Exploring feasibility of JPAXI and JPFXI*

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Abstract

This note is a feasibility study of a Japanese version of Across-the-Curve Credit Spread Index (JPAXI) and the Financial Condition Credit Spread Index (JPFXI) accounting for specific features of the Japanese corporate bond market. Our analysis demonstrates that while JPAXI has comparable dynamics to JPFXI, JPAXI exhibits unreasonable fluctuations due to the limited number of trading bonds issued by banks in Japan. As a result, JPFXI presents more stable dynamics and appears to be a more reliable benchmark index for Japan, considering the current constraints on data availability. However, if there was sufficient bond pricing data of senior bonds issued by Japanese banks, JPAXI would be a major transaction-based credit spread benchmark for bank lending and risk management, reflecting the actual funding costs of banks.

JEL classification: E43, G12, G21

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1 Introduction

The London Interbank Offered Rate (LIBOR) was a benchmark interbank offered rate for short-term loans in London market, widely used as a reference rate for various financial products and transactions globally. LIBOR is calculated as an average interest rate of the estimated rate submitted by the leading banks in London. The submitted rate is supposed to be the rate, which would be charged by other banks to borrow short-term loans. Consequently, LIBOR can be a benchmark rate that reflects the best estimates of the cost of unsecured borrowing for large banks. However, the LIBOR manipulation scandal of 2012 revealed that several prominent international financial institutions had improperly manipulated the submitted rate to earn substantial profits by sending false signals to the market. This scandal highlighted a fundamental flaw in the mechanism used to calculate the LIBOR based on the declarative inputs.

In response to the scandal's impact, efforts were made to develop more transparent and reliable benchmark interest rates based on market transaction data. For example, the Federal Reserve Bank of New York started reporting the Secured Overnight Financing Rate (SOFR). This is a broad measure of the cost of borrowing cash overnight collateralized by Treasury securities based on the transactions of government bonds in the repurchase agreement (repo) market.[1] In addition, Berndt et al. (2023) have proposed an across-the-curve index (AXI) as a measure of the recent cost of wholesale unsecured debt funding for publicly listed US bank holding companies and commercial banks. More specifically, AXI is calculated by a volume-weighted median of recent credit spreads of unsecured US bank funding transactions with maturities ranging from overnight to five years, with weights that reflect both transaction volumes and issuances. AXI has been made publicly available by Invesco.[2] AXI has been also applied to China (Li et al. (2022)) and the eurozone (Saroyan and Cont (2023)) recently. Berndt et al. (2023) have also built a financial conditions index (FXI) by widening coverage to include all corporate bond issuers.

This note is a feasibility study of JPAXI and JPFXI, which are similar benchmark indices, accounting for specific features of the Japanese corporate bond market. More specifically, JPAXI is calculated by a transaction-volume-weighted median of recent credit spreads for both senior and subordinated corporate bonds that are publicly issued in Japan by Japanese bank holding compa-

[1] See Schrimpf and Sushko (2019) for an overview of the development of benchmarks based on overnight risk-free rates.

[2] https://www.invescosofracademyaxi.com/

nies and commercial banks. Unlike the calculation of AXI for the US, JPAXI includes subordinated bonds in its computation, given that a substantial portion of traded corporate bonds issued by bank holding companies and commercial banks in Japan are subordinated bonds. JPFXI, on the other hand, expands its coverage to encompass all corporate bonds issued in Japan.

Our analysis demonstrates that while JPAXI has comparable dynamics to JPFXI, JPAXI exhibits unreasonable fluctuations due to the limited number of trading bonds issued by banks in Japan. As a result, JPFXI has more stable dynamics and appears to be more reliable as a benchmark index for Japan, given the current constraints on data availability. However, if Japan had a large enough pool of bond market transactions for corporate bonds issued by banks, JPAXI could reflect the actual funding costs of banks more efficiently and accurately, thus becoming a major transaction-based credit spread benchmark for Japanese bank lending and pricing various financial instruments such as derivatives and securities.

The remainder of this note is organized as follows. Section 2 describes our data and explains the calculation of the credit spreads of the traded bonds. Section 3 reports the results of the constructions of JPAXI and JPFXI, while Section 4 summarizes the limitations of the two indices. Finally, Section 5 provides a discussion of the benchmark for the Japanese bond market.

