

Developments in Corporate Bond Spreads at Issuance

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Firms' financing environment in terms of commercial paper, corporate bond, and bank lending is one of the spillover channels of monetary policy. In particular, this article overviews the recent developments in corporate bond spreads in the primary markets, focusing mainly on the period from mid-2022 to early 2023 when we witnessed the spread widening. A quantitative time-series analysis using issue-by-issue data suggests that the widening of corporate bond spreads was caused by (1) increased demand for working capital in response to rising commodity prices and (2) spillover effects of tightening foreign financial conditions, reflecting monetary policy tightening by foreign central banks, and was likely affected by (3) a decline in the degree of functionality of the Japanese government bond (JGB) market.

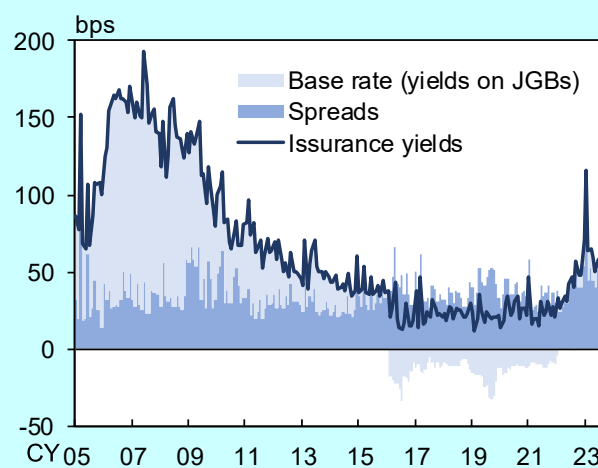
Introduction

Firms' financing environment in terms of commercial paper, corporate bond, and bank lending is one of the spillover channels of monetary policy. In particular, this article overviews the recent developments in corporate bond spreads in the primary markets in Japan.

In the primary corporate bond markets, the bond yields at issuance had increased since mid-2022 to early 2023 (Chart 1). This was accompanied by the rise in Japanese government bond (JGB) yields, which is the base rate for the corporate bond yields, and by the widening of corporate bond spreads, which is a margin added to the base rate. Conceptually, the corporate bond spreads at issuance can be determined by the following two factors: (1) *issue-specific factors*, which reflect issuer's credit risk based on the financial positions and the credit rating, as well as issuance conditions for each issue such as maturity and call clause, and (2) *across-issue common factors*, which reflect market conditions such as the risk sentiment of investors and therefore affect spreads of all issues at one time.

As shown in Chart 2, fluctuations of aggregated spreads on lower-rated corporate bonds tend to be very volatile, reflecting the greater variation in the financial positions of issuers, namely *issue-specific factors*. To detect material changes in the corporate bond issuance environment, it is critical to monitor the *common-factor components* of spread movements across all issues by eliminating such issue-specific fluctuations.

[Chart 1] Corporate Bond Yields at Issuance

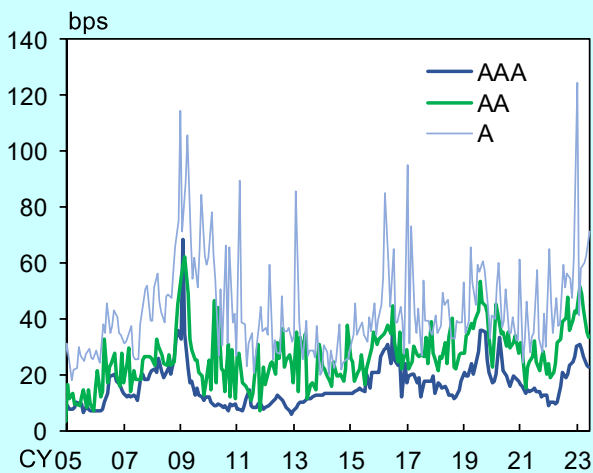


Note: The latest data are for June 2023 (the same hereafter). Figures for corporate bond spreads are calculated by (1) taking simple averages of spreads within the same rating categories and then (2) taking the weighted average of them using issuance amounts as weights. Covers domestic publicly offered bonds, excluding bonds issued by banks, securities firms, and nonbank financial institutions. Subordinated bonds and bonds with an initial issue period of 15 years or longer are also excluded.

