdot \Delta w_i^{LC,China} + \epsilon_i, \tag{1}$$

where $\Delta w_i^{c,k}$ is fund i's overall weight change in country group k and currency c from June 2017 to December 2021 $\Delta w_i^{LC,China}$ is fund i's overall weight change in local currency Chinese bonds during the same window. The coefficient of interest is β, which represents the average sensitivity of weight changes in bonds issued by country group k, denominated in currency c, to the weight change in local currency Chinese bonds across all funds. Funds are weighted by their average AUM.

Table 3 presents the regression estimates. The coefficient for local currency bonds issued

by G7 countries suggests that a 1% increase in the weight of local currency Chinese bonds is associated with a 0.37% decrease in the weight of G7 local currency bonds. This suggests that, over a longer horizon (more than four years), global bond funds substituted local currency bonds from G7 countries with local currency Chinese bonds.

Over a shorter horizon, the substitution of local currency bonds was most pronounced from G7 countries to China. To demonstrate this, I analyze the month-to-month weight changes at the fund level and estimate the effect using a panel regression. For each country group and local/foreign currency combination, I regress the fund-level monthly percentage point change in weight for that category on the corresponding monthly percentage point change in weight for local currency Chinese bonds:

$$\Delta w_{it}^{c,k} = \alpha + \beta \cdot \Delta w_{it}^{LC,China} + \epsilon_{it}, \tag{2}$$

where $\Delta w_{it}^{c,k}$ denotes fund i's weight change in country group k, currency c from month $t-1$ to month t. The coefficient of interest, β, estimates the average sensitivity of weight changes in currency-C bonds issued by country group k to the weight changes in local currency Chinese bonds, across time and funds. Funds are weighted by their average AUM.

Table 4 presents the estimates from Eq. (2). The coefficient for local currency bonds issued by G7 countries suggests that a 1% increase in the weight of local currency Chinese bonds is associated with an 24 basis point decrease in G7 local currency bonds over a month. In contrast, the substitution effect for emerging market local currency bonds is smaller at the monthly frequency, with a 1% increase in local currency Chinese bonds corresponding to only a 8 basis point decrease. Comparing these panel regression results with those from the cross-sectional regression suggests that global bond mutual funds adjust their portfolio weights gradually and incrementally over time.

The combined analysis of both the long and short horizons reveals that global bond investors consistently substituted local currency G7 bonds with local currency Chinese bonds. This pattern suggests that local currency Chinese bonds are likely to exhibit stronger co-movement with bonds

issued by G7 countries after the policy change.

4.2. How investor flows responded

After the policy change, investor flows shifted toward global bond funds with higher allocations in local currency Chinese bonds, while moving away from funds with greater exposure to local currency G7 bonds. To analyze how investor flows respond to a fund's performance and weight allocation, I estimate the following regression model using monthly data from July 2017 to December 2021:

$$\%Flow_{i,t} = \alpha + \beta_0 r_{i,t-1} + \beta_1 w_{i,t-1}^{LC,G7} + \beta_2 w_{i,t-1}^{LC,OtherDMs} + \beta_3 w_{i,t-1}^{LC,EMs} + \beta_4 w_{i,t-1}^{LC,China} + \epsilon_{i,t}, \quad (3)$$

where $\%Flow_{i,t}$ denotes the net flow into fund i at month t as a percentage of fund i's size in the previous month, $t-1$. The term $r_{i,t-1}$ represents fund i's return in the previous month, expressed as a percentage. Funds are weighted by their average AUM.

Table 5 presents the regression estimates. Column 5 shows that investor flows are return-chasing, as expected: a 1% increase in the lagged return is associated with an additional investor flow equal to 0.11% of the fund's lagged AUM. Moreover, a higher allocation to local currency Chinese bonds appears to attract more investor flows in the future, with a 1% increase in the weight of local currency Chinese bonds associated with an additional 0.12% of current AUM in the following period. In contrast, investor flows tend to move away from funds with higher allocations to local currency G7 bonds, although the effect is relatively small.

The comparison between fund managers' actions and investor flows indicates that both played a significant role in the substitution from local currency G7 bonds to local currency Chinese bonds. Table 6 breaks down the aggregate cumulative weight change into two components: changes driven by manager rebalancing and returns, and changes driven by investor flows. The second column estimates the first component, showing that of the 1.23% weight increase in local currency Chinese bonds, 0.66% resulted from managerial reallocation and capital gains. The third column estimates the second component, indicating that the remaining 0.52% increase is

attributable to investors reallocating funds across global bond portfolios. Additionally, investor flows contributed to a 0.84% reduction in the cumulative weight of local currency G7 bonds.

In summary, the mutual fund sector responded quantitatively to the opening of China's domestic bond market. Both managers and investors shifted from local currency G7 bonds to local currency Chinese bonds. As a result, if the inclusion of China in the investment universe of global bond investors leads to any heightened co-movement, it is most likely to occur between China and G7 countries.

5. Strengthened Long-term Yield Co-movement

I document that after the policy change, the long-term yields on local currency Chinese government bonds comoved more strongly with long-term yields on local currency government bonds issued by developed markets, the G7 countries in particular. The policy change and the series of index inclusion events that followed led to an increasing number of foreign investors incorporating local currency Chinese bonds into their investment habitats. As a result, their subsequent trading results in a stronger co-movement in returns between local currency Chinese bonds and the bonds they initially held.

5.1. Long-term yield integration with the developed markets

Theory and evidence in the existing literature on index inclusion predict that local currency Chinese government bonds should comove more with other assets held by global bond investors after China's opening up. A classic paper in this literature is Barberis et al. (2005), which examines additions to the S&P 500 and provides empirical evidence supporting the friction-based or sentiment-based theories of co-movement. To understand this theory, suppose some investors choose to invest only in a subset of securities within the investment universe. Whenever they trade, they increase or decrease their exposure to this subset of securities as a whole. Thus, the change in their investment positions induces a common factor in the returns of the securities within their chosen habitat.

Applying this theory to the opening of the Chinese domestic bond market suggests that local currency Chinese bonds should comove more strongly with bonds primarily held by global bond funds. Section 4 has identified the primary component of their investment habitat: local currency bonds of G7 countries. The G7 country group includes the United States, Canada, the United Kingdom, Japan, Italy, France, and Germany. Therefore, the friction- or sentiment-based theories of co-movement predict that the yield on local currency Chinese bonds should covary more with the yields of these countries.

To test the prediction of yield co-movement, I examine the co-movement between the 10-year yield on local currency Chinese government bonds and the 10-year yield of the G7 countries. The yield data is sourced from Bloomberg, starting on July 1, 2010. I end the data on December 31, 2021, to exclude the period of hyperinflation that follows. I construct an average G7 yield by value-weighting the 10-year yields on local currency government bonds issued by the G7 countries. The weights are based on the average dollar value of local currency bond positions held by Morningstar non-U.S. mutual funds. This approach results in a balanced panel of 586 weeks.

First, I regress the changes in the weekly average 10-year Chinese yield against the changes in the weekly average 10-year G7 yield as follows:

$$\Delta y_t^{CNY} = \alpha + \beta_1 \cdot \Delta y_t^{G7} + \beta_2 \cdot \mathbf{1}_{Post} + \beta_3 \cdot \Delta y_t^{G7} \times \mathbf{1}_{Post} + \epsilon_t \tag{4}$$

Δy_t^{CNY} and Δy_t^{G7} denote the weekly changes in the 10-year Chinese government yield and the 10-year G7 yield from period $t-1$ to period t, respectively. $\mathbf{1}_{Post}$ is a dummy variable that takes the value one from July 3, 2017. The coefficient β_1 estimates the sensitivity of changes in the 10-year Chinese yield to changes in the 10-year G7 yield before the policy change. The sum of β_1 and β_3 represents this sensitivity after the policy change. If the long-term Chinese government yield comoves more strongly with the G7 yield, β_3 should be positive.

