White Paper on Across-the-Curve Credit Spread Indices (AXI) for China

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Abstract

This paper constructs the across-the-curve credit spread indices (AXI) for the Chinese market. The indices reflect the average funding costs for Chinese major commercial banks and can serve as references for credit pricing and risk management. Following Berndt, Duffie, and Zhu (2020), for the long-term credit spread index, we aggregate the credit spreads of bonds with different maturities issued by Chinese commercial banks, with weights that reflect both transaction volumes and issuance volumes. For the short-term credit spread index, we calculate it as a volume-weighted average of the credit spreads of interbank certificates of deposits. We also discuss the possible applications of AXI in the Chinese market.

Keywords: LIBOR, SOFR, reference rate, credit spreads, floating rate, Chinese market

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1. Introduction

London Interbank Offered Rate (LIBOR), as a benchmark for the interbank offered rate of large banks, has been widely used by market entities around the world since 1986. However, there are many problems when LIBOR is applied in the industry, including the shrinking in the size of the interbank lending market and the inherent vulnerability to manipulation. In response to these problems, central banks worldwide are looking for new benchmark interest rates. One prominent example is the Secured Overnight Financing Rate (SOFR) released by the Federal Reserve Bank of New York. SOFR is based on the transactions of government bonds in the repurchase agreement (repo) market, which is active in market transactions, and the transaction rate is close to the risk-free rate. Similar benchmark interest rates have been introduced in other countries, such as the Sterling Overnight Index Average (SONIA) in the UK, the Euro Short-term Rate (€STR) in the Eurozone, and Tokyo Overnight Average Rate (TONA) in Japan. As LIBOR ceased to update in 2021, SOFR has emerged as a new benchmark rate to replace the US-dollar LIBOR.

According to a report released by the Federal Reserve Bank of New York, by the end of 2021, 90% of floating-rate bonds issued by U.S. companies were SOFR-denominated, while 40% of interest rate swaps (IRS) were SOFR-denominated. Meanwhile, the market faces a new challenge as to how the new risk-free benchmark interest rate should be applied to broader credit pricing. Berndt, Duffie, and Zhu (2020) construct the across-the-curve credit spread indices (AXI) based on the commercial-bond-based credit spreads, which provide more options to address the above-mentioned problems.

As an emerging economy, China faces many challenges in participating in the reform of the international benchmark interest rates. On the one hand, as China is undergoing interest rate liberalization reform, the comprehensive market-oriented interest rate pricing has not been realized

yet. On the other hand, while LIBOR is being replaced by other new benchmark reference rates, China needs to actively adapt to international rules and improve the interest rate pricing mechanism of the local market. The report, titled *Participating in International Benchmark Interest Rate Reform and Improving China's Benchmark Interest Rate System* issued by the People's Bank of China in 2020, states that

> "*Next, the development priority of China's interbank benchmark interest rate system is to promote the wide application of various benchmark interest rates. Efforts will be made in innovating and broadening the application of depository-institutions repo rate (DR) in financial products, including floating-rate bonds and floating-rate interbank certificates of deposits (CDs), etc., so as to make DR a key reference indicator for China's monetary policy management and financial market pricing*."

In this paper, we aim to construct the China AXI by exploiting secondary-market bond price and volume data from China Foreign Exchange Trade System (CFETS). Following Berndt, Duffie, and Zhu (2020), we use straight bonds and interbank certificates of deposits, both issued by commercial banks, to construct long-term and short-term credit spread indices, respectively. The AXI index is the simple average of the long-term and short-term credit spreads, which can reflect the borrowing costs of the commercial banks and is expected to be applied to bank loan pricing and risk management.

The remainder of this paper is organized as follows. Section 2 introduces the institutional background of the Chinese bond market. Section 3 describes the data, methodology, and the China AXI. Section 4 concludes this paper and presents further discussions.

2. Background

China's commercial banks can issue straight bonds, subordinated bonds, interbank certificates of deposits, asset-backed securities (ABS), convertible bonds, and foreign bonds. The first four types of bonds are traded on the China interbank bond market (CIBM), which dominates the trading in China's bond market and accounts for more than 70% of the outstanding bonds as of December 2021.[2] The convertible bond is usually traded on the exchanges, including the Shanghai Stock Exchange and the Shenzhen Stock Exchange. The foreign bond, issued in foreign countries by the banks, is usually denominated in U.S. dollars or other foreign currencies and traded in overseas markets.