2 Data

We use a dataset on over-the-counter (OTC) transactions of issued bonds obtained from the Japan Securities Dealers Association (JSDA). The dataset encompasses trade-specific details, such as issuer name, trade date, due date, coupon rate, traded amount, and traded price of OTC transactions conducted by the head offices, branches, and other business offices of JSDA Regular Members (securities firms) and Special Members (only transactions related to the business of registered financial institutions). This data source stands as the most comprehensive coverage of secondary market transactions for corporate bonds publicly issued within the Japanese market.

To formulate the credit spread of each transaction, our sample includes both senior and subordinated corporate bonds that are publicly issued in Japan by Japanese corporations. Unlike the calculation of AXI and FXI for the US, we include subordinated bonds for the calculation of JPAXI and JPFXI, since a substantial portion of traded corporate bonds issued by bank holding companies and commercial banks in Japan are subordinated bonds and it is not feasible to compute JPAXI,

otherwise.

Possible reasons for this situation are the following. Subordinated bonds have lower funding costs compared to equity securities, partly due to the prolonged monetary easing by the Bank of Japan over the past two decades. Furthermore, subordinated bonds have other advantages, such as not lowering return on equity (ROE). Specifically, they can assist in satisfying regulatory requirements, i.e., a bank that has an overseas sales base can include the funds raised from these bonds in its Tier 2 capital, provided that they meet all the criteria specified in the Basel framework's definition of capital.

We exclude Fiscal Investment and Loan Program agency bonds that are guaranteed by the central government. To ensure that we assess the borrowing costs of firms at the same point in their capital structures, we narrow our sample to straight corporate bonds issued in Japanese Yen by Japanese firms.

We use these data along with the government bond zero curve data to derive the credit spreads. The government bond yield data are obtained from Thomson Reuters Eikon, which collects market data on Japanese government bonds from Tradeweb and calculates the zero curve. This dataset contains government bond zero curve data across different maturities, ranging from one month to forty years. If the government bond zero curve is missing for a specific corporate bond maturity, it is filled via cubic spline interpolation.

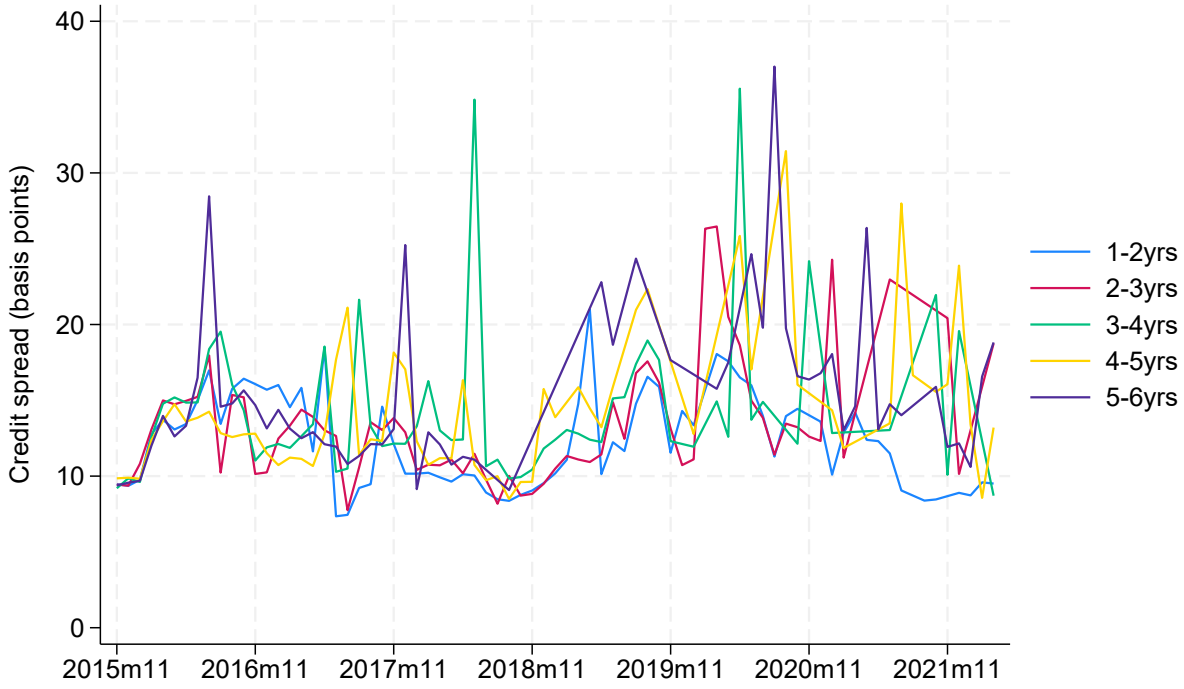
With individual data points from traded corporate bond and government bond yields, credit spreads are calculated as differences between corporate and government bond yields of the same maturity. This approach ensures that credit spreads are computed using corporate and government bond yields that share an identical maturity. Thereafter, for the construction of JPAXI and JPFXI, we derive the credit spreads for corporate bonds traded in the secondary market during the period from November 2015 to March 2022.