Source: Capital Eye; I-N Information Systems; Bloomberg.

In this article, we first present some hypotheses regarding factors that may have contributed to the widening of corporate bond spreads from mid-2022 to early 2023. Then, we attempt to quantitatively assess how these factors have affected the firms' bond issuance environment using granular issue-by-issue time-series data on corporate bonds.

[Chart 2] Corporate Bond Spreads by Rating



Source: Capital Eye; I-N Information Systems; Bloomberg.

Situations behind the Widening of the Corporate Bond Spreads at Issuance

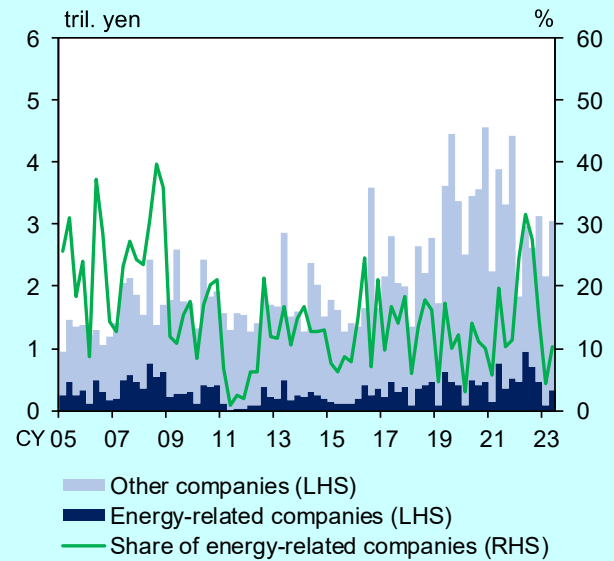
The widening of corporate bond spreads from mid-2022 to early 2023 can be attributed mainly to factors such as (1) increased demand for working capital due to rising commodity prices and (2) spillover effects of a tightening of foreign financial market conditions, reflecting monetary policy tightening by foreign central banks. In addition, the spread movements likely were affected by (3) a decline in the degree of functionality of the JGB market, which was observed during the same period.

Increased demand for working capital as commodity prices rise

One of the reasons behind the widening of corporate bond spreads could be increasing demand for working capital in response to rising commodity prices triggered by Russia's invasion of Ukraine in the first half of 2022. Energy-related companies in particular were unable to raise sales prices sufficiently while costs rose sharply, resulting in deteriorating profits and a sharp increase in working capital demands. As a result, the share of energy-related companies in the amount of corporate bond issuance rose to about 30% in the April-June period of 2022 (Chart 3).

In general, corporate bond spreads for firms with deteriorating financial positions tend to widen, reflecting higher credit risk. Moreover, the demand for funds by such firms has increased their share in the overall primary markets, which tends to widen the average corporate bond spreads.

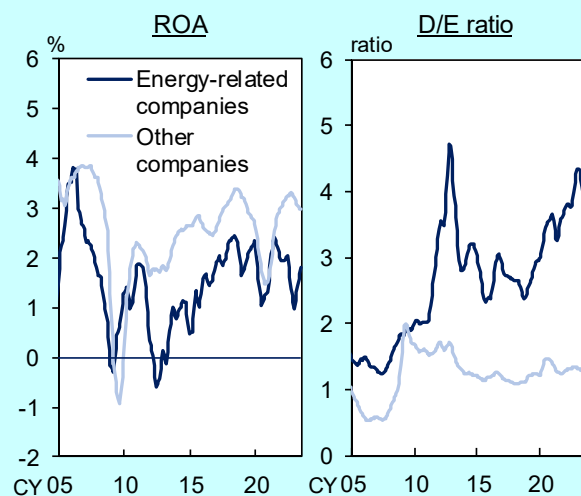
[Chart 3] Amount of Newly Issued Corporate Bonds



Note: Covers publicly offered domestic bonds excluding those issued by banks. Figures for energy-related companies cover electricity, gas, and petroleum & coal products companies.