We estimate long-term across-the-curve credit spreads using the trading information of straight bonds, the senior debenture bond issued by commercial banks. We use the transaction data on interbank certificates of deposits to estimate short-term across-the-curve credit spreads.[3] The subordinated bond is excluded in our calculation of the across-the-curve credit spreads because it is used to supplement the banks' capital. The repayment order of the principal and interest is listed after other commercial bank liabilities and before the equity capital of the commercial bank.

While commercial banks can issue bonds to satisfy their capital needs, bond financing only accounts for a relatively small proportion of the debts in China's banking industry. Taking the Industrial and Commercial Bank of China (ICBC) as an example, the proportion of bond financing in the debt structure, as stated in its 2021 yearbook, was merely 3.48%. Furthermore, over one-third of this proportion is contributed by foreign bonds issued by ICBC's entities outside mainland China, such as the Hong Kong Branch of ICBC

[2] As an over-the-counter market, CIBM is open only to institutional investors, including commercial banks, insurance companies, mutual funds, and foreign institutions.

[3] Interbank certificate of deposit is a book-entry time deposit voucher issued by depository institutions on CIBM. Its maturity is no more than one year, usually 1 month, 3 months, 6 months, 9 months, or 12 months.

3. Illustrative construction of the AXI

In this section, we describe how to construct AXI in the Chinese market. Following the approach of Berndt, Duffie, and Zhu (2020), this paper first constructs China's long-term AXI. The specific screening requirements are as follows:

1. Straight bonds of commercial banks traded on CIBM are included;

2. Subordinated capital bonds, convertible bonds, exchangeable bonds, perpetual bonds, bonds with call provisions, private placement bonds, and foreign bonds are excluded.

The bonds issued by commercial banks are classified into four groups, according to their maturity ranges. Figure 1 shows the monthly trading amount of bonds in each maturity range over time. The trading amount of straight bonds issued by commercial banks has seen a significant increase since 2017. Therefore, to ensure a sufficiently large sample with repressiveness, only bond trading data after 2017 is used to construct the AXI. In addition, the straight bonds issued by commercial banks with a maturity of 2-3 years have achieved the largest trading amount, followed by those with a maturity of 1-2 years. All bond data used in this paper are collected from the China Foreign Exchange Trade System (CFETS), including basic bond information, yield to maturity (YTM), and the trading amount of every single bond for each day.

China's long-term AXI is constructed based on the following steps:

1. For each maturity range m of each month, we retain the observations of all bonds with a non-zero daily trading amount. Thus, we calculate the volume-weighted median credit spread denoted as s_m.[4]

[4] The credit spread of a bond equals the yield to maturity of the bond minus that of the government bonds with

2. The long-term AXI can be expressed as $S = \sum_m q_m s_m$, where q_m is the fraction in maturity bucket m of total issuance in the previous year.