For the computation of credit spreads associated with subordinated bonds, at first the credit spreads of subordinated bonds are calculated as described above. We then assess the difference in average credit spreads between senior bonds and subordinated bonds for each maturity and subtract this difference from the credit spreads of subordinated bonds.

3 Illustrative construction of JPAXI and JPFXI

This section outlines the construction of JPAXI and JPFXI. AXI, which is a transaction-based credit spread index focused on the credit risk of bank holding companies and commercial banks, has been widely used since Berndt et al. (2023) proposed it. For example, recently, AXI has been applied to China (Li et al. (2022)) and the eurozone (Saroyan and Cont (2023)). Berndt et al. (2023) have also built FXI by widening coverage to include all corporate bond issuers. JPAXI and JPFXI are similar benchmark indices, accounting for specific features of the Japanese corporate bond market.

Figure 1: Spreads by maturity for JPAXI data

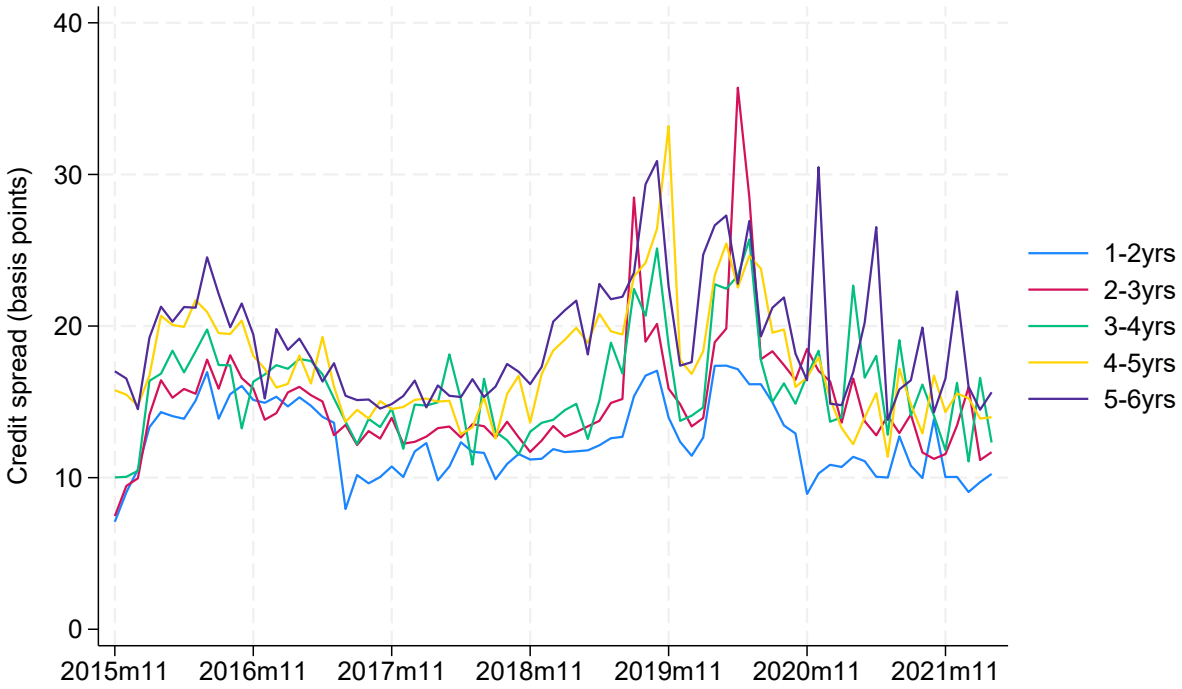


Notes: This figure plots transaction-volume-weighted credit spreads of bank holding companies and commercial banks in Japan, for each of four maturity ranges, 2015-2021. Underlying data: JSDA, transactions of all yen-denominated bonds issued by bank holding companies and commercial banks in Japan, excluding yen-denominated bonds issued overseas and foreign-currency-denominated bonds.

Figure 1 illustrates the corporate bond credit spreads (in basis points) for five one-year maturity ranges, based on the secondary market trading of straight corporate bonds, including subordinated

bonds, issued by bank holding companies and their commercial banking subsidiaries. Noticeably, almost all the maturities exhibit volatile patterns with unexplained fluctuations. This undesirable characteristic is largely attributed to the fact that a substantial portion of the bonds issued by bank holding companies and commercial banks in Japan are subordinated bonds. To address this concern, these bonds are integrated into JPAXI's calculation; however, their infrequent trading due to higher coupon payments leads to unstable dynamics, since most investors buy and hold them to maturity to enjoy relatively higher coupon payments. Consequently, each component in Figure 1 appears to be considerably affected by a few transactions, which introduce unexpected fluctuations.