Source: Capital Eye; I-N Information Systems; Bloomberg.

[Chart 4] Financial Positions of Bond-Issuers



Note: Covers around 500 companies that have issued bonds at least once from January 2002 to June 2023 and for which financial data are available. Figures for energy-related companies cover electricity, gas, and petroleum & coal products companies. ROA denotes net income divided by the average total assets, and D/E ratio denotes long- and short-term debt divided by market capitalization. Figures represent one-year moving averages.

Source: I-N Information Systems; Bloomberg; each company's financial releases.

Chart 4 shows the developments in financial positions of bond issuers during the period. Net income ROA clearly declined for energy-related companies due to the impact of rising commodity prices, while for other companies, it has recovered from a temporary

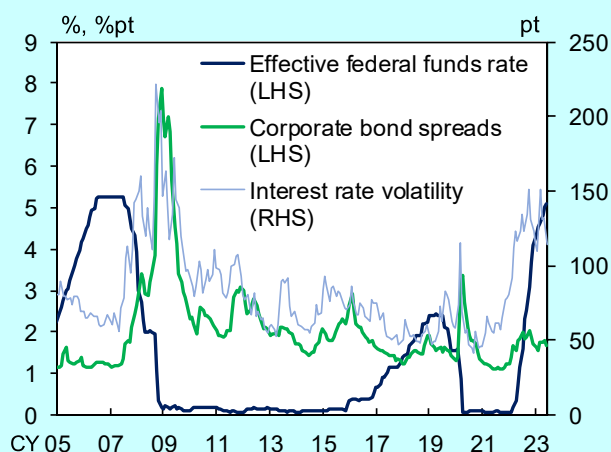
decline after the outbreak of COVID-19 and remained at a high level. As for the Debt-to-Equity ratio (D/E ratio, calculated as debt divided by market capitalization), energy-related companies showed a large increase, reflecting the recent rise in debt, while other companies' ratios were more or less unchanged.

Spillover effects of tightening foreign financial market conditions

In 2022, foreign central banks, mainly in the U.S. and Europe, began raising interest rates. In response, in the foreign financial markets, interest rate volatility increased and the financial conditions tightened, which worsened investors' risk sentiment. These foreign factors may have contributed to the widening of corporate bond spreads in the Japanese bond market.

In this regard, indicators related to the U.S. Treasury and corporate bond markets have shown tightening financial conditions since 2022 (Chart 5). The deterioration of global investors' risk sentiment likely spilled over into Japanese markets as well.

[Chart 5] U.S. Financial Market Conditions



Note: Figures for corporate bond spreads are for BBB-rated bonds (ICE BofA BBB US Corporate Index Option-Adjusted Spread). Figures for interest rate volatility are for the U.S. Treasury bonds (ICE BofAML MOVE Index).

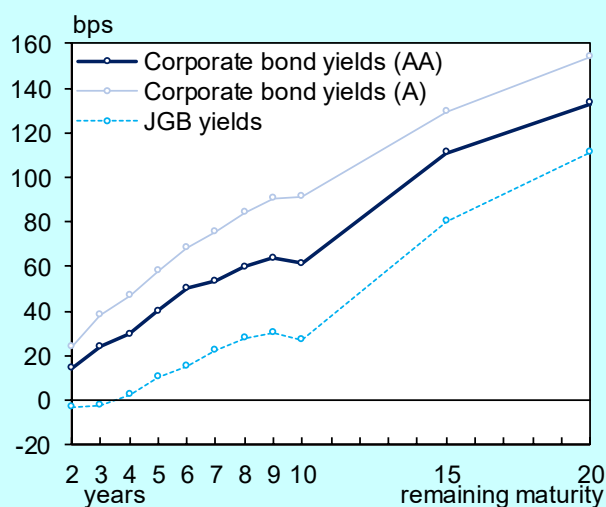
Source: FRB; ICE Data Indices; Bloomberg.