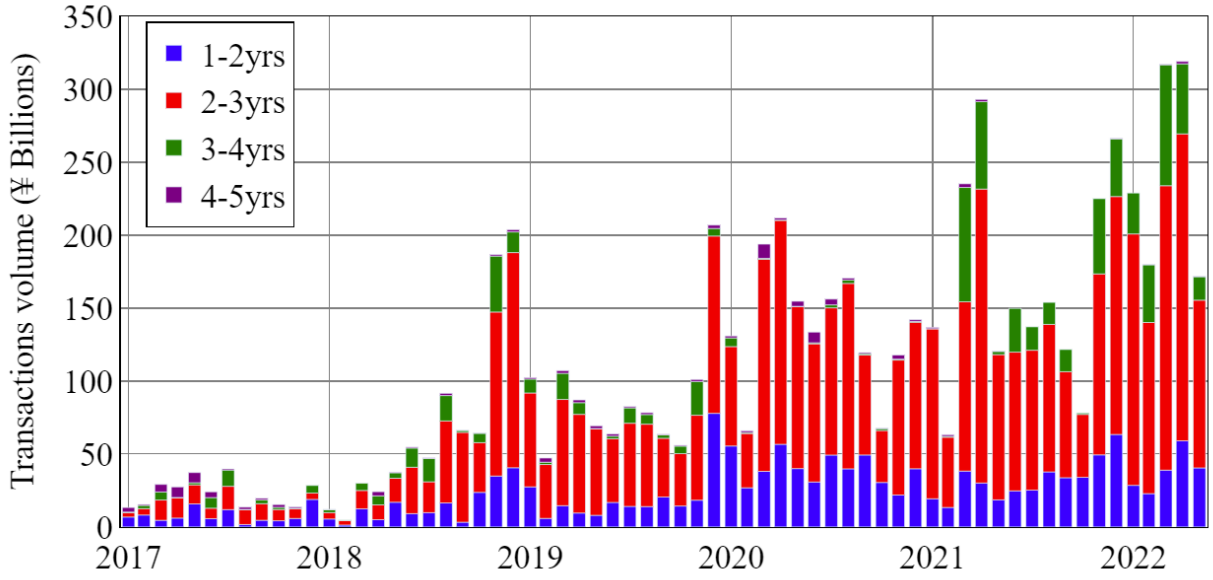

Figure 1: **Transaction volumes of commercial bank bonds** (Unit: CNY billion) monthly transaction volumes in each maturity range over time. Datasource: China interbank bond market (CIBM)

Figure 2 shows the trailing annual issuance of bonds in different maturity ranges. Among them, the straight bonds issued by commercial banks with a maturity of 2–3 years have the largest issue size that is showing a steady increase over time.

This paper also constructs China's short-term AXI. The bond data includes the interbank certificates of deposits issued by the six largest commercial banks on the money market with a maturity of 1, 3, 6, 9, and 12 months.[5] For each month, we retain the daily observations of a non-zero trading amount of interbank certificates of deposits with issuances over ¥ 50 million and maturities under 250 days. We calculate the short-term volume-weighted average credit spread, in

the corresponding maturity (the maturities are matched by the linear interpolation).

[5] The six state-owned banks include the Industrial and Commercial Bank of China, Bank of China, China Construction Bank, Agricultural Bank of China, Bank of Communications, and Postal Savings Bank of China.

consideration of the following points:

- Weighting is based on principal transaction amount.
- Transactions with statistically abnormal spreads (high or low) are removed
- The interbank certificates of deposits credit spread equals the yield to maturity minus the risk-free rate (the yield of government bonds with the same maturity).
- Only include the fixed-rate interbank certificates of deposits.

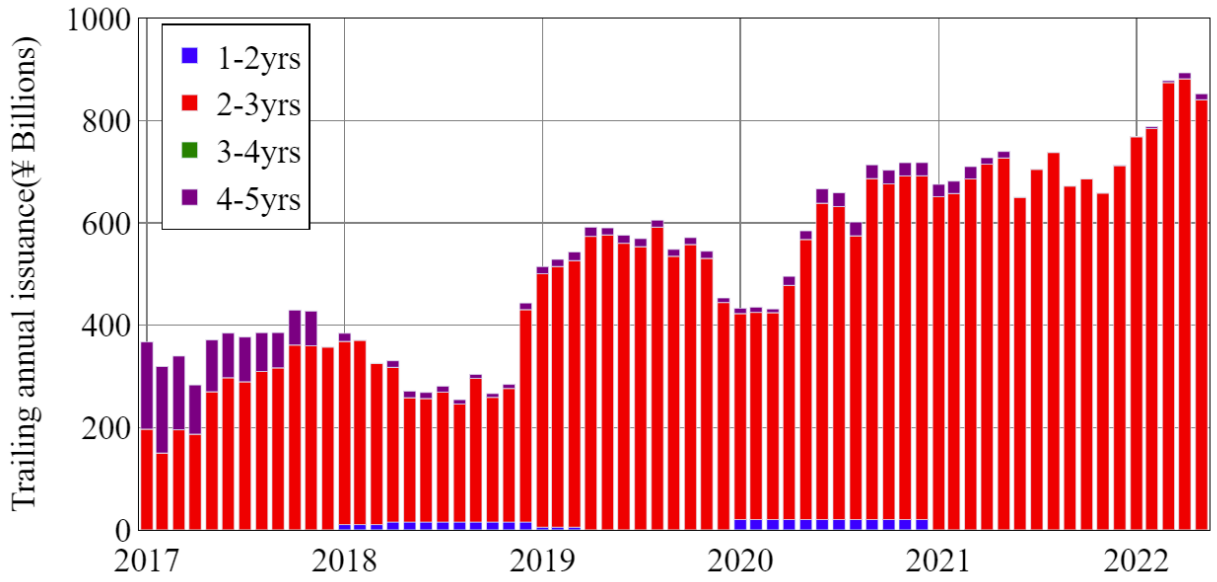

Figure 2: **Issuance** Trailing annual issuance (principal amount) in each of four maturity ranges from January 2017 to May 2022 (Unit: CNY billion). Datasource: China interbank bond market (CIBM)

Figure 3 presents the time-series plot of long-term AXI for four maturity ranges. The long-term components are relatively high from 2017 to 2018. They increase sharply at the end of 2017 until early 2018, and show gradual declines from then on. Figure 4 presents the time-series plot of short-term AXI for different maturity ranges, which show a similar pattern to their long-term counterparts. Figure 5 plots China's AXI, as the simple average of short- and long-term credit spreads, which again shows a similar pattern to those observed in Figures 3 and 4.