Figure 2: Spreads by maturity for JPFXI data



Notes: Transaction-volume-weighted credit spreads of bank holding companies and commercial banks in Japan, for each of four maturity ranges, 2015-2021. Data source: JSDA, all yen-denominated bonds issued in Japan, excluding yen-denominated bonds issued overseas and foreign-currency-denominated bonds.

JPFXI can mitigate this issue by expanding its scope to encompass all corporate bonds issued in Japan. To confirm this, Figure 2 plots the same component credit spreads for five one-year maturity ranges based on secondary market trading of straight corporate bonds issued in Japan by

Table 1: Summary statistics of each component of JPAXI and JPFXI data

		1-2yrs	2-3yrs	3-4yrs	4-5yrs	5-6yrs
JPAXI	Mean	12.326	13.419	14.354	14.289	15.433
	Median	12.117	12.628	12.801	13.203	13.995
	SD	3.098	4.071	5.005	4.625	5.306
JPFXI	Mean	12.474	14.995	15.942	17.504	19.101
	Median	11.885	13.936	15.227	16.718	17.905
	SD	2.471	4.066	3.396	3.813	4.072

$Notes$: The table presents the basic statistics of each component of JPAXI and JPFXI data.

both non-financial and financial firms. While exhibiting a similar trend to that of Figure 1, each plot demonstrates notably more stable dynamics. To see the difference between the components of the two indices more clearly, Table 1 summarizes the basic statistics of each maturity component of JPAXI and JPFXI. As can be seen, each component shares a similar upward-sloping average (median) credit spread curve, with the JPFXI components generally displaying a higher average (median) across the maturities. More importantly, the standard deviations (SDs) of the JPAXI components are much higher than those of the JPFXI ones, suggesting that JPFXI is a more stable and reliable benchmark for the Japanese corporate bond market.

