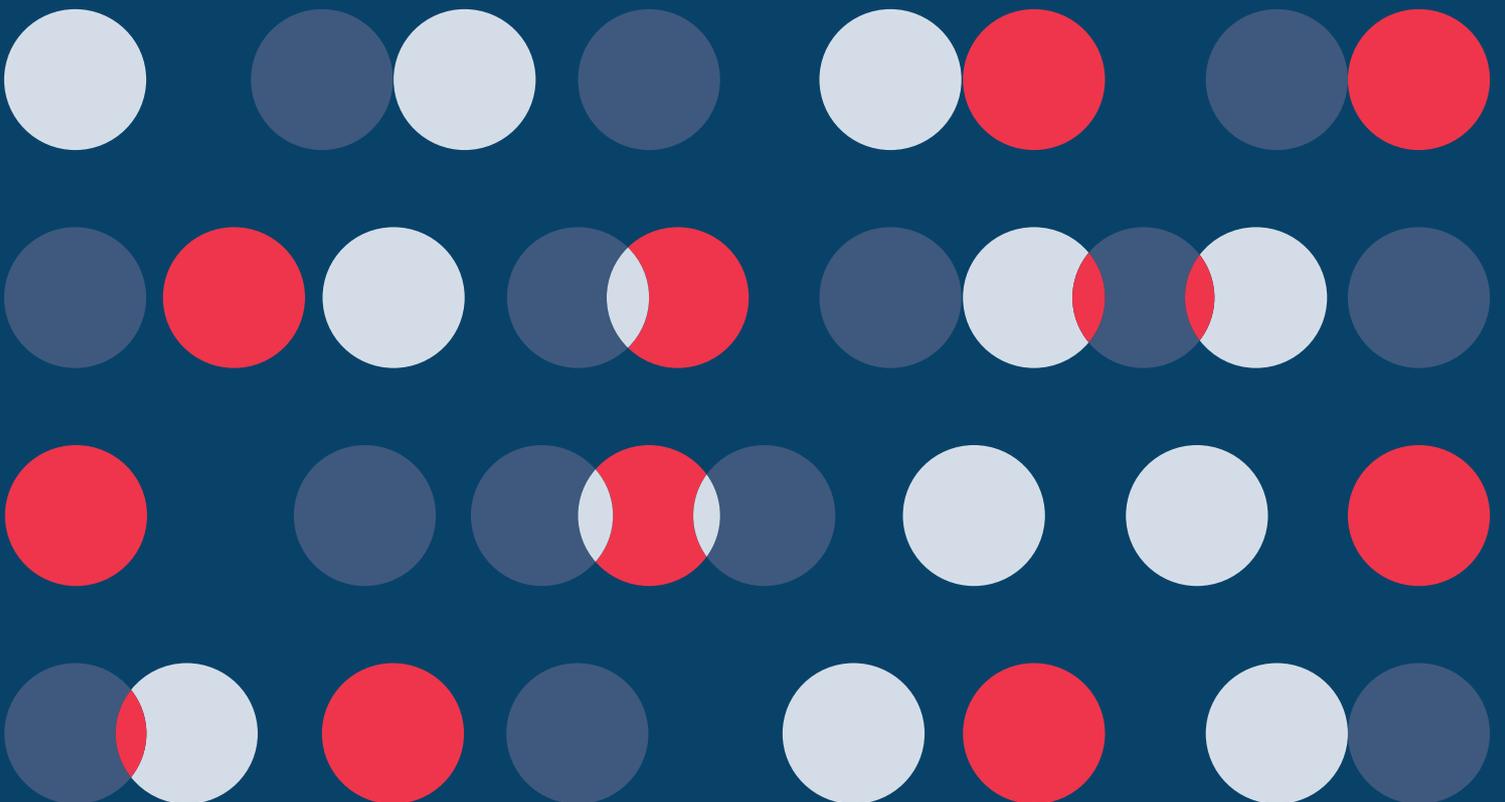


April 2017

RESEARCH REPORT

HKEX'S FIVE-YEAR CHINA MINISTRY OF FINANCE
TREASURY BOND FUTURES —
THE WORLD'S FIRST RMB BOND DERIVATIVES
ACCESSIBLE TO OFFSHORE INVESTORS



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SUMMARY

China's debt capital market has now become the third largest in the world at RMB56.3 trillion, or about US\$8.1 trillion, after a rapid expansion over years. China also made significant strides to advance RMB internationalisation and the openness of the domestic financial market. Although the current share of foreign holdings of Chinese bonds is still at a low level, foreign capital shows a strong appetite for Chinese sovereign bonds, and foreign holdings in the sovereign bond segment has significantly increased after the formal inclusion of RMB into the International Monetary Fund's Special Drawing Right (SDR) basket in October 2016. If China implements the pilot Bond Connect scheme between Hong Kong and the Mainland in the near future, the increased foreign investment in Chinese bonds would result in a surging demand for related risk management.