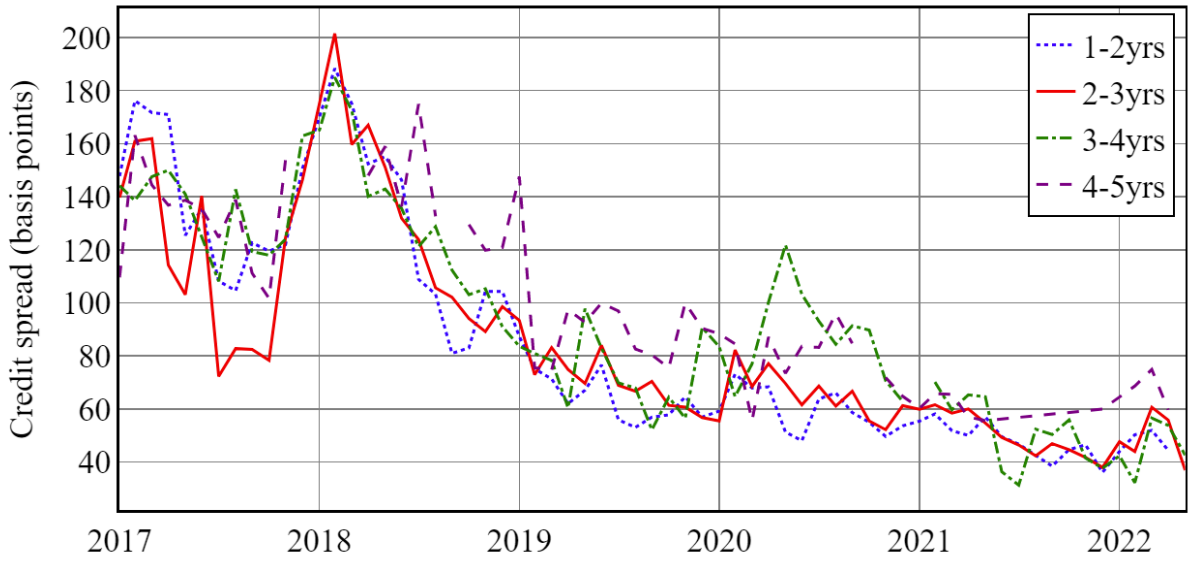

Figure 1: **Spreads by Maturity in the long-term AXI** Transaction-volume-weighted credit spreads of commercial banks, for each of four maturity ranges from January 2017 to May 2022. Datasource: China interbank bond market (CIBM).