Table 7 confirms that the co-movement between the 10-year Chinese yield and the 10-year G7 yield strengthened after the policy change. The first column of the table shows that, un-

conditionally, over the full sample from July 2010 to December 2021, a one percent increase in the average 10-year G7 yield is associated with a 19 basis point increase in the 10-year Chinese yield. The second column presents the specification from Eq. (4), including the interaction term that captures the change in sensitivity from the pre-period to the post-period. The coefficient on Δy_t^{G7} indicates that before the policy change, a one percent increase in the 10-year G7 yield was associated with a 16 basis point increase in the 10-year Chinese yield. In contrast, after the policy change, a one percent increase in the 10-year G7 yield was associated with a 27 basis point increase in the 10-year Chinese yield. The effect increased by two-thirds.

To visualize this change, I repeat the specification in column 1 of Table 7 month by month using a three-year rolling window and plot the estimated β_1 from 2012 to 2021 in Figure 3. Prior to the policy change, the curve is almost flat, if not slightly decreasing. After the policy change, the estimated coefficient starts to increase gradually.

To examine how the co-movement between China and the G7 countries changed for each individual country, I repeat the same regression for each G7 country separately. The results are shown in Table 8. At the country level, we observe a statistically significant and stronger association after China's opening with the U.S., the U.K., Japan, and Germany. In particular, the sensitivity of changes in the Chinese 10-year yield to changes in the U.S. 10-year yield increased from 11 basis points in the pre-period, to 24 basis points in the post-period. During the same time, the foreign ownership of local currency Chinese central government securities rose from 4% to 9%. The change in sensitivity relative to the change in foreign ownership is close to, but slightly greater than, a one-to-one ratio.

Figure 1 plots a country's long-term yield co-movement with the U.S. and its local currency central government debt securities owned by foreigners. The dashed line represents the regression slope estimated using all these developed and emerging economies, excluding China. The figure also illustrates China's position before and after the policy change. The slope of China's trajectory nearly aligns with the fitted line estimated using data from other countries, suggesting that the increase in foreign ownership may have contributed causally to the strengthened co-movement.

5.1.1. Is the strengthened yield co-movement a global pattern?

It is possible that the increased co-movement with G7 countries occurred globally from 2017 to 2021. To rule out this possibility, I estimate the regression below, which includes other developed and emerging economies besides China:

$$\begin{aligned}\Delta y_t^i =& \alpha_i + \beta_1 \cdot \Delta y_t^{G7} + \beta_2 \cdot \mathbf{1}_{Post} + \beta_3 \cdot \Delta y_t^{G7} \times \mathbf{1}_{Post} + \\ &+ \beta_4 \cdot \Delta y_t^{G7} \times \mathbf{1}_{China} + \beta_5 \cdot \mathbf{1}_{Post} \times \mathbf{1}_{China} + \beta_6 \cdot \Delta y_t^{G7} \times \mathbf{1}_{Post} \times \mathbf{1}_{China} + \epsilon_{it}.\end{aligned} \tag{5}$$

Δy_t^i denotes the weekly change in country i's 10-year yield from period $t-1$ to period t. $\mathbf{1}_{China}$ is a dummy variable that takes the value of one if the country is China. The coefficients of interest are β_3, β_4, and β_6. Specifically: β_1 estimates the average sensitivity of weekly changes in the 10-year yield to weekly changes in the 10-year G7 yield across other countries, excluding China, before the policy change. β_3 estimates how this average sensitivity changed in the post-period. β_4 measures the difference between China's sensitivity and this average sensitivity (β_1) in the pre-period. β_6 tests whether the change in China's sensitivity in the post-period can be distinguished from the change in the average sensitivity across other developed and emerging market countries. For a developed or emerging market country to be included in this regression, it must meet the following criteria:

- From 2012 to 2021, its average annual inflation must be no greater than 10%.
- From January 1, 2012, to December 31, 2021, the country must have a valid 10-year yield for at least 80% of the weeks covered.
- From January 1, 2012, to December 31, 2021, the standard deviation of weekly changes in the country's 10-year yield must be less than 20 basis points.

Table 9 illustrates that the stronger co-movement experienced by China is notably distinct compared to other countries. Column 1 indicates that, over the full sample from January 2012 to December 2021, a one percent increase in the 10-year G7 yield was associated with a 64 basis point increase in the average 10-year yield across developed and emerging market countries, including

China. Column 2 repeats the estimation in Eq. (4), but as a panel. The average co-movement with G7 countries did not significantly increase after the policy change. Column 3 presents the specification from C5. In this specification, the estimated β_1 is significant, suggesting that, prior to the policy change, a one percent increase in the 10-year G7 yield was associated with an average increase of 67 basis points in the 10-year yield of a country other than China. The coefficient on $\mathbf{1}_{Post} \times \mathbf{1}China$ indicates that, in the pre-period, a one percent increase in the 10-year G7 yield had an effect on China that was 50 basis points lower than the average. Specifically, a one percent increase in the 10-year G7 yield was associated with a 17 basis point increase in the 10-year Chinese yield, approximately a quarter of the average effect. Furthermore, in the post-period, the regression does not find any significant change in the average sensitivity across other countries.

However, the estimated coefficient on $\Delta y^{G7}t \times \mathbf{1}_{Post} \times \mathbf{1}_{China}$ indicates that, in the post-period, a one percent increase in the 10-year G7 yield was associated with an additional 14 basis point increase in the 10-year yield for China compared to other countries. This suggests that the stronger co-movement observed for China was unique and not a global phenomenon.

5.1.2. Is the strengthened yield co-movement driven by other factors?

It is possible that the increased co-movement with G7 countries was caused by some contemporaneous changes in China's economy. To rule out this possibility, I compare Chinese government bonds with two control groups—the Chinese railway bonds and notes issued by Chinese corporates—which were minimally affected by foreign demand. If the two control groups did not experience the same stronger co-movement with G7 countries as long-term Chinese government bonds, then it would prove that this strengthened co-movement was indeed driven by the increased foreign ownership of Chinese government bonds.

Chinese railway bonds are a close substitute for Chinese government bonds in the domestic bond market and are issued by a state-owned corporation named *China State Railway Group*. The company was originally a government agency and was separated from the Chinese Ministry of Railways in 2000. Its issuance is fully backed by the Chinese government. Additionally, no Chinese railway bond is included in any global bond benchmarks and, therefore, they are barely

demanded by foreign investors.

To compare the co-movement with G7 countries experienced by Chinese railway bonds and that experienced by Chinese government bonds, I estimate the regression below using data over the same period:

$$\begin{aligned}\Delta y_t^i = \alpha + \beta_1 \cdot \Delta y_t^{G7} + \beta_2 \cdot \mathbf{1}_{Post} + \beta_3 \cdot \Delta y_t^{G7} \times \mathbf{1}_{Post} + \beta_4 \cdot \mathbf{1}_{Government} \\ + \beta_5 \cdot \Delta y_t^{G7} \times \mathbf{1}_{Government} + \beta_6 \cdot \mathbf{1}_{Post} \times \mathbf{1}_{Government} + \beta_7 \cdot \Delta y_t^{G7} \times \mathbf{1}_{Post} \times \mathbf{1}_{Government} + \epsilon_{it}.\end{aligned} \tag{6}$$

$\Delta y^i t$ denotes the weekly changes in the 10-year Chinese government yield or weekly changes in the 10-year Chinese railway bonds. $\mathbf{1}_{Government}$ is a dummy variable that takes the value of one for Chinese government bonds only. In this specification, the coefficient β_1 estimates the sensitivity of yield changes in 10-year railway bonds to changes in the 10-year G7 yield before the policy change. The sum of β_1 and β_3 represents this sensitivity after the policy change. The sum of β_1 and β_5 estimates the sensitivity of yield changes in 10-year Chinese government bonds to changes in the 10-year G7 yield before the policy change. β_7 estimates the change in co-movement experienced by Chinese government bonds after the policy change, in addition to the change in co-movement experienced by Chinese railway bonds. If β_3 is not significantly positive whereas β_7 is, then the increased co-movement experienced by Chinese government bonds should be unique and not driven by other changes in the Chinese capital market.