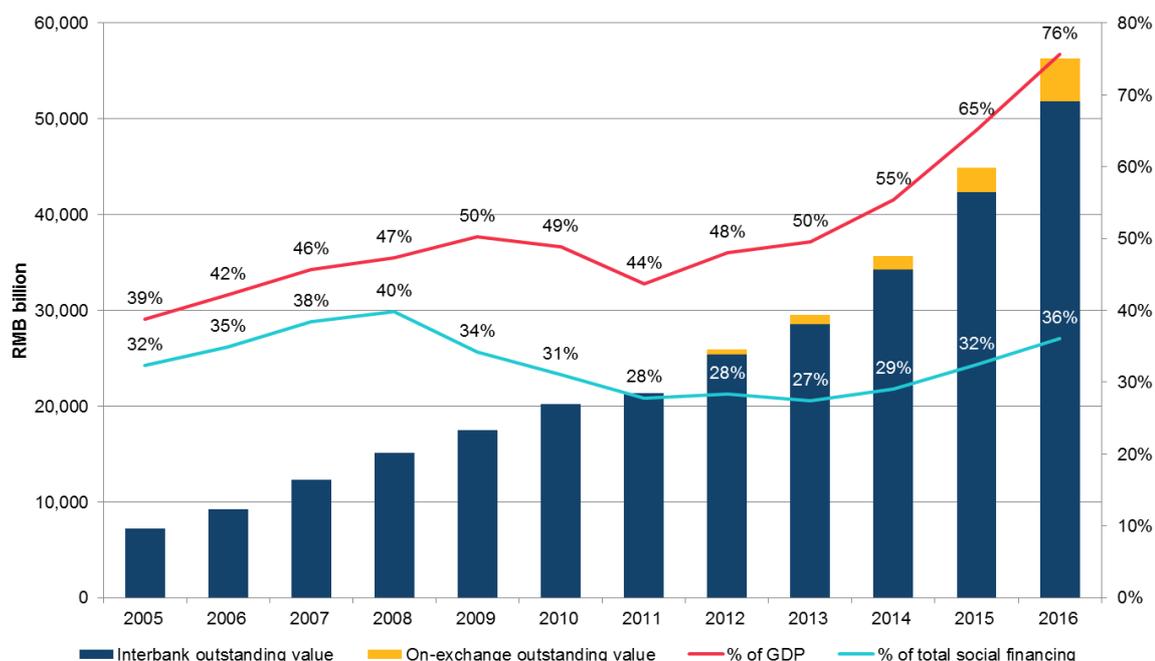
Developing effective hedging support and providing foreign exchange (FX) access are important for foreign investors to increase their exposure to RMB assets. To date, there are a number of interest rate risk management products in the onshore market, which provides supportive tools to hedge RMB interest rate risks. Along with further opening up of the domestic foreign exchange market to foreign investors recently, some eligible foreign investors can also directly access mainland derivatives. HKEX's T-Bond Futures utilizes the product strength of offshore market and is carefully designed with a few distinguishing features, in order to ensure that the trading of this product would unlikely have an adverse impact on the onshore market.

Based on the experience of developed countries, the introduction of treasury bond futures plays an important role in improving the pricing function of the underlying bond market, promoting the liquidity of spot market and enriching the means of interest rate risk management of bond investors. A majority of empirical studies finds either no significant effect, or else a decrease in volatility, of the spot market following the introduction of treasury bond futures. HKEX's T-Bond Futures provides a solid tool for foreign investors to hedge against interest rate volatility of RMB assets, and could be regarded as a quickening step to support the development of the onshore fixed income market and facilitate foreign capital flows into China's domestic bond market. Banks, asset management companies, brokerage firms and insurance companies are the main target users of this product.

1. THE OPENNESS OF CHINA'S DOMESTIC BOND MARKET

China's debt capital market has now become the third largest in the world at RMB56.3 trillion, or about US\$8.1 trillion, after a rapid expansion at a simple average annual growth rate of 21% in outstanding value over the past five years (see Figure 1).

Figure 1. Year-end outstanding value of China's debt securities and its share of GDP and total social financing (TSF) (2005-2016)



Source: China Central Depository & Clearing (CCDC) annual reports on statistical analysis of bond market (債券市場年度統計分析報告) (2011 - 2016), excluding data for on-exchange market and bonds settled in Shanghai Clearing House (SCH) (2005-2011) due to data unavailability. GDP and TSF data are from Wind.

China has promoted its debt capital market to play a more prominent role in financial resources allocation. Meanwhile, it also made significant strides to advance RMB internationalisation and the openness of the domestic financial market. One major direction is to invite more foreign participation to tap into the domestic bond market in order to boost the diversity and variety of the bond sector and further increase the scale and depth of the domestic financial market. In 2010, China took the first step to allow qualified institutions to use offshore RMB to invest in the interbank bond market, and then introduced Renminbi Qualified Foreign International Investor (RQFII) program in 2011 and relaxed the investment restrictions of Qualified Foreign International Investor (QFII) in 2013 as another steps towards opening domestic bond market.