Decline in the degree of functionality of the Japanese government bond (JGB) markets

Interest rate hikes by foreign central banks and increases in domestic inflation rates added upward pressure on long-term interest rates in Japan in late 2022. In this situation, the Bank of Japan (BOJ) conducted fixed-rate purchase operations of 10-year JGBs at a yield of 0.25% (0.5% after the Monetary Policy Meeting in December 2022¹) on every business day to restrain rises in long-term yield.

As a result, while long-term interest rates were contained, the yield curve of JGBs became distorted, mainly with regard to remaining maturities of less than 10 years, and the linkage with futures and interest rate swaps markets declined. As such, the functionality of the JGB market deteriorated in some respects. Similar to the JGB market, the corporate bond market also faced distortions in its yield curve (Chart 6). Market participants pointed out that prospects for interest rates had not converged among investors and issuers, leading to a deteriorating environment for bond issuance.

[Chart 6] Corporate Bond Yield Curve



Note: Data for the October-December quarter of 2022. Figures for corporate bond yields are based on reference rates for OTC bond transactions in the secondary market by credit rating and remaining maturity (between t years and t-1 years). The credit ratings for bonds are by Rating and Investment Information, Inc.

Source: Japan Securities Dealers Association; Bloomberg.

Analysis of Factors affecting Corporate Bond Spread Movements

As described in the previous section, various factors could have played a role in the widening of corporate bond issuance spreads from mid-2022 to early 2023. In order to understand these developments better, we attempt to quantitatively assess the impact of these factors using issue-by-issue time-series data since 2005.

Measuring impacts of issue-specific factors and across-issue common factors using panel data

Specifically, we constructed granular panel data that contain issue-level information such as the issuance conditions of individual issues and the financial positions of firms. Using this dataset, we estimate fixed effects models to decompose the corporate bond spreads into *issue-specific factors*, which reflect

issuers' credit risk, and *across-issue common factors*.²

The explanatory variables for our estimation³ include (1) indicators of corporate credit risk (ROA, D/E ratio, and historical volatility of firms' equity values) and (2) dummies for each firm (firm fixed effects), which can capture other factors related to firm-specific characteristics. In addition, (3) dummies for initial maturity at issuance and credit rating are included. The variables above represent *issue-specific factors*. In addition to these variables, time dummies for each month (month fixed effects) are included in order to capture *across-issue common factors* that represent the overall condition of the market environment in each month, in the sense that they are common across all issues at each period. Other variables include dummies that captures the impact of Great East Japan Earthquake and a variable that captures the impact of negative interest rates.⁴

[Chart 7] Estimation results: Corporate Bond Spreads at Issuance

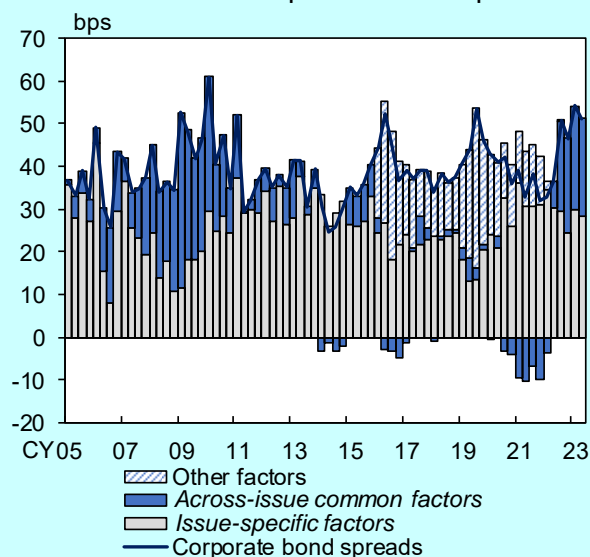
Dependent variable: Corporate bond spreads at issuance		
	Model 1	Model 2
Explanatory variables:		
ROA (%)	-1.45*** (0.16)	-1.25*** (0.15)
D/E ratio (ratio)	2.47*** (0.33)	2.16*** (0.33)
Historical volatility of equity value (pt)	0.30*** (0.03)	0.24*** (0.04)
Initial maturity (year)	-0.23 (0.18)	0.36** (0.17)
Dummy for credit rating: AA	10.53*** (2.30)	13.27*** (2.15)
Dummy for credit rating: A	23.02*** (2.74)	27.54*** (2.58)
Dummy for credit rating: BBB	46.28*** (3.43)	51.49*** (3.26)
Firm fixed effects	✓	✓
Month fixed effects		✓
Adjusted R-squared	0.08	0.27
Number of observations	3,410	3,410