Table 10 shows the regression estimates. Column 1 implies that from July 2010 to December 2021, a one percent increase in the average 10-year yield of G7 countries is associated with an average increase of 16 basis points in the 10-year yield across Chinese government bonds and Chinese corporate notes. Column 2 interacts the change in the average 10-year yield of G7 countries with the period after the policy change. It shows that, on average, Chinese government bonds and Chinese corporate notes did not experience a significantly stronger co-movement. Column 3 further interacts the change in the average 10-year yield of G7 countries with the period after the policy change and with Chinese government bonds. It shows that before the policy change, if the 10-year U.S. yield increased by 1%, the 10-year yield on Chinese corporate

notes would rise by 0.15%; after the policy change, this number did not increase and may have decreased by 0.05%. In contrast, before the policy change, if the 10-year U.S. yield increased by 1%, the 10-year yield on Chinese government bonds would rise by 0.16%; after the policy change, this number rose to 0.27%.

To further support the test, I repeat the estimation, replacing Chinese railway bonds with an index of 10-year notes issued by Chinese corporations. Chinese railway bonds, similar to agency bonds, are likely priced at a spread over Chinese government bonds. Therefore, when comparing the co-movement between Chinese government bonds and Chinese railway bonds, the effect on Chinese government bonds may appear less pronounced. On the other hand, 10-year notes issued by Chinese corporations, which are generally riskier than both Chinese government bonds and railway bonds, should show a stronger effect when used as a control group. Table 11 confirms that corporate notes did not experience any stronger co-movement with the G7 countries after the policy change. By contrast, the additional co-movement effect experienced by Chinese government bonds was statistically and economically significant.

To specifically show that this strengthened co-movement is not due to a convergence in monetary policy, I estimate the following regression using interest rates from China and the G7 countries:

$$\Delta r_t^{CNY} = \alpha + \beta_1 \Delta r_t^k + \beta_2 \mathbf{1}_{Post} + \beta_3 \Delta r_t^k \times \mathbf{1}_{Post} + \epsilon_t, \tag{7}$$

where Δr_t^{CNY} represents the weekly changes in the 1-year yield on Chinese government bonds. Column "U.S." in Table 12 shows the specification when Δr_t^k represents the weekly changes in the 1-year U.S. Treasury yield. Column "G7" shows the specification when Δr_t^k represents the weekly changes in the average 1-year G7 yield. The results show no monetary policy convergence, neither between China and the U.S. nor between China and the G7 countries.

With all the tests above, it is safe to conclude that the 10-year Chinese yield experienced a stronger co-movement with the 10-year G7 yield after the policy change. This strengthened co-movement was caused by the increased foreign ownership in local currency Chinese government bonds.

5.1.3. *Long-term yield co-movement and China's progressive opening-up*

As explained in Section 2, there was a testing opening period from August 2012 to March 2017 when the Chinese government piloted several programs that allowed certain types of foreign institutional investors to enter its domestic bond market. I refer to this period as the soft opening period. Clayton et al. (2024) closely examine these investors and conclude that stable investors generally entered during the soft opening, whereas flighty investors entered after 2017. To test how the shift in the foreign investor base impacts yield integration, I add an additional dummy variable for the soft opening period to the baseline regression in Eq. (8):

$$\begin{aligned}\Delta y_t^{CNY} = \alpha + \beta_1 \cdot \Delta y_t^{G7} + \beta_2 \cdot \mathbf{1}_{Soft} + \beta_3 \cdot \Delta y_t^{G7} \times \mathbf{1}_{Soft} \\ + \beta_4 \cdot \mathbf{1}_{Post} + \beta_5 \cdot \Delta y_t^{G7} \times \mathbf{1}_{Soft} \times \mathbf{1}_{Post} + \epsilon_t\end{aligned} \tag{8}$$

$\mathbf{1}_{Post}$ is an indicator variable equal to 1 from July 3, 2017 to December 31, 2021. $\mathbf{1}_{Soft}$ is an indicator variable equal to 1 from August 16, 2010 to December 31, 2021 and 0 otherwise. The estimates for β_3 and β_5 together can show if the shift in the structure of foreign investors matters for the enhanced co-movement.

Table 13 confirms the results from Clayton et al. (2024). The estimated coefficient on $\Delta y_t^{G7} \times \mathbf{1}_{Soft}$ is almost zero, whereas the estimated coefficient on $\Delta y_t^{G7} \times \mathbf{1}_{Soft} \times \mathbf{1}_{Post}$ is nearly the same as in Eq. (4). The p-value of the joint hypothesis test $\beta_3 + \beta_5 = 0$ is 0.049. This suggests that the foreign investors selected during the soft opening stage are likely to be buy-and-hold investors. They tend not to adjust their holdings of local currency Chinese bonds when they rebalance the other assets in their portfolios, and hence there was no significant increase in co-movement driven by them.

5.2. *Comparison to index inclusions*

A large body of literature studies index inclusion effects. An index inclusion event occurs when an asset is added to an index, which typically increases the investor base for that asset. Most of the literature focuses on the stock market. For example, Barberis et al. (2005) find that

stocks co-move more with the index after they enter the S&P index and co-move less with the index after they leave. They argue that this co-movement is driven by the common trading patterns of investor groups. Greenwood and Sosner (2007) find similar effects in stock replacements within the Nikkei 225 index. In the sovereign debt market, Rigobon (2002) examines the event when Mexico was upgraded to investment grade and finds that the correlation between Mexico and other Latin American countries decreased afterward. The paper provides strong evidence suggesting that this reduction is due to changes in the investor universe.

A unique feature of the opening of the Chinese domestic bond market is the breakdown of the co-movement between the Chinese government yield and the government yields of other emerging market countries. By the end of 2020, China was added to both the Bloomberg Global Aggregate Index (which includes global investment-grade debt from many local currency markets) and the JP Morgan Government Bond Index-Emerging Markets Indices (which tracks local currency government debt issued by emerging market countries). Index inclusions have been shown to increase the co-movement between the asset and the index. For example, Barberis et al. (2005) show that an S&P index addition is associated with an increase in the weekly market beta of 11 basis points. Current findings would predict that the Chinese government yield should co-move more with both government yields of developed markets, which are the primary components of the Bloomberg Global Aggregate Index, and with government yields of emerging markets. Indeed, I have shown in Section 5 that the sensitivity of changes in the 10-year Chinese yield to changes in the 10-year G7 yield increased by 10 basis points. However, empirical evidence is at odds with the prediction: the co-movement between China and other emerging market countries did not increase, and may have even decreased, after China's index inclusion. The flow into China comes from two sets of benchmark-driven investors that track their indices, respectively. This contrast suggests that flows from the set of global bond investors holding more developed market debt are of a much larger magnitude and hence overshadow the effect from the emerging market trackers.

China was already the world's second-largest bond market when its index inclusion was completed, receiving weights ranging from 6% to 10%, depending on the index. An ordinary

index inclusion event typically involves an asset that is marginally eligible based on criteria such as market capitalization or liquidity. The weight of the newly added asset in the index is usually small, if not tiny, and as a result, this minor addition tends to become more similar to the larger index family. This, however, was not the case for China. The weight that Chinese government bonds and policy bank bonds received was significant enough to influence the movement of these indices. It is difficult to say whether China has become more similar to the index or whether the index has become more similar to China.