Drawing on the approach proposed by Berndt et al. (2023), our illustrative JPFXI is constructed as follows:

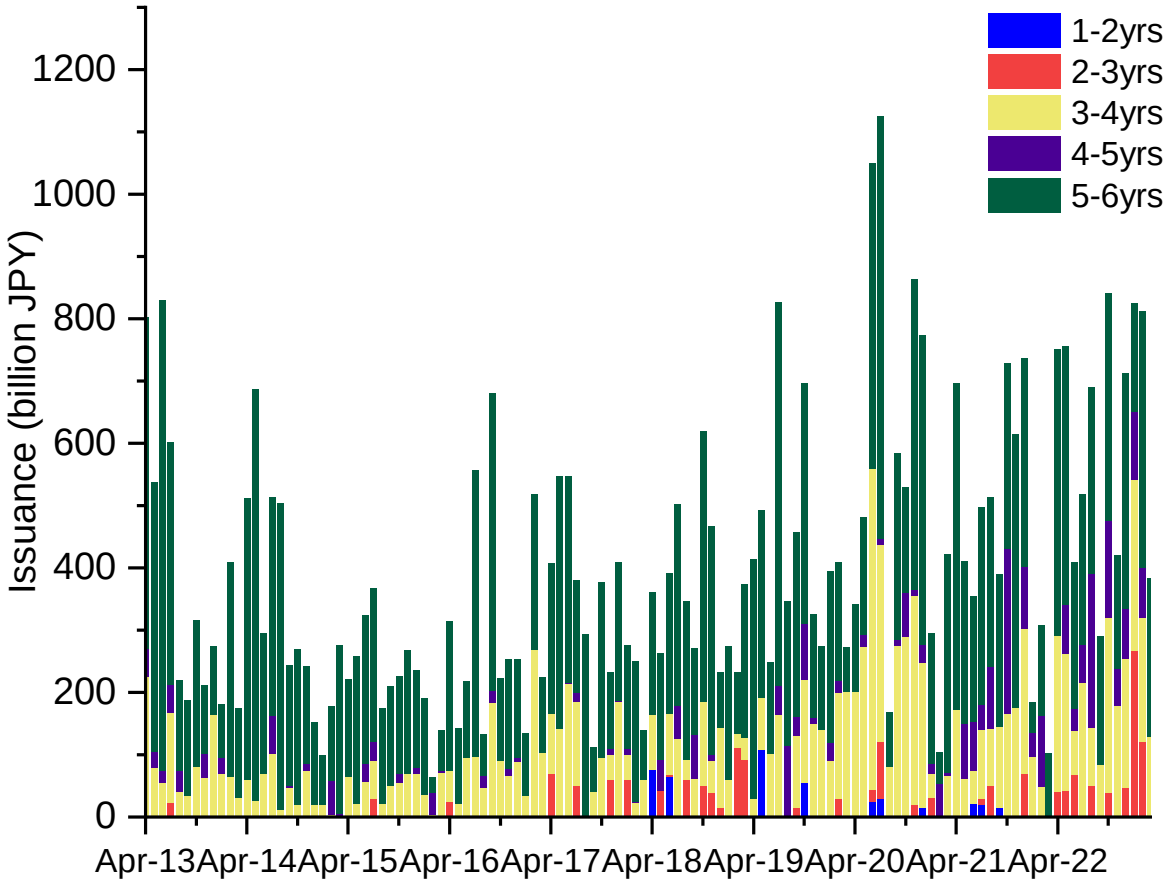
1. For each maturity bucket m, we obtain the credit spread and trading volume of all the secondary market transactions in the trailing month of the included instrument types whose remaining maturities are in the indicated bucket. Then, we compute the volume-weighted median credit spread denoted by s_m.[3]
2. JPFXI is calculated as $S = \sum_m q_m s_m$, where q_m is the fraction in the maturity bucket m of the total issuance in the previous year.

As the methodology makes clear, the issuance for each bond market component plays a pivotal role in determining the component's significance in the computation of JPFXI. To visualize this point, Figure 3 shows the annual issuance (principal amount) in each of five maturity ranges in

[3]The available information on the trading volume published by the JSDA is limited to whether the trading volume exceeds 500 million yen or not. To compute s_m, We put double weight on transactions that exceed 500 million yen.

JPFXI. The 5-6 years maturity component holds the largest share during most of the years, followed by the 3-4 years component. Moreover, the recent trends indicate non-negligible roles for the 4-5 years and 2-3 years maturity components.