Since 2015, a number of notable liberalisation measures were launched to further facilitate foreign investors to access China's interbank bond market (CIBM). Specifically, in late-May 2015, the People's Bank of China (PBOC) allows offshore RMB clearing and participating banks to conduct repurchase (repo) financing by using their onshore bond holdings. In mid-July 2015, the PBOC further eased the scope of eligible bond transactions by allowing eligible entities to engage in bond trading, bond repo, bond lending, bond futures, interest rate swaps and other trades permitted by the PBOC in the interbank market. In February 2016, the PBOC released new regulations which relaxed the rules applicable to foreign institutional investors accessing the interbank bond market. In May 2016, China further published the detailed rules to clarify the investment procedure of foreign institutional investors in the interbank bond market.

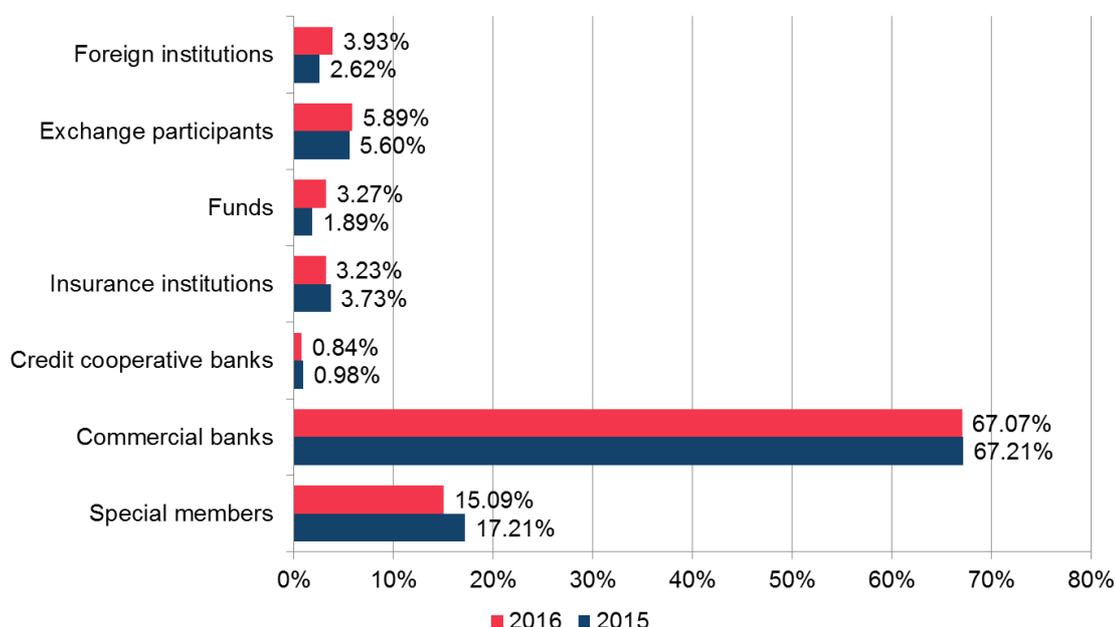
Those policy moves, to some extent, pass on a message to the market that China is on the way to further open its capital account and encourage more foreign capital inflows.

2. THE SURGING DEMAND FOR CHINESE SOVEREIGN BONDS

Given the formal inclusion of RMB into the SDR basket in 2016, the demand for RMB assets, especially RMB bond assets, would steadily grow when central banks and global investors started to consider reallocating funds into RMB-denominated assets. The achievement of SDR status increases the global acceptance of RMB as a global investment and reserve currency, which would most likely trigger an increasing demand for RMB-denominated assets from both public- and private-sectors internationally. According to our estimation, if the holding share of RMB assets by global institutions or individuals could reach to 10% of total domestic bond market, it could be expected that over RMB9.5 trillion would flow into relevant RMB bond assets in the coming years.

Typically, debt securities, especially the sovereign bonds are a top asset class for central banks and global fund managers in assets management. Although the share of foreign holdings of Chinese bonds are still at a low level, foreign capital shows a strong appetite for Chinese sovereign bonds, and foreign holdings in the sovereign bond segment have significantly increased recently. In 2016, the foreign holdings of Chinese government and policy-bank bonds increased by RMB233 billion, a six-fold rise compared with RMB35 billion in 2015. The foreign ownership in China's sovereign bond market rose to 3.93% from 2.62% at end-2015 (see Figure 2). Due to the current low (or negative) yield environment among sovereign bonds of major developed countries, the movement of capital reallocation from other financial segments to Chinese sovereign bond segment would likely be stronger after China takes more welcoming steps to foreign participants.