Another feature that distinguishes financial liberalization from index inclusion is the participation of active investors. A change to an index is more likely to induce passive investors to trade because they are required to track the index closely. The soft-opening stage of China's market liberalization had already allowed some of these buy-and-hold investors to enter. The full opening brought many active foreign investors into China's domestic bond market, which can be seen in the increased diversification of bonds held by foreign investors. For instance, the weight of bonds issued by Chinese commercial banks in the aggregate foreign portfolio rose from less than 0.5% in January 2019 to 1.5% in December 2021. None of the commercial bank bonds are included in any global bond indices, suggesting that their inclusion is likely the result of active bond selection by certain funds. Although this increment is small, its growth trend is steady. These active investors also highlight the difference between financial liberalization and a typical index inclusion event.

Despite the contrasts mentioned above, the opening-up of the Chinese domestic bond market resembles an extreme version of index additions. The gradual change in the foreign investor base led to a reduced non-trading effect. To illustrate this, during the soft opening period, local currency Chinese government bonds were traded less frequently by long-term global bond investors. As a result, the weekly changes in the 10-year Chinese government yield may not fully reflect shocks to the global bond market or news about global risks, causing the co-movement effect estimated during this period to be artificially low. After China's full market opening, which introduced more active global bond investors, this non-trading effect diminished, and the co-movement strengthened.

In addition, the entry of international rating agencies has lowered information barriers. Before the liberalization, foreign rating agencies were restricted to monitoring only Chinese government bonds within the Chinese domestic bond market. To invest in other Chinese domestic bonds, foreign investors had to rely on information provided by Chinese domestic rating agencies. This naturally created information friction and resulted in minimal investment in local currency Chinese bonds, aside from Chinese government bonds, by foreign investors. The entry of foreign rating agencies (S&P, Fitch, and Moody's) in 2019 lowered the information barrier for Chinese non-government bonds. In the context of an index inclusion event, when a stock is added to the S&P index, its price begins to incorporate news at the same rate as other S&P stocks.

In these respects, financial liberalization can be seen as an extremely clean form of index inclusion. All the changes are binary: assets that were previously inaccessible to foreign investors can now be freely traded, and information that was previously undisclosed is now available.

6. Empirical Evidence on the Level Shift of Long-Term Yields

Lastly, I present an estimate suggesting a negative shift in the level of the 10-year Chinese government yield in response to the positive foreign demand shock triggered by the opening of the Chinese domestic market. The slow and gradual increase in foreign ownership of local currency Chinese government bonds makes it inherently difficult to estimate the effects on prices and yields. My estimation relies on the yield spread of Chinese railway bonds over Chinese government bonds. This estimate will underestimate the true effect if domestic investors substitute Chinese government bonds with Chinese railway bonds to accommodate the increased foreign demand. Conversely, it could also overestimate the true effect given the growing volume of outstanding Chinese railway bonds. Therefore, I cautiously conclude that this cannot serve as compelling or significant evidence.

6.1. *Predictions from existing theories*

The purchase of local currency Chinese government bonds by foreign investors represents a demand shock to the Chinese domestic bond market. Foreign ownership of local currency Chinese government bonds increased from around 5% at the end of 2017 to nearly 9% by the end of 2022, peaking in 2021 with a share exceeding 10%. In the rest of this section, I examine whether this positive demand shock has affected the yield of Chinese government bonds.

Theories in the existing literature predict that the yield on Chinese government bonds should decrease in response to this positive foreign demand shock. Greenwood and Vayanos (2014) offer a simplified version of the preferred-habitat model of the term structure of interest rates developed by Vayanos and Vila (2021). They assume that, in the absence of arbitrageurs, the demand and supply for bonds of different maturities are price-inelastic. The simplified model has only two risk factors: a short rate factor and a supply factor. It predicts that given a positive supply shock, the price of the bond must drop, and therefore the yield should increase, in order to have arbitrageurs hold the increased supply. In the context of China's opening up, the demand for RMB-denominated Chinese government bonds from foreign institutional investors can be seen as equivalent to a negative supply shock for domestic Chinese arbitrageurs. For these domestic arbitrageurs to reduce their holdings of local currency Chinese government bonds, bond prices must rise, resulting in a decline in yield.

6.2. *Identification strategy and concerns*

The empirical challenge in testing this prediction is that the amount of outstanding Chinese government bonds also increased from 2017 to 2021. To address this issue, I use the yield spread of the 10-year Chinese railway bond over the 10-year Chinese government bond and estimate a difference-in-differences regression as follows:

$$y_t^{Railway} - y_t^{CNY} = \alpha + \beta \cdot \mathbf{1}_{\text{Post}} + \epsilon_t. \tag{9}$$

China Open-up is an indicator variable equal to 1 on and after July 3, 2017. The yield spread $y_t^{railway} - y_t^{CNY}$ is measured at a weekly frequency from July 3, 2014, to July 3, 2020.

My identifying assumption is that there should have been no change in the yield spread in the absence of the policy change. However, there are two concerns with this assumption. First, Chinese railway bonds are imperfect substitutes for Chinese government bonds in the eyes of domestic investors. In response to the foreign demand shock for local currency Chinese government bonds, domestic investors might sell their holdings of these bonds and substitute them with Chinese railway bonds. This would decrease the yield on railway bonds as well, potentially underestimating the impact on Chinese government bond yields caused by increasing foreign demand. Another threat to the identification is that the outstanding amount of Chinese railway bonds has also been steadily rising over time. This increase in supply could raise the yield on Chinese railway bonds and lead to a larger spread, which might overestimate the impact of the foreign demand shock on Chinese government bond yields.

The yield spread of the 10-year Chinese railway bond over the 10-year Chinese government bond is plotted in Figure 4. The spread consistently declined from 2015 but experienced a sharp reversal at the beginning of 2017. The no-pretrend requirement for a solid difference-in-differences estimation is not satisfied here. After China's opening up, there was a temporary large increase in the spread, which subsequently disappeared in the middle of 2018.

6.3. Estimation and interpretation

Given these caveats, the true effect of foreign demand on the level of long-term Chinese yield remains ambiguous. The coefficient β in Eq. (9) provides an estimate of the change in the 10-year Chinese yield due to foreign demand. Table 14 displays the results. The coefficient estimate for China Open-up suggests that, in the three years following the announcement of China's opening up, the average spread widened by 8 basis points. It is important to note that this increase in the spread is primarily driven by a temporary 50 basis point rise in the first two quarters of 2018. Therefore, a more cautious conclusion is that there is no compelling evidence that the 10-year yield on Chinese government bonds experienced any significant shift in level due to the foreign

demand shock.

7. Conclusion

In this paper, I provide evidence of a causal relationship between foreign ownership of a country's sovereign debt and the co-movement of its domestic bond market with the global bond market. I examine a policy change in China that increased foreign participation in the Chinese domestic bond market, raising foreign ownership of local currency Chinese government bonds from 4% to 9%. I find that, in response to the policy change, both fund managers and investor flows in the mutual fund sector substituted local currency bonds issued by the G7 countries with local currency Chinese bonds. This expansion of the investment habitat for global bond investors led to an enhanced long-term yield co-movement between China and developed markets. I show that after the policy change, the sensitivity of changes in the Chinese 10-year yield to changes in the average 10-year yield of the G7 countries increased by two-thirds. To further support the findings, I compare Chinese government bonds with two control groups — bonds issued by China State Railway Group and Chinese corporates — which were minimally affected by foreign demand. The results confirm that the increased co-movement was driven by rising foreign ownership of Chinese government bonds, offering new insights into the relationship between foreign participation and global bond market integration. Additionally, I explore the impact of foreign demand on Chinese bond yields, finding no compelling evidence of a significant long-term shift in yield levels.