Note: Based on fixed effects models. Estimated coefficients on the other explanatory variables (such as dummies issued by electric power firms after March 2011 and the interaction term of the negative 5-year JGB yields and dummies for higher-rated bonds) are not shown. ***, **, and * denote statistical significance at the 1%, 5%, and 10% level, respectively. Figures in parentheses represent standard errors. The estimation period is from January 2005 to June 2023.

Looking at the estimation results (Chart 7), we can see that a rise in corporate bond spreads tends to accompany a decreasing ROA, an increasing D/E ratio, and/or an increasing volatility of its equity value. Corporate bond spreads also tend to be higher for bonds

with lower ratings, i.e., lower credit quality. These relationships are robust regardless of whether time fixed effects are in the model or not.⁵

[Chart 8] Impacts of Factors affecting Fluctuation of Corporate Bond Spreads



Note: Decomposition of corporate bond spreads based on the estimation results of Model 2 in Chart 7. Figures for *Issue-specific factors* are calculated as the sum of the contributions of ROA, D/E ratio, historical volatility of equity value, initial maturity, dummies for credit rating, firm fixed effects, and dummies issued by electric power firms after March 2011. Figures for *across-issue common factors* represent the contributions of time fixed effects. Figures for other factors represent the contributions of the interaction term of the negative 5-year JGB yields and dummies for higher-rated bonds.

Source: Bloomberg; Capital Eye; I-N Information Systems; QUICK; each company's financial releases.

[Chart 9] Impacts of Issue-specific Factors by Sector

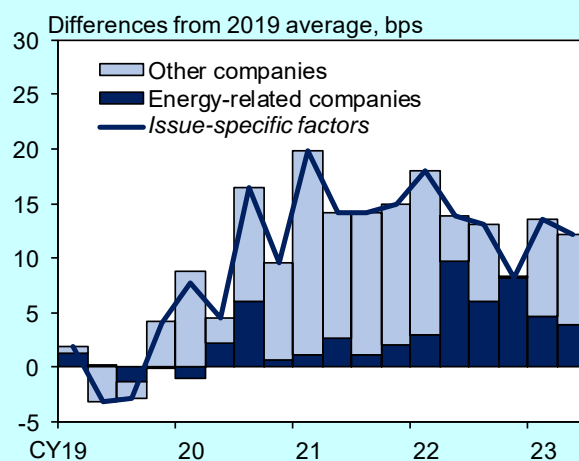


Chart 8 shows the decomposition of the changes in corporate bond spreads based on the estimation results. The impacts of *across-issue common factors* rose sharply during the global financial crisis before turning

downward and remaining at low levels over the past 10 years or so. After mid-2022, they have been rising significantly. In contrast, movements stemming from *issue-specific factors* since mid-2022 have been limited. The further breakdown of the factors in Chart 9 shows that the impacts of energy-related companies have increased due to their financial deterioration and the increase in their share in the primary markets, as mentioned above. Meanwhile, the contribution of other industries had been rising since 2020 due to the impact of the economic downturn caused by the COVID-19 pandemic, but it has been improving since mid-2022 as economic activity has gradually resumed. As a result, the overall *issue-specific factors* are largely unchanged. All told, these decompositions suggest that the increase in corporate bond spreads during this period was accompanied by increasing impacts of factors common to the overall corporate bond market, which are independent from firm- or industry-specific factors.⁶

It should be noted that the contributions of other factors increased from 2016 to 2021. This reflects the fact that, as the period when JGB yields had been below zero percent continued, investors tended to focus more on the absolute yields of corporate bonds rather than spreads, especially among higher-rated bonds for which yields are relatively low. In other words, there exists a zero lower bound for corporate bond yields, even as JGB yields continue to fall into negative territory. In this sense, the corporate bond spreads had just technically widened. The environment for corporate bond issuance during the period was favorable, as the corporate bond yields fell to extremely low levels, and the amount of corporate bond issuance increased substantially, particularly for long-term and super-long-term issues.