Figure 2. The share in China's sovereign bond market by investor type (End-2016)



Source: Wind

3. THE ADVANTAGE OF OFFSHORE MARKET IN RISK HEDGING AND ACCESSIBILITY

Developing an effective hedging support and providing the FX access are important for foreign investors to increase their exposure to RMB assets. Currently, China's domestic FIC derivatives market is relatively deep and liquid, with a range of FX products available (including spot, forwards, swaps, and options) and also treasury bond futures products available. However, foreign institutions are not yet to be allowed access to the domestic treasury bond futures for risk hedging. Moreover, domestic insurance companies and banks, the main holders of Treasury cash bonds, are not yet to be allowed to participate in the trading of treasury bond futures. Such segmentation of the domestic bond market could split liquidity and market depth.

The availability of bond futures with better liquidity can help foreign investors improve their ability to hedge against interest rate risks via risk transfer and channeling, and increase their willingness to hold a larger portion of Chinese bond assets. On 15 March 2017, Li Keqiang, the Premier of the State Council of the People's Republic of China, publicly stated the plan to set up bond market links between Hong Kong and Mainland China¹. Under such pilot Bond Connect scheme to be implemented in future, the increased foreign investment in Chinese bonds could result in a surging demand for related risk management.

It is on this backdrop that HKEX's 5-Year China Ministry of Finance Treasury Bond Futures (T-Bond Futures) is designed and introduced. To date, there are a number of interest rate risk management products in the onshore market, which provides supportive tools to hedge RMB interest rate. Along with further opening up of the domestic foreign exchange market for foreign investors recently, certain eligible foreign investors can also directly access mainland derivatives. HKEX's T-Bond Futures utilizes the product strength of offshore market to provide such differentiation. Its introduction in the offshore market provides a solid tool to help foreign investors hedge against interest rate volatility of RMB assets, could be regarded as a quickening step to facilitate foreign capital flows into China's domestic bond market.

4. ONSHORE AND OFFSHORE HEDGING TOOLS FOR CHINESE BOND ASSETS

Sovereign bond futures are an important section in the exchange-traded interest rate derivatives market. They are designed to allow price convergence to the most liquid sovereign bonds at the stated maturity (e.g. 2-, 5-, 10- or 30-year). This makes sovereign bond futures a valuable instrument for hedging interest rate exposure represented by sovereign bond yields. For example, sovereign bond derivatives can be used for hedging by a corporate borrowing at a fixed spread above the government treasuries, or a fund manager investing in this corporate's bonds.

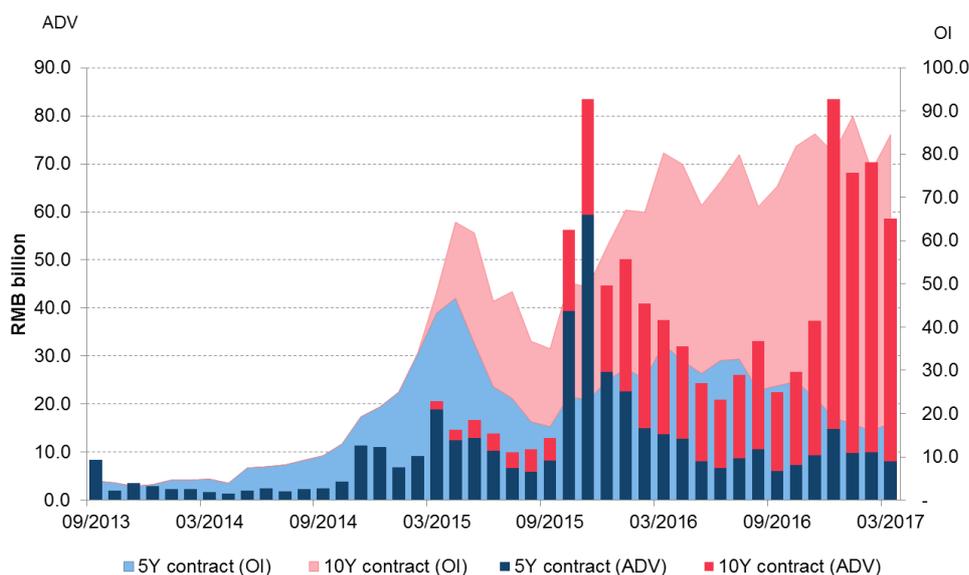
Currently, the sovereign bond futures available in the China's domestic market are the 5-year and 10-year MOF T-Bond Futures contracts listed on the China Financial Futures Exchange (CFFEX). The 5-year contract was introduced on 6 September 2013, followed by the 10-year contract on 20 March 2015. As of March 2017, the average daily (ADT) of these bond futures amounted to RMB 67.73 billion with an open interest (OI) of RMB84.57 billion (see Figure 3). However, these products have not been available for foreign investors to hedge interest rate risks of RMB assets, and the liquidity is limited due to the absence of major participants, such as domestic insurance companies and banks.