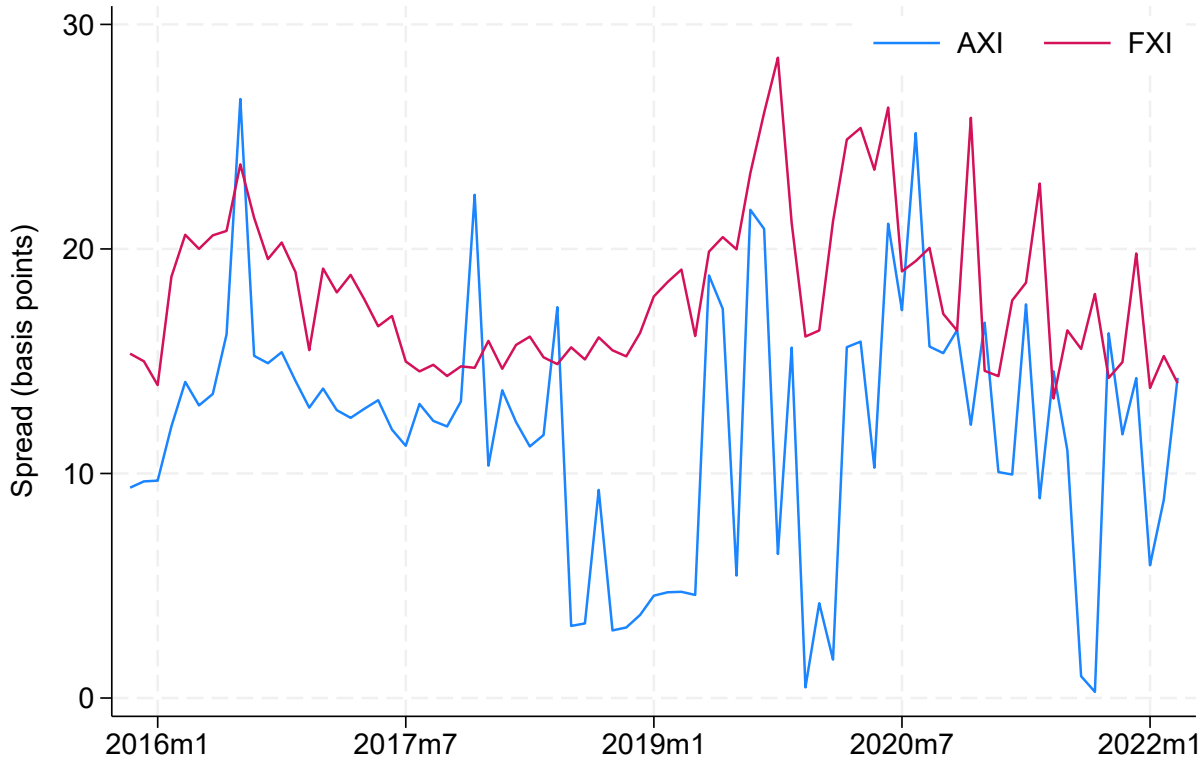
Figure 3: Issuance by maturity for JPFXI data



Notes: This figure trails annual issuance (principal amount) in each of five maturity ranges. Data: JSDA, all yen-denominated bonds issued in Japan, excluding yen-denominated bonds issued overseas and foreign-currency-denominated bonds.

Figure 4 plots the dynamics of actual JPAXI and JPFXI, constructed from the 1-year component to 6-year one. Not surprisingly, this graph shows the same characteristics observed in the individual components; JPAXI and JPFXI exhibit similar dynamics, but JPFXI tends to be larger than JPAXI. Furthermore, JPAXI has greater fluctuations with occasional sudden drops. Based on this evidence, we consider JPFXI to be the primary benchmark for the corporate bond market in Japan, considering the current constraints on data availability.

Figure 4: Long-term JPAXI and JPFXI data



Notes: This figure plots the long-term (1-year to 6-year) component of JPAXI and JPFXI. Data: JSDA, all yen-denominated bonds issued in Japan, excluding yen-denominated bonds issued overseas and foreign-currency-denominated bonds.