Underlying sources of common factors

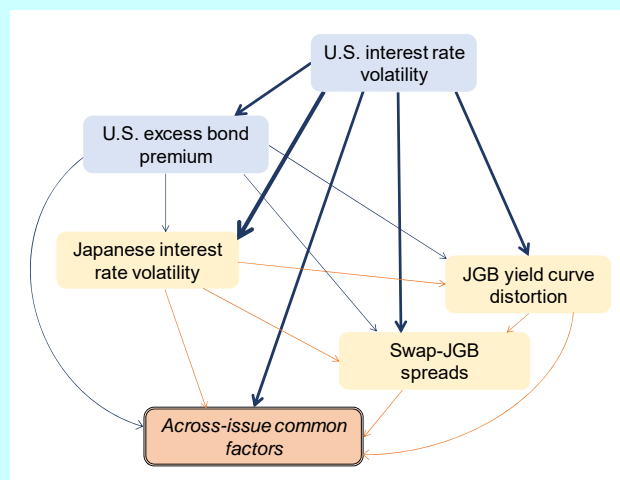
Turning to the next question, we explore what determines the *common factors* that explain much of the widening of corporate bond spreads from mid-2022 onward.

First, as mentioned above, the tightening of the foreign financial conditions may have spilled over into the Japanese corporate bond markets through investors' risk sentiment. Academic studies have also pointed out the international spillover channels of tightening financial conditions, including not only the effects through economic activities such as international trade, but also financial channels. For example, when long-term interest rates rise abroad, there is a possibility that (1) portfolio rebalancing by globally active investors affects domestic financial assets prices and (2) the

domestic financial conditions are affected by changes in risk-taking capacity or deleveraging by globally active financial institutions.⁷ Second, a decline in the degree of functionality of the JGB market may also have broadly affected the corporate bond issuance environment.

With these channels in mind, we estimated the strength of the interconnectedness and the direction of influences among financial market-related indicators in Japan and the U.S. and the *across-issue common factors* estimated above.^{8, 9}

[Chart 10] Spillover Effects of Foreign Financial Market Conditions to the Domestic Corporate Bond Markets



Note: Based on interconnectedness analysis following the framework proposed by Diebold and Yilmaz [2012, 2014]. The thickness and direction of each arrow are based on the results of variance decomposition by the VAR model. The estimation period is from January 2008 to December 2022.

The results in Chart 10 show that the Japanese bond markets are susceptible to the U.S. financial conditions. Specifically, the *common factors* in Japanese corporate bond markets are directly influenced by the U.S. interest rate volatility and the excess bond premium, as well as indirectly through the Japanese interest rate volatility and the degree of functionality of the JGB market (represented by JGB yield curve distortion and swap-JGB spreads).

Quantifying impacts of underlying sources on common-factor components

To quantitatively assess how much these underlying sources affect corporate bond spreads, we estimated regression models with the *common-factor* components of corporate bond spreads as a dependent variable.¹⁰

The estimation results in Chart 11 and the decomposition of the *common-factor* components in Chart 12 show that the increase in U.S. interest rate volatility has statistically significant impacts on the *common-factor* components, and this is economically significant as well. The degree of functionality of the JGB market is also positively associated with the *common factors*. In particular, the contribution had increased from late 2022 to early 2023 when the distortion of the JGB yield curve led to disagreement over prospects for interest rates among investors and issuers at corporate bond issuances and trading transactions where the JGB yields are used as the base rate. That said, such impacts have diminished more recently as the degree of functionality of the JGB market has been improving.