The offshore market also lacks efficient RMB rates hedging tools for mid- to long-term yield curve before the launch of T-Bond Futures. Previously, the management tools for hedging

¹ Mr Li answered questions from domestic and foreign journalists at a news conference after the national legislature's annual session concluded in Beijing on 15 March 2017 and stated that China are preparing to implement for this year a pilot bond market scheme connecting between Hong Kong and the Mainland allowing for the first time overseas capital to buy Mainland RMB bonds.

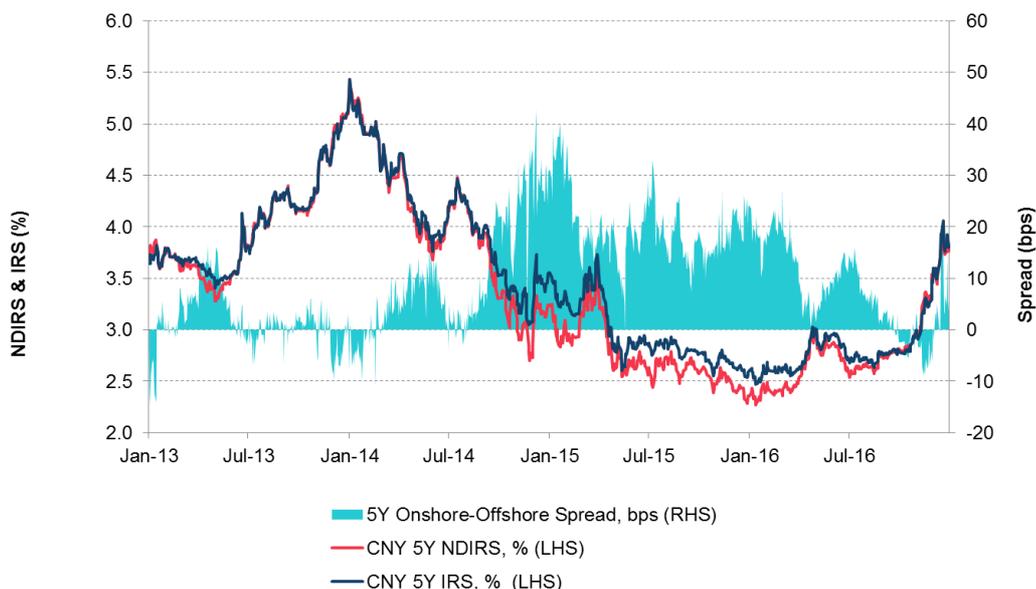
RMB interest rate risks in the offshore market are the non-deliverable interest rate swap (“NDIRS”) and offshore RMB (CNH) interest rate swap (“IRS”). The pricing of NDIRS is more influenced by speculative factors instead of fundamental capital flows, and NDIRS is therefore not generally regarded as an efficient tool to hedge RMB interest rate exposure. Along with the growth of CNH money market, CNH IRS has developed further and more market transactions have shifted from NDIRS to CNH IRS. However, the key issue in CNH IRS pricing is that the offshore RMB deposit rates differ from the rates onshore due to the relatively low market liquidity and lack of demand for lending. This contributes to a different pricing of the CNH IRS from the rates in the domestic market (see Figure 4). HKEX’s MOF T-Bond Futures can serve as a benchmark tool of long-term interest rate of Chinese domestic assets for offshore investors, supplementing the existing CNY NDIRS yield curve.

Figure 3. The turnover of the 5-year and 10-year MOF T-Bond Futures contracts listed on CFFEX (March 2017)



Source: Bloomberg

Figure 4. The performance of NDIRS and CNY IRS (End-2016)



Source: Bloomberg

5. PRODUCT DESIGN: METHODOLOGY AND APPLICATIONS

HKEX's T-Bond Futures is designed in a similar way as CFFEX's bond futures contract in that the underlying is the onshore China Ministry of Finance treasury bonds and the coupon rate is 3% per annum. The difference is that the domestic bond futures adopt a physical delivery design, known as "cheapest-to-deliver", which allows the short-position holder to deliver the cheapest among the eligible bond securities to the long position at contract expiry. Moreover, the product design of HKEX's T-Bond Futures has similarities² with the government bond futures listed on the Australian Securities Exchange (ASX) and Korea Exchange (KRX).

5.1 Principles for construction of the bond basket

Construction of the bond basket of HKEX's T-Bond Futures is based on the principles including transparency, predictability, liquidity, ease of replication and reliability.