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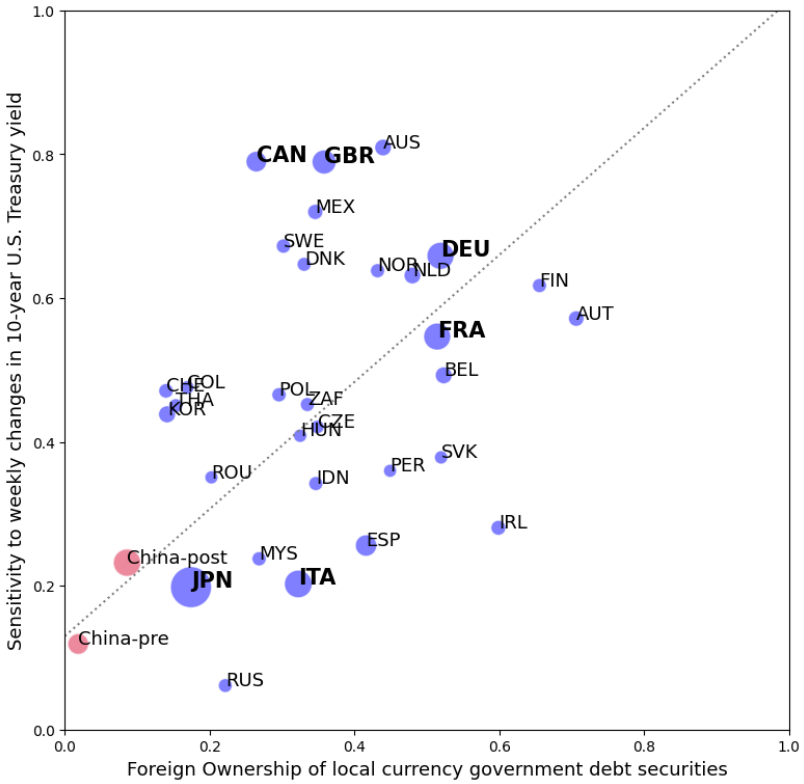
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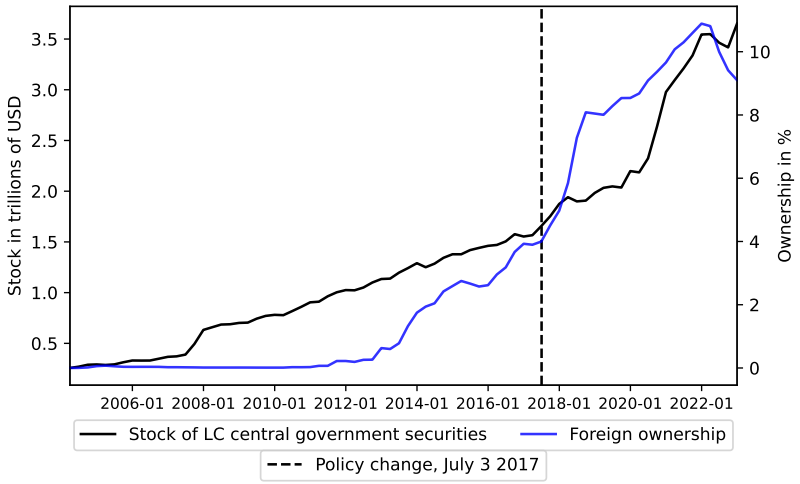
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Figure 1: Co-movement with the U.S. Bond Market vs. Foreign Ownership of Sovereign Debt



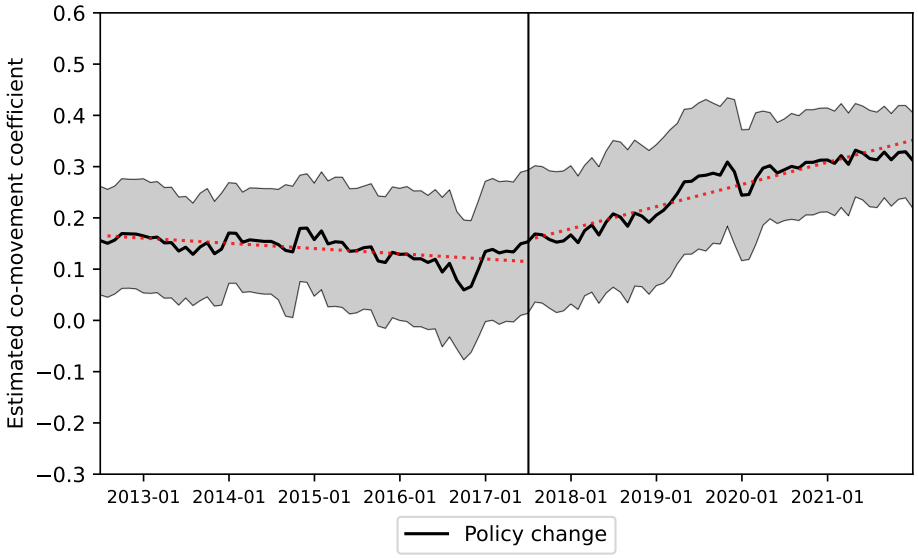
Note: This figure plots the co-movement between a country's domestic bond market and the global bond market against the share of its local currency government debt securities owned by foreigners. The size of each dot reflects the amount of outstanding local currency government debt securities for that country. Foreign ownership for Canada, Japan, and the U.K. is estimated excluding their central banks' holdings. The co-movement is estimated using the following equation: $\Delta y_t^i = \alpha_i + \beta_i \cdot \Delta y_t^{U.S.} + \epsilon_t^i$, where $\Delta y_t^{U.S.}$ denotes the weekly change in the 10-year U.S. Treasury yield, and Δy_t^i denotes the weekly change in the 10-year government yield of country i.

Figure 2: Trends in Local Currency Chinese Central Government Securities and Foreign Ownership



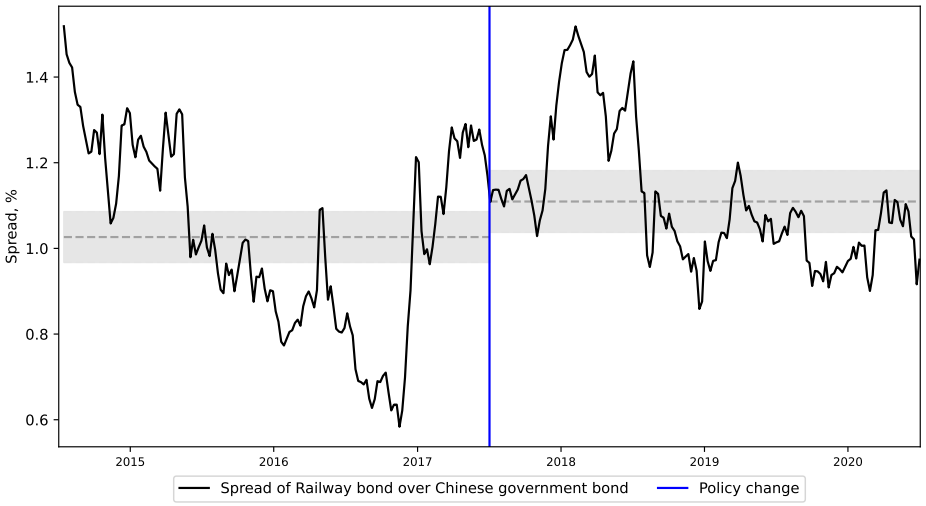
Note: This figure plots the outstanding Chinese central government securities in local currency and their foreign ownership over time. The data are presented at a quarterly frequency from 2004 to 2022. The figure indicates that by the end of 2022, the stock of local currency Chinese central government securities exceeded 3.5 trillion USD. The foreign ownership of RMB-denominated Chinese central government securities is approximately 9%.