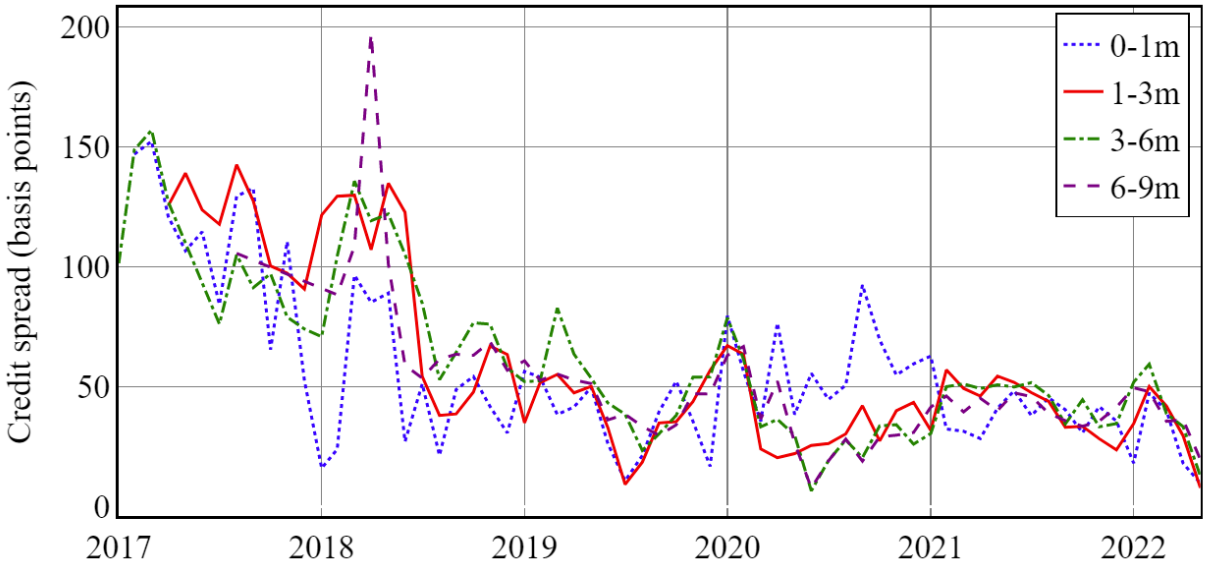

Figure 4: **Spreads by maturity in the short-term AXI** Volume-weighted credit spreads of interbank certificates of deposits, for each of four maturity ranges from January 2017 to May 2022. Datasource: China interbank bond market (CIBM).

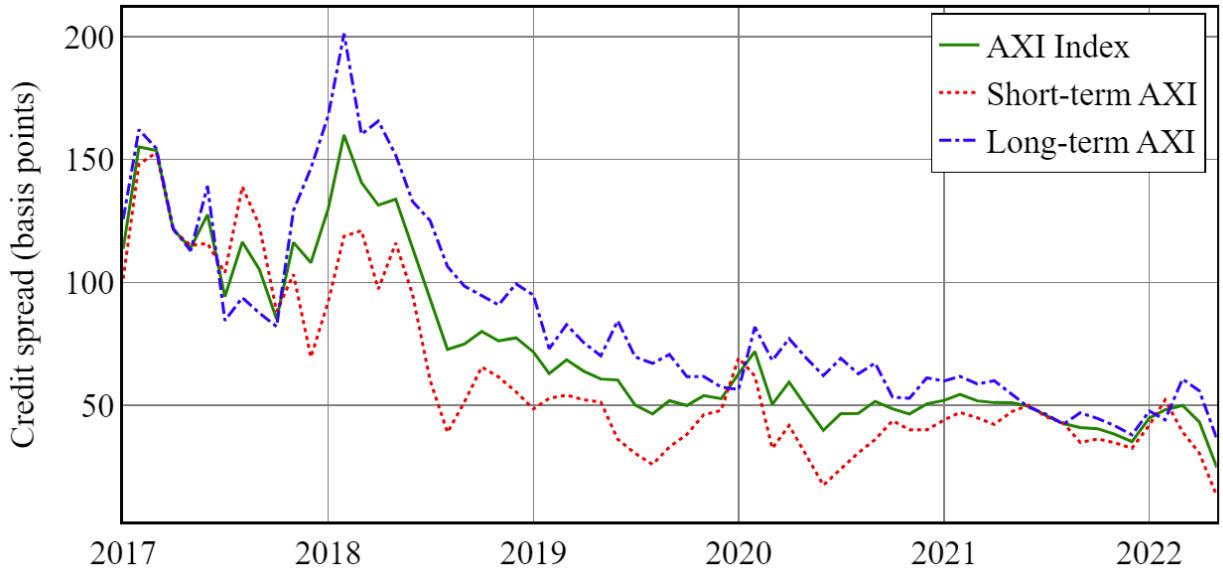

Figure 5: **China's AXI from January 2017 to May 2022** The across-the-curve credit spread index (AXI) is constructed as the simple average of (a) weighted average long-term spreads (1-5year bond spreads), and (b) weighted average short-term spreads, using interbank certificates of deposits data of a panel of 5 banks, restricted to issuances over ¥ 50 million and maturities under 250 days. Short-term spreads are weighted by principal amount of transaction volume.

4. Conclusion

We construct the across-the-curve credit spread indices (AXI) for the Chinese market using secondary-market bond price and volume data from China Foreign Exchange Trade System. Our methodology closely follows Berndt, Duffie, and Zhu (2020), and we believe the constructed indices reflect the funding costs for Chinese commercial banks.

With the continued progress of the interest rate liberalization in China, especially the implementation of depository-institutions repo rate (DR) as the benchmark interest rate, the AXI can serve as a reference credit spread for commercial banks to conduct credit pricing and risk management. Regulators and other market participants can also use the AXI as indicators to gauge the funding costs for Chinese commercial banks.

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