[Chart 11] Estimation results: *Common-factor Components of Spread Movements*

Dependent variable: <i>across-issue common factors</i>		
	Model 1	Model 2
Explanatory variables:		
Japanese interest rate volatility (pt)	1.99** (0.82)	0.67 (0.87)
JGB yield curve distortion (pt)	8.36*** (1.41)	8.12*** (1.37)
Swap-JGB spreads (bps)	0.49*** (0.13)	0.41*** (0.13)
U.S. interest rate volatility (pt)	0.16*** (0.03)	0.18*** (0.03)
U.S. excess bond premium (bps)	0.02* (0.01)	0.01 (0.01)
BOJ's share of corporate bond holdings (%)		-0.97*** (0.26)
Adjusted R-squared	0.57	0.60
Number of observations	186	186

Note: The BOJ's share of corporate bond holdings denotes the ratio of the corporate bonds amount held by the BOJ to the amount of markets' total outstanding. ***, **, and * denote statistical significance at the 1%, 5%, and 10% level, respectively. Figures in parentheses represent standard errors. The estimation period is from January 2008 to June 2023.

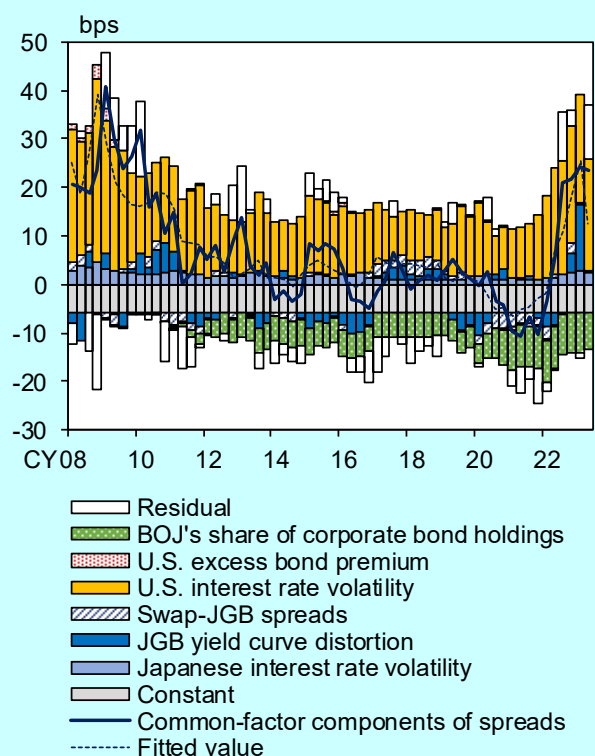
Effect of the BOJ's outright purchases of corporate bonds

In our regression analysis, we also consider the impacts of the BOJ's outright purchases of corporate bonds as one of the factors that affect the *common-factor* components.¹¹ The results show that the outstanding amount (stock) of the BOJ's corporate bond holdings has the effect of pushing down the spreads to a certain extent (Chart 12).

In this regard, academic studies have pointed out that a decrease in the supply of corporate bonds in the markets due to the BOJ's purchases has the effect of (1) pushing down yields on highly substitutable bonds and

(2) pushing down overall yields in the corporate bond markets by increasing investors' capacity to invest in bonds and take on risk.¹² Some studies for the U.S. (the Secondary Market Corporate Credit Facility, or SMCCF, introduced by the Federal Reserve immediately after the outbreak of COVID-19) and for Europe (the Corporate Sector Purchase Program, or CSPP, implemented by the ECB as part of its monetary easing measures) find statistical evidence of their impacts on pushing down the spreads of relevant corporates bonds significantly.¹³ The results of this article are in line with these findings.

[Chart 12] Impacts of Underlying Sources on *Common-factor Components*



Note: Decomposition of monthly common components of corporate bond spreads across issues (i.e., *across-issue common factors*) based on the estimation results of Model 2 in Chart 11.

Source: Bloomberg; FRB; Japan Exchange Group; Capital Eye; I-N Information Systems; QUICK; LSEG; ICE Data Indices; each company's financial releases; Japan Securities Depository Center; Bank of Japan.

Conclusion

This article reviews and analyzes the factors behind the widening of corporate bond spreads at issuance in Japan, focusing mainly on the period from mid-2022 to early 2023.