Figure 3: Co-Movement of 10-Year Yields Between China and G7 Countries



Note: This figure employs rolling regressions to illustrate how the sensitivity of changes in the 10-year Chinese yield to changes in the 10-year G7 yield evolves over time. The solid black line represents the estimated slope from a regression that analyzes weekly changes in the 10-year Chinese yield in relation to weekly changes in the 10-year G7 yield. The regression is re-estimated each month using the previous three years of weekly data.

Figure 4: Yield Spread: 10-Year Chinese Railway Bonds vs. 10-Year Chinese Government Bonds



Note: This figure plots the spread of the yield on the 10-year Chinese railway bond over the yield of the 10-year Chinese government bond. The data is presented at a weekly frequency and covers the period from July 3, 2014, to July 3, 2020.

Table 1: Summary Statistics of Global Bond Funds

	AUM	Weight in bonds	Weight in LC Chinese bonds	
			Jun 2017	Dec 2021
#funds	1144	1144	1144	1144
mean	868	93.50	0.20	1.23
std	1627	4.25	2.21	5.93
min	10	80.44	0.00	0.00
25%	136	91.28	0.00	0.00
50%	332	94.50	0.00	0.00
75%	903	96.66	0.00	0.00
max	21424	100.20	40.89	93.81

Note: This table presents the statistics of global bond funds. AUM (assets under management) is measured in USD millions, and weights are expressed as fractions of AUM in percentage points. There were 1,144 global bond funds, with an average AUM of 868 million dollars and an average weight in bonds of 93.50%. The average weight of local currency Chinese bonds across global bond funds increased from 0.2% in June 2017 to 1.23% in December 2021.

Table 2: Aggregate Cumulative Substitution by Currency and Country Group

LC/FC	Country group	Jun 2017 weight, %	Dec 2021 weight, %	Weight change, %
LC	China	0.05	1.23	1.18
	EMs	8.03	3.66	-4.37
	G7	44.80	45.77	0.97
	Other DMs	13.16	14.99	1.84
	Rest of the World (RoW)	1.47	1.09	-0.38
FC	China	0.50	1.26	0.75
	EMs	5.35	5.50	0.14
	G7	12.44	11.28	-1.16
	Other DMs	8.51	8.27	-0.24
	Rest of the World (RoW)	4.55	5.70	1.15
Unknown	Rest of the World (RoW)	1.14	1.24	0.10

Note: Table 2 displays the changes in the aggregate weight of global bond funds by local and foreign currency, as well as by country group. For example, the row for LC, China indicates that, in aggregate, the sample of global bond funds increased their weight in local currency Chinese bonds by 1.18% from June 2017 to December 2021.

Table 3: Cross-Section Regression Analysis by Currency and Country Group

			FC		
	China	EMs	G7	Other DMs	RoW
Intercept	0.24**	−0.15	−0.29	−0.78***	0.56*
	(0.12)	(0.21)	(0.35)	(0.21)	(0.29)
LC China	−0.27	0.03	0.01	0.03	−0.06*
	(0.20)	(0.02)	(0.03)	(0.02)	(0.04)
N	1144	1144	1144	1144	1144
R^2	0.18	0.00	0.00	0.00	0.00

	Unknown		LC		
	RoW	EMs	G7	Other DMs	RoW
Intercept	−0.05	−1.34**	1.29***	0.47	0.05
	(0.44)	(0.55)	(0.37)	(0.45)	(0.15)
LC China	−0.07	−0.13	−0.37***	−0.09	−0.07**
	(0.10)	(0.09)	(0.12)	(0.07)	(0.03)
N	1144	1144	1144	1144	1144
R^2	0.00	0.01	0.02	0.00	0.01

Note: This table estimates the sensitivity of cumulative weight changes in local currency (LC) or foreign currency (FC) bonds of different country groups to the cumulative weight change in Chinese LC bonds across funds. Each unit of observation corresponds to a fund's cumulative weight change in a country group and currency combination. Funds are weighted by their average AUM. Standard errors are heteroskedasticity-robust standard errors (White, 1980). The β estimate in the third column of the bottom panel, labeled LC G7, indicates that a 1% increase in LC Chinese bonds held by a global bond fund is associated with a 0.37% decrease in LC bonds issued by G7 countries.

Table 4: Panel Regression Analysis by Currency and Country Group

			FC		
	China	EMs	G7	Other DMs	RoW
Intercept	0.01^{***}	-0.01	-0.02^{***}	-0.02^{***}	0.01^{***}
	(0.00)	(0.00)	(0.01)	(0.00)	(0.00)
LC China	-0.30^{**}	-0.01	-0.01	-0.18^{***}	-0.05^{***}
	(0.14)	(0.01)	(0.01)	(0.04)	(0.01)
Time FE	No	No	No	No	No
Fund FE	No	No	No	No	No
#Funds	1144	1144	1144	1144	1144
#Time periods	54	54	54	54	54
N	61776	61776	61776	61776	61776
R^2	0.06	0.00	0.00	0.01	0.00

	Unknown		LC		
	RoW	EMs	G7	Other DMs	RoW
Intercept	0.00	-0.03^{***}	0.02^{*}	0.03^{***}	0.00
	(0.00)	(0.01)	(0.01)	(0.01)	(0.00)
LC China	-0.03	-0.08	-0.24^{**}	0.04	-0.07^{***}
	(0.02)	(0.06)	(0.12)	(0.03)	(0.02)
Time FE	No	No	No	No	No
Fund FE	No	No	No	No	No
#Funds	1144	1144	1144	1144	1144
#Time periods	54	54	54	54	54
N	61776	61776	61776	61776	61776
R^2	0.00	0.00	0.00	0.00	0.00

Note: This table estimates the sensitivity of funds' percentage weight changes in local currency (LC) or foreign currency (FC) bonds of different country groups to their percentage weight change in LC Chinese bonds at a monthly frequency. Each unit of observation corresponds to the change in a fund's weight in a specific country group and currency combination within a month. Each regression is based on 54 periods. Funds are weighted by their average AUM. Standard errors are clustered by fund. The β estimate in the third column of the bottom panel, labeled LC G7, indicates that a 1% increase in LC Chinese bonds held by a global bond fund is associated with a 0.24% decrease in LC bonds issued by G7 countries.

Table 5: Responses by investor flows

	(1)	(2)	(3)	(4)	(5)	(6)
Intercept	0.301*					0.567**
	(0.16)					(0.24)
$r_{i,t-1}$	0.128**	0.118**	0.119**	0.119**	0.113**	0.127**
	(0.06)	(0.05)	(0.05)	(0.05)	(0.05)	(0.06)
$w_{i,t-1}^{LC,G7}$			−0.001	0.000	−0.004	−0.004
			(0.00)	(0.00)	(0.00)	(0.00)
$w_{i,t-1}^{LC,OtherDMs}$					−0.000	−0.001
					(0.00)	(0.00)
$w_{i,t-1}^{LC,EMs}$					−0.020***	−0.019***
					(0.01)	(0.01)
$w_{i,t-1}^{LC,China}$				0.109*	0.121**	0.109**
				(0.06)	(0.05)	(0.05)
Time FE	No	Yes	Yes	Yes	Yes	No
Fund FE	No	No	No	No	No	No
#Funds	1144	1144	1144	1144	1144	1144
Avg. #Time periods	54	54	54	54	54	54
N	61776	61776	61776	61776	61776	61776
R^2	0.00	0.00	0.00	0.00	0.01	0.01

Note: This table presents estimates from the following regression:
$\%Flow_{i,t} = \alpha + \beta_0 r_{i,t-1} + \beta_1 w_{i,t-1}^{LC,G7} + \beta_2 w_{i,t-1}^{LC,OtherDMs} + \beta_3 w_{i,t-1}^{LC,EMs} + \beta_4 w_{i,t-1}^{LC,China} + \epsilon_{i,t}$.
Flow is measured as a fraction of a fund's lagged AUM. Weights and returns are expressed in percentage points. Funds are weighted by their average AUM. Standard errors are clustered by both fund and time.