- a) **Transparency and predictability:** The bond basket and reference price is based on a rule-based design, with its methodology made publicly available, including pricing and valuation process, formula and models. HKEX reserves the right to exercise discretion, when necessary, due to the substantial changes in China's treasury bond issuance policy.
- b) **Constituents liquidity:** The bond basket constituents should exhibit good liquidity in general for hedging purposes. Therefore, the bonds selected as the bond basket constituents must be in the top 3 most liquid issues based on ChinaBond's³ relative liquidity measure as of the date of basket construction.
- c) **Ease of replication:** Based on historical performance, the bond basket's total trading volume should represent at least 50% of that of the bond universe. Futures based on the bond basket should track the 5-year MoF T-Bond performance closely. Therefore, investors can easily replicate the underlying bond basket for hedging purposes.
- d) **Price reliability:** The reference price of the bond basket (5-year MOF T-Bond) is provided by ChinaBond on a daily basis. ChinaBond, is a fully state-owned non-bank official financial institution authorised by the China MOF to develop and operate the national treasury bond depository system.

5.2 Determination of daily reference price for each futures contract

ChinaBond shall, in accordance with the procedures and methodologies provided by Hong Kong Futures Exchange, a fully-owned subsidiary of HKEX, determine the bond basket and calculate the daily reference price of the bond basket for each Futures Contract.

The bond basket before the listing of each futures contract (quarterly) is determined according to the below arrangements:

- a) The date of basket determination is defined as 5 working days before the listing date of the futures contract;
- b) The bonds must be in the top 3 most liquid issuances based on ChinaBond's relative liquidity measure; and
- c) The liquidity measure is based on the trading data for the last 22 working days dating back from the date of basket determination.

² Similar to the government bond futures listed on ASX and KRX, the HKEX's T-Bond Futures contract is based on a cash settlement methodology based on an underlying basket of bonds. Both ASX and KRX will announce the underlying basket of bonds ahead of the contract's first trading day. On the last trading day, the contract will be cash settled based on the average yield of the bond constituents in the bond basket.

³ ChinaBond is China Central Depository & Clearing Co. Ltd, the domestic central depository of Chinese bonds.

Similar to the design of ASX and KRX Government Bond Futures, daily reference price for each futures contract is calculated based on the formulas as below:

- a) Collect the yield from ChinaBond for the constituent bonds in the Basket of Bonds, denoting as r_1, r_2, r_3
- b) Calculate the simple average yield to maturity of the Basket of Bonds with formula:

$$r = \frac{\sum_{i=1}^3 r_i}{3}$$

- c) Calculate daily reference price of the bond basket: Nominal 5-year term bond with coupon rate of 3% paid on an annual basis, with formula:

$$\sum_{i=1}^5 \frac{3\% \times 100}{(1+r)^i} + \frac{100}{(1+r)^5}$$

Where r is the average yield to maturity calculated in (b)

5.3 Hypothetical examples for illustration⁴

Example 1 – Hedging against interest rate movement

Assume a fund manager, concerned about a potential tightening of monetary conditions in China, wants to hedge against the interest rate risk. On 31 Oct 2016, the fund manager holds RMB100 million nominal value of treasury bond 160014.IB at price 101.813 with a duration of 5.901. HKEX's T-Bond Futures Mar-17 contract is traded at 102.282, with a duration of 4.80. With the objective of neutralising the dollar duration, he hedges his holding by selling 245 contracts of HKEX's T-Bond Futures Mar-17. By 26 Jan 2017, the yield has gone up and the value of the bond has decreased to 98.439 (-3.374), recording a loss of RMB3.4 million. The price of HKEX's T-Bond Futures Mar-17 drops to 99.480 (-2.802). The portfolio manager closes the position, gaining RMB3.4 million. The loss of RMB3.4 million from the cash bond holding is covered by RMB3.4 million profit from T-Bond futures positions.

Example 2 – Duration management

Assume a portfolio manager has a diversified bond portfolio of RMB300 million market value with duration of 7.00. She has the flexibility to adjust duration either up or down by 10% under the fund's stated investment objectives. The portfolio manager expects rates to fall. She therefore intends to increase duration to 7.70. HKEX's T-Bond Futures contract is currently traded at 102.282, with a duration of 4.80. She can buy 86 contracts of HKEX's T-Bond Futures.

Example 3 – Synthetic bond

Assume a foreign institutional investor does not have access to China's onshore bond market, but wishes to create a synthetic cash bond position in order to gain proxy bond exposure due to the China market's yield differential. He can buy 100 contracts of HKEX's T-Bond Futures, creating a proxy bond position with notional value of RMB50 million.

⁴ These examples do not constitute investment advice and independent advice should be sought where appropriate. In the case of risky strategies, investors may lose the entirety of their investment.