4 Limitations

Our study demonstrates that, while the construction of JPAXI and JPFXI is feasible, it is imperative to acknowledge several limitations. First, Japanese banks tend to issue yen-denominated subordinated corporate bonds in the Japanese corporate bond market compared to issuers in other sectors. For example, between January 2005 and December 2022, 30.15% of yen-denominated bonds issued by banks in the Japanese domestic market were subordinated bonds. In contrast, only 0.1% of yen-denominated bonds issued by firms in other sectors were subordinated bonds. Additionally, subordinated bonds have become more popular among non-financial companies recently. Therefore, it is crucial to include subordinated bonds to construct JPAXI and JPFXI. Despite our

efforts to normalize the difference in credit spreads between senior and subordinated bonds, including subordinated bonds introduces distinctive differences in JPAXI and JPFXI compared to AXI in other countries.

Second, related to the first point, the trading volume of corporate bonds in Japan is relatively low, and the trading itself is infrequent, especially for those bonds issued by the financial sectors. This is partly due to the fact that subordinated bonds tend to be held longer and to be infrequently traded, owing to their higher coupon rates. Consequently, constructing JPAXI in a stable manner is a formidable, if not impossible, task because the scarcity of trades causes a problem with insufficient data. In this context, JPFXI is a more robust and suitable benchmark for a corporate bond market in Japan.

Third, even within the scope of JPFXI, the construction of daily index is infeasible because of the low daily trading volume of corporate bonds in Japan. In our construction, a monthly frequency could be the most viable option to ensure the reliability and stability of the index.

Last, but not least, the constrained availability of trading volume information poses a significant hurdle in building JPAXI and JPFXI. In Japan, the only available data pertains to whether the trading amount exceeds 500 million yen or not. We mitigate this issue by double-weighting trades exceeding such a threshold. While this approach could be one of the best options to adopt, it may fall short of a precise representation of reality. Therefore, we should be very careful on this point when considering JPAXI/JPFXI as a benchmark for the Japanese bond market.

5 Discussion

This note considers the applicability of AXI and its methodology proposed by Berndt et al. (2023) to the Japanese market. As Saroyan and Cont (2023) noted, heterogeneity both in terms of reference rates and debt instruments exists across markets and currency zones. We argue for the construction of JPAXI and JPFXI and demonstrate how these indices fluctuate based on actual Japanese transaction data. The plot of the two indexes shows the unexplained fluctuation of JPAXI compared to JPFXI, which is partly due to the small amounts of traded corporate bonds issued by banks.

If there was sufficient bond pricing data of senior bonds issued by Japanese banks, JPAXI would be a major transaction-based credit spread benchmark for bank lending and risk manage-

ment. The index would be able to reflect the actual funding costs of banks and would be in compliance with "Final Report on Principles for Financial Benchmarks" published by the International Organization of Securities Commissions (IOSCO) in July 2013 (IOSCO (2013)).[4]

Japan keeps using reference interest rate benchmarks even after the LIBOR manipulation scandal.[5] The Japanese Bankers Association (JBA) has published "Japanese Yen TIBOR (Tokyo Inter-Bank Offered Rate)" since November 1995 and "Euroyen TIBOR" since March 1998. The JBA TIBOR Administration has undertaken the calculation and publication of the JBA TIBOR from April 1, 2014. With the reform of July 2017, the JBA TIBOR is most likely to continue as an alternative benchmark for the JPY LIBOR, whereas the Euroyen TIBOR will probably be discontinued due to the lack of an active underlying market. The JBA TIBOR reform introduced a waterfall methodology to make the benchmark better anchored to actual transactions and to make the process as free as practically possible from any arbitrarily manipulated rates, which helps the JBA TIBOR serve as an interest rate benchmark that complies with IOSCO principles in IOSCO (2013).

Even though Japan will retain the Japanese Yen TIBOR, the JPAXI based on the methodology proposed by Berndt et al. (2023) has the following three advantages: 1) it is free from arbitrary judgment by reference banks; 2) it has a wide range of longer maturities; and 3) it is a direct measure of the actual costs of funds for banks. If Japan had a large enough pool of bond market transactions for corporate bonds issued by banks, this index could potentially serve as a benchmark for the Japanese market in accordance with the IOSCO principles. This would offer a reliable point of reference for pricing various financial instruments, including derivatives, loans, and securities across a broad spectrum.

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[4] IOSCO is the international body that groups the world's securities regulators and sets the global standard for the securities sector.

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