Table 6: Decomposition of Aggregate Cumulative Weight Change

LC/FC	Country group	Jun 2017 weight, %	+Managers & Return	+Investor Flows	Dec 2021 weight, %
LC	China	0.05	+0.66	+0.52	1.23
	EMs	8.03	-3.04	-1.33	3.66
	G7	44.80	+1.81	-0.84	45.77
	Other DMs	13.16	+1.54	+0.30	14.99
	RoW	1.47	+0.09	-0.46	1.09
FC	China	0.50	+0.29	+0.46	1.26
	EMs	5.35	-0.33	+0.48	5.50
	G7	12.44	-0.90	-0.26	11.28
	Other DMs	8.51	-0.92	+0.69	8.27
	RoW	4.55	+0.83	+0.32	5.70
Unknown	RoW	1.14	-0.02	+0.12	1.24

Note: This table breaks down the aggregate cumulative weight change from June 2017 to December 2021 into two components: changes driven by manager rebalancing and returns, and changes driven by investor flows. The weights are expressed in percentage points.

Table 7: Co-Movement of 10-Year Chinese Yields with G7 Yields

	(1)	(2)
Intercept	−0.00	0.00
	(0.00)	(0.00)
Δy_t^{G7}	0.19***	0.16***
	(0.03)	(0.04)
$\mathbf{1}_{Post}$		−0.00
		(0.00)
$\Delta y_t^{G7} \times \mathbf{1}_{Post}$		0.11*
		(0.06)
N	586	586
R^2	0.06	0.07

Note: This table estimates the sensitivity of weekly changes in the 10-year Chinese yield to weekly changes in the 10-year G7 yield from July 1, 2010, to December 31, 2021. The G7 yield is a value-weighted average of the 10-year yields of G7 countries. The weights are constructed based on the average dollar value holdings of local currency bonds from each country held by global bond funds between July 2017 and December 2021. $\mathbf{1}_{Post}$ is an indicator variable equal to 1 after July 3, 2017, and 0 otherwise. Standard errors are computed using Newey-West standard errors (Newey and West, 1994). Column 1 shows that a 1 percent unconditional increase in the average 10-year G7 yield is associated with a 19 basis point increase in the 10-year Chinese yield. Column 2, which interacts the change in the average G7 yield with the period of China's opening up, shows that the co-movement is much stronger during this period: a 1 percent increase in the average G7 yield is associated with a 27 basis point increase in the 10-year Chinese yield. This effect represents a two-thirds increase compared to the period before China's opening up.

Table 8: Country-Specific Co-Movement of Chinese and G7 Yields

	United States	Canada	Italy	Japan	United Kingdom	France	Germany
Intercept	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Δy_t^i	0.11^{***}	0.14^{***}	0.04^{*}	0.28^{***}	0.11^{***}	0.11^{**}	0.12^{***}
	(0.03)	(0.04)	(0.02)	(0.09)	(0.03)	(0.04)	(0.03)
$\mathbf{1}_{Post}$	-0.00	-0.00	-0.00	-0.00	-0.00	-0.00	-0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
$\Delta y_t^i \times \mathbf{1}_{Post}$	0.13^{**}	0.05	-0.03	0.42^{**}	0.09^{*}	0.06	0.11^{*}
	(0.05)	(0.06)	(0.03)	(0.17)	(0.05)	(0.06)	(0.06)
N	586	586	586	586	586	586	586
R^2	0.06	0.05	0.01	0.04	0.05	0.03	0.04

Note: This table estimates the sensitivity of weekly changes in the 10-year Chinese yield to weekly changes in the 10-year yield of each G7 country from July 1, 2010, to December 31, 2021. Standard errors are computed using Newey-West standard errors (Newey and West, 1994). The first row shows that, before the policy change, a 1 percent increase in the 10-year U.S. yield was associated with an 11 basis point increase in the 10-year Chinese yield. After the policy change, a 1 percent increase in the 10-year U.S. yield was associated with a 24 basis point increase in the 10-year Chinese yield. This stronger co-movement is also observed between China and the U.K., Japan, and Germany at a statistically and economically significant level.

Table 9: Comparative Analysis of China with Other Developed and Emerging Market Countries

	(1)	(2)	(3)
Intercept	-0.00	-0.00^{*}	-0.00^{**}
	(0.00)	(0.00)	(0.00)
Δy_t^{G7}	0.64^{***}	0.68^{***}	0.67^{***}
	(0.05)	(0.07)	(0.06)
$\mathbf{1}_{Post}$		0.01	0.01^{*}
		(0.00)	(0.00)
$\Delta y_t^{G7} \times \mathbf{1}_{Post}$		0.01	-0.05
		(0.14)	(0.08)
$\mathbf{1}_{Post} \times \mathbf{1}_{China}$			-0.01^{***}
			(0.00)
$\Delta y_t^{G7} \times \mathbf{1}_{China}$			-0.50^{***}
			(0.05)
$\Delta y_t^{G7} \times \mathbf{1}_{Post} \times \mathbf{1}_{China}$			0.14^{*}
			(0.09)
Time FE	No	No	No
Entity FE	Yes	Yes	Yes
#Entities	27	27	27
#Time periods	508	508	508
N	13296	13296	13296
R^2	0.20	0.18	0.21

Note: This table estimates the average sensitivity of weekly changes in a country's 10-year yield to changes in the average 10-year yield of G7 countries from January 1, 2012, to December 31, 2021. $\mathbf{1}_{Post}$ is an indicator variable equal to 1 from July 3, 2017, to December 31, 2021, and 0 otherwise. $\mathbf{1}_{China}$ is an indicator variable equal to 1 when the country is China and 0 otherwise. Standard errors are clustered by country and by time. Column 1 implies that, from 2012 to 2021, a one percent increase in the average 10-year yield of G7 countries is associated with an average increase of 64 basis points in the 10-year yield across 27 developed and emerging market countries, including China. Column 2 interacts the change in the average 10-year yield of G7 countries with the post-policy change period. It shows that, on average, developed and emerging market countries did not experience stronger co-movement after the policy change. Column 3 further interacts the change in the average 10-year yield of G7 countries with China and the post-period. It shows that before the policy change, a one percent increase in the 10-year G7 yield resulted in a rise in the 10-year Chinese yield that was 50 basis points lower than that of other developed and emerging economies. After the policy change, this association strengthened by 14 basis points.

Table 10: Comparative Yield Co-Movement: Chinese Government Bonds vs. Chinese Railway Bonds

	(1)	(2)	(3)
Intercept	-0.00	0.00	0.00
	(0.00)	(0.00)	(0.00)
Δy_t^{G7}	0.16^{***}	0.14^{***}	0.13^{***}
	(0.02)	(0.03)	(0.05)
$\mathbf{1}_{Post}$		-0.00	-0.01
		(0.00)	(0.00)
$\Delta y_t^{G7} \times \mathbf{1}_{Post}$		0.05	-0.01
		(0.04)	(0.06)
$\mathbf{1}_{Government}$			-0.00
			(0.00)
$\mathbf{1}_{Post} \times \mathbf{1}_{Government}$			0.00
			(0.00)
$\Delta y_t^{G7} \times \mathbf{1}_{Government}$			0.03
			(0.04)
$\Delta y_t^{G7} \times \mathbf{1}_{Post} \times \mathbf{1}_{Government}$			0.12^{**}
			(0.06)
Time FE	No	No	No
Entity FE	No	No	No
#Entities	2	2	2
#Time periods	586	586	586
N	1172	1172	1172
R^2	0.04	0.04	0.04

Note: This table compares the yield comovement between 10-year local currency Chinese government bonds and 10-year local currency G7 bonds with the yield comovement between 10-year local currency Chinese railway bonds and 10-year local currency G7 bonds, from July 1, 2010, to December 31, 2021. $\mathbf{1}_{Post}$ is an indicator variable equal to 1 for the period from July 3, 2017, to December 31, 2021, and 0 otherwise. $\mathbf{1}_{Government}$ is an indicator variable equal to 1 when the yield changes are for Chinese government bonds and 0 for Chinese railway bonds. Standard errors are clustered by time.