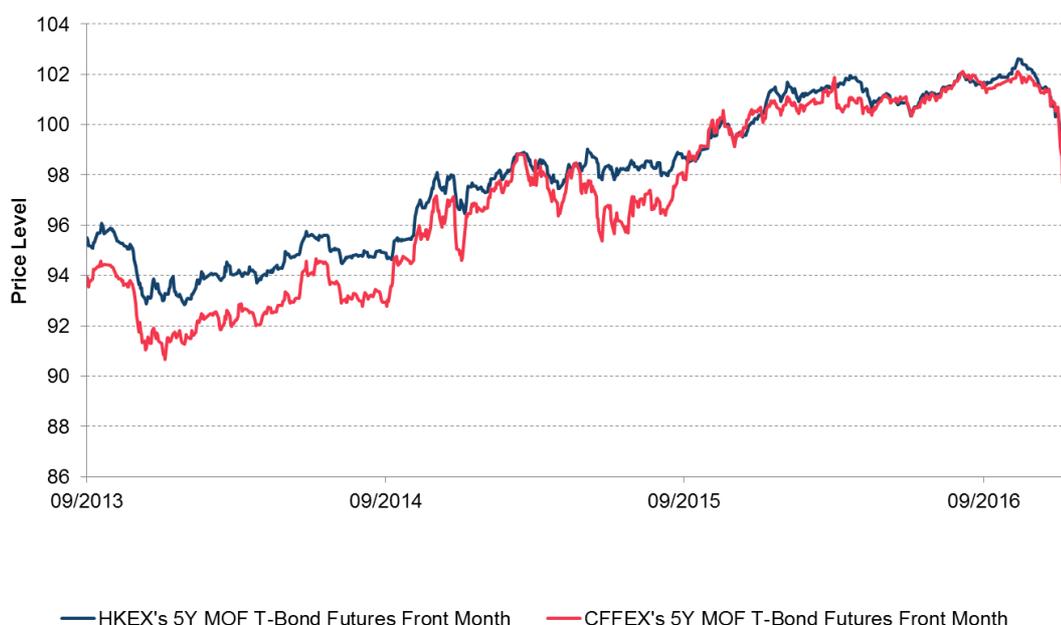
Example 4 – Credit spread trade

Assume an investor expects the yield of a corporate bond to diverge from the yield of the HKEX's T-Bond Futures. If the investor expects the credit spread (the yield of a corporate bond minus the yield of the HKEX's T-Bond Futures) to narrow, he can consider buying the corporate bond and selling the HKEX's T-Bond Futures. Alternatively, if the investor expects the credit spread to widen, he can consider selling the corporate bond and buying the HKEX's T-Bond Futures.

5.4 Pro-forma performance analysis

The reference price of the HKEX's pro-forma futures has an annualised correlation of 92.1% against CFFEX's futures (September 2013- December 2016), which is based on a physically-delivered design (see Figure 5). Therefore, it could facilitate international investors to effectively address the growing interest rate risk management demand. Banks, asset management companies, brokerage firms and insurance companies will be the main target users of this product.

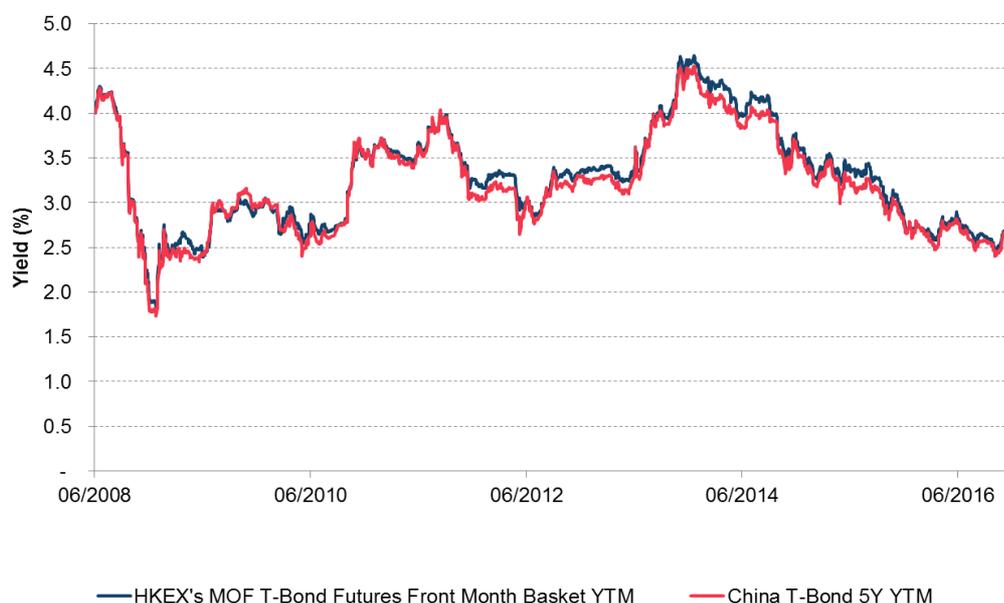
Figure 5. Correlation between HKEX's pro-forma futures against CFFEX's futures (Sep 2013 to End-2016)



Source: Bloomberg, HKEX

In addition, HKEX's T-Bond Futures could be regarded as a proxy for the RMB bond yield index due to the high degree of correlation between the two. HKEX's pro-forma futures bond basket yield tracks closely the Sovereign Bond Yield (5Y) published by ChinaBond (see Figure 6). The yield-to-maturity (YTM) of the two series has an annualised correlation of 98.3% over the past six years (2011-2016). Therefore, HKEX's T-Bond Futures provide a relatively convenient tool for the market to evaluate Chinese bond assets.