From mid-2022, the corporate bond spreads widened due to rising demand for working capital stemming from rising commodity prices and the effects of tightening foreign financial market conditions. In

addition, from late 2022 to early 2023, a decline in the functionality of the JGB market also appears to have affected the widening of spreads. That said, the spreads narrowed somewhat afterward as the functioning of the JGB market has improved. Meanwhile, our estimation results suggest that the BOJ's outright purchases of corporate bonds have contributed to pushing down the spreads.

¹ Since the July 2023 Monetary Policy Meeting, a fixed-rate purchase operation of 1.0% had been conducted every business day.

² Our regression analysis covers publicly listed business corporations for which financial data are available. Subordinated corporate bonds and corporate bonds for individual investors, which differ from standard corporate bonds in terms of their characteristics and investors, are excluded. Corporate bonds with initial maturity of 15 years or longer are also excluded because of the large heterogeneity among these bonds.

³ For selecting explanatory variables, we refer to previous studies such as Merton [1974], which applies an option pricing model to corporate bonds and calculates the theoretical price using non-arbitrage conditions with corporate assets, liabilities, and equity. In this model, the worse the financial positions of the firm and the greater the volatility of asset changes, the higher the corporate bond spreads.

Merton, R. C. [1974]: "On the Pricing of Corporate Debt: The Risk Structure of Interest Rates," *Journal of Finance*, vol. 29, No. 2, pages 449-470.

As a reference for analyses of the Japanese corporate bond markets, see the following papers:

Ohyama, S., and Y. Hongo [2010]: "The Determinants of New Issue Spread Changes in Japanese Corporate Bond Market (available only in Japanese)," Bank of Japan Working Paper Series, No. 10-J-10.

Suganuma, K., and Y. Ueno [2018]: "The Effects of the Bank of Japan's Corporate and Government Bond Purchases on Credit Spreads," IMES Discussion Paper Series, No. 2018-E-4.

⁴ Specifically, to capture the effect of the upward shift in spreads on bonds issued by electric power firms after the Great East Japan Earthquake, we include a dummy variable that takes 1 for bonds issued by electricity companies after March 2011 and 0 otherwise. We also include interaction terms between 5-year JGB yields in the negative territory and the higher-rating dummies (AAA, AA, and A-rated) to capture the impact of negative interest rates.

⁵ The results of Model 1 in Chart 7, which does not consider time fixed effects, show that the coefficient on initial maturity does not satisfy the sign condition. This is possibly because firms tend to issue bonds with shorter-than-normal maturities in times of stress when the bond issuance environment deteriorates, as was the case during the global financial crisis, for example. This suggests that the impacts of initial maturity should be evaluated after controlling for such differences across the periods by introducing time fixed effects in estimations.

⁶ It should be noted that our estimation may not adequately capture the effects of *issue-specific factors* of energy-related companies that push up corporate bond spreads, especially when channels other than credit risk deterioration play a role. To check this possibility, we examine industry-level estimation errors but do not find that the estimation errors for energy-related companies have been higher than those for other companies since 2022. We also conduct additional regression with interaction terms between time dummies and an energy-related companies dummy. The results show that there were large

As described in this article, there are various possible factors behind the fluctuation of corporate bond spreads. With this in mind, it is valuable to employ various approaches from a broad perspective, including econometric analysis using granular data. It is important to make continuous efforts to closely monitor Japan's financial conditions by carefully analyzing their developments.

deviations at certain times, such as during the global financial crisis and after the Great East Japan Earthquake, but significant deviations were not observed in 2022 or later for any of the industries. Since 2022, the impacts of *across-issue common factors* for each industry have increased by the same amount.

⁷ See, for example, the following papers:

Caldara, D., F. Ferrante, and A. Queralto [2022]: "International Spillovers of Tighter Monetary Policy," FEDS Notes, Board of Governors of the Federal Reserve System, December 22, 2022.

Akinci, O., S. Kalemli-Ozcan, and A. Queralto [2022]: "Uncertainty Shocks, Capital Flows, and International Risk Spillovers," Federal Reserve Bank of New York Staff Reports No. 1016.

Kearns, J., A. Schrimpf, and F. D. Xia [2018]: "Explaining Monetary