Table 11: Comparative Yield Co-Movement: Chinese Government Bonds vs. Corporate Bonds

	(1)	(2)	(3)
Intercept	−0.00	−0.00	−0.00
	(0.00)	(0.00)	(0.00)
Δy_t^{G7}	0.16***	0.15***	0.15***
	(0.02)	(0.03)	(0.05)
$\mathbf{1}_{Post}$		−0.00	−0.00
		(0.00)	(0.01)
$\Delta y_t^{G7} \times \mathbf{1}_{Post}$		0.03	−0.05
		(0.05)	(0.07)
$\mathbf{1}_{Government}$			0.00
			(0.00)
$\mathbf{1}_{Post} \times \mathbf{1}_{Government}$			0.00
			(0.00)
$\Delta y_t^{G7} \times \mathbf{1}_{Government}$			0.01
			(0.04)
$\Delta y_t^{G7} \times \mathbf{1}_{Post} \times \mathbf{1}_{Government}$			0.16***
			(0.06)
Time FE	No	No	No
Entity FE	No	No	No
#Entities	2	2	2
#Time periods	546	546	546
N	1092	1092	1092
R^2	0.04	0.04	0.04

Note: This table compares the yield comovement between 10-year local currency Chinese government bonds and 10-year local currency G7 bonds with the yield comovement between an index of 10-year notes issued by Chinese corporations and 10-year local currency G7 bonds, from April 1, 2011, to December 31, 2021. $\mathbf{1}_{Post}$ is an indicator variable equal to 1 for the period from July 3, 2017, to December 31, 2021, and 0 otherwise. $\mathbf{1}_{Government}$ is an indicator variable equal to 1 when the yield changes are for Chinese government bonds and 0 for the Chinese corporations index. Standard errors are clustered by time.

Table 12: No Monetary Policy Convergence Between China and the G7

	U.S.	G7
Intercept	0.00	0.00
	(0.01)	(0.01)
Δr_t^k	0.30^{**}	0.19
	(0.14)	(0.23)
$\mathbf{1}_{Post}$	-0.00	-0.00
	(0.01)	(0.01)
$\Delta r_t^k \times \mathbf{1}_{Post}$	-0.43^{*}	-0.57
	(0.23)	(0.38)
Time FE	No	No
Fund FE	No	No
N	548	548
R^2	0.01	0.01

Note: This table estimates the sensitivity of weekly changes in the Chinese interest rate to weekly changes in the U.S. interest rate or the average G7 interest rates: $\Delta r_t^{CNY} = \alpha + \beta_1 \Delta r_t^k + \beta_2 \mathbf{1}_{Post} + \beta_3 \Delta r_t^k \times \mathbf{1}_{Post} + \epsilon_t$. The interest rate is measured by the yield on 1-year local currency government bonds and ranges from July 1, 2010, to December 31, 2021. $\mathbf{1}_{Post}$ is an indicator variable equal to 1 after July 3, 2017, and 0 otherwise. Standard errors are computed using Newey-West standard errors (Newey and West, 1994).

Table 13: Yield Co-Movement: Soft Opening vs. Post-Policy Change

	(1)	(2)	(3)	(4)
Intercept	0.000	0.001	0.001	0.001
	(0.00)	(0.00)	(0.01)	(0.01)
Δy_t^{G7}	0.128***	0.099*	0.043	0.043
	(0.05)	(0.06)	(0.10)	(0.10)
$\mathbf{1}_{Post}$		−0.004		−0.004
		(0.00)		(0.00)
$\Delta y_t^{G7} \times \mathbf{1}_{Post}$		0.164**		
		(0.07)		
$\mathbf{1}_{Soft}$			−0.002	−0.001
			(0.01)	(0.01)
$\Delta y_t^{G7} \times \mathbf{1}_{Soft}$			0.147	0.114
			(0.10)	(0.11)
$\Delta y_t^{G7} \times \mathbf{1}_{Soft} \times \mathbf{1}_{Post}$				0.105*
				(0.06)
N	810	810	810	810
R^2	0.03	0.04	0.04	0.04

Note: This table compares the sensitivity of weekly changes in the Chinese 10-year yield to weekly changes in the average G7 yield during China's soft opening period with the period following China's opening up. The regression below is estimated using data from March 1, 2006, to December 31, 2021:
$\Delta y_t^{CNY} = \alpha + \beta_1 \cdot \Delta y_t^{G7} + \beta_2 \cdot \mathbf{1}_{Soft} + \beta_3 \cdot \Delta y_t^{G7} \times \mathbf{1}_{Soft} + \beta_4 \cdot \mathbf{1}_{Post} + \beta_5 \cdot \Delta y_t^{G7} \times \mathbf{1}_{Soft} \times \mathbf{1}_{Post} + \epsilon_t$.
$\mathbf{1}Post$ is an indicator variable equal to 1 from July 3, 2017, to December 31, 2021. $\mathbf{1}Soft$ is an indicator variable equal to 1 from August 16, 2010, to December 31, 2021, and 0 otherwise. The p-value of the joint hypothesis test $\beta_3 + \beta_5 = 0$ is 0.049. Standard errors are computed using Newey-West standard errors (Newey and West, 1994).

Table 14: Yield Spread of Chinese Railway Bonds Over Government Bonds

	(1)
Intercept	1.026^{***}
	(0.03)
$\mathbf{1}_{Post}$	0.083^{**}
	(0.04)
N	308
R^2	0.05

Note: This table estimates the yield spread of the 10-year Chinese railway bond over the 10-year Chinese government bond before and after the policy change: $y_t^{Railway} - y_t^{CNY} = \alpha + \beta \cdot \mathbf{1}_{\text{Post}} + \epsilon_t$. $\mathbf{1}_{Post}$ is an indicator variable equal to 1 on and after July 3, 2017. The spread is measured weekly from July 3, 2014, to July 3, 2020. Standard errors are computed using Newey-West standard errors (Newey and West, 1994). The results indicate that, in the three years following the policy change, the average spread widened by 8 basis points.

Online Appendix

Appendix H. Additional Empirical Results

Table H.1: Co-movement between USD and other G10 currencies

	1994	2023
Δy_t^i	0.18^{***}	0.59^{***}
	(0.02)	(0.02)
Time FE	No	No
Currency FE	Yes	Yes
#Currencies	8	9
#Time periods	692	661
N	3370	5790
R^2	0.06	0.28

Note: This table compares the sensitivity of daily changes in the U.S. Treasury 10-year yield to daily changes in the 10-year government yields of other G10 currencies (AUD, NZD, CAD, CHF, SEK, JPY, GBP, DEM, NOK) in 1994 and 2023: $\Delta y_t^{USD} = \alpha_i + \beta \cdot \Delta y_t^i + \epsilon_{it}$. The column for 1994 is estimated using data from 12/31/1991 to 12/31/1994. The column for 2023 is estimated using data from 12/31/2020 to 12/31/2023. G10 yields are calculated as simple averages of the yields of individual G10 countries. Standard errors are heteroskedasticity-robust standard errors (White, 1980).