Figure 6. Correlation between HKEX's pro-forma futures against ChinaBond's Government Bond Yield (End-2016)



Source: Wind, HKEX

6. INTERACTION AND EFFECTIVENESS

Based on the experience of developed countries, the introduction of treasury bond futures plays an important role in improving the pricing function of the underlying bond market, promoting the liquidity of spot market and enriching the means of interest rate risk management of bond investors. Across the market literature, a majority of empirical studies finds either no significant effect, or else a decrease in volatility, of the spot market following the introduction of treasury bond futures⁵.

HKEX's T-Bond Futures is carefully designed with a few distinguishing features to ensure that the trading of this product would unlikely have an adverse impact on the onshore market. In fact, this product serves the function of supporting the development of the onshore fixed income market. These features are as below:

- a) HKEX's T-Bond Futures contract is cash settled for difference in RMB cash in the offshore market. At each futures contract expiry, the amount of transactions to be exchanged between market participants for settlement purpose happen in the offshore market, and only represent a fraction of the full contract notional amount. The impact of settlement process on liquidity is therefore considerably less compared to a physically-delivered futures contract.
- b) HKEX's T-Bond Futures contract is settled to the price based on the average yield of three constituent bonds in the bond basket, which represents the top three most liquid onshore T-Bonds within the bond universe. This final settlement price design reduces the risk of manipulation on any individual underlying bond. Under such design, HKEX's T-Bond Futures in effect provide investors the exposure to a part of the bond yield curve, rather than the exposure to individual bond (please refer to Section 5.1 and 5.2 for further details of the final settlement price).

⁵ See "The Impact of Futures Trading on the Spot Market for Treasury Bonds" (Shantaram Hegde, 1994) and "The Impact of Derivatives on Cash Markets: What Have We Learned?" (Stewart Mayhew, 2000).

In addition, as the HKEX's T-Bond Futures contract will converge to the final settlement price at expiry, any significant price deviation between HKEX's T-Bond Futures and the similar onshore product would be costly and for offshore market participants to take on more positions. A case in point was the CNH IRS market where the pricing differential between the onshore and offshore rates contributed to a lack of liquidity. Based on the pro-forma analysis, the average yield of HKEX's T-Bond Futures contract dummy bond basket has a high correlation with the onshore 5-year treasury bond yield (98.3% from 2011 to 2016), and the daily reference price of HKEX's T-Bond futures contract is also highly correlated with CFFEX's T-bond futures price (92.1% from September 2013 to December 2016) (please refer to Section 5.4 for further details). Taking a one-way position in HKEX's T-Bond Futures contract that is of sufficient magnitude to affect the onshore market stability would be very difficult, if not impossible, in practice.

- c) HKEX's T-Bond Futures contract is traded in a regulated, centralised and transparent exchange platform. This improves the market transparency and offers useful information to participants on price expectations and open interest levels.
- d) As is the case with other HKEX listed futures products, there are several measures in HKEX's trading and clearing rules and in relevant Securities and Futures Commission regulations, which can be used to deter the accumulation of large open positions of the T-Bond Futures contract, and thus may minimise the risk of unwanted volatility in the market, such as:
 - Requiring additional concentration collateral from clearing participants with a large share of the outstanding open interest, thus effectively lowering the leverage on large open positions;
 - Requiring exchange participants (either acting for their own account or on behalf of any client) to report large open positions (LOPs) in the contract to the HKEX. HKEX also has the power to require additional contextual information from any LOP holders to justify their large positions;
 - Imposing position limits to cap the position that can be held by a single beneficial owner. Position limits are taken seriously, and breaching them might constitute a breach of relevant HKEX rules and the Securities and Futures Ordinance, including potential criminal liability. HKEX and the SFC both can take remedial action against any breaches, including forcing a participant to reduce their positions in a timely and orderly manner where appropriate.

China is now the fastest growing bond market in the world and is the third largest after the United States and Japan. International participation in China's bond market continues to increase, driven by the further opening up of China interbank bond market, the broadening of international acceptance of the RMB, the inclusion in the emerging markets bond indices and the yield differential compared to developed markets. **HKEX's 5-Year China Ministry of Finance T-Bond Futures contract is the world's first bond derivatives accessible to offshore investors. It is an efficient, transparent and easy-to-access tool which may help investors to manage against China interest rate risk exposure.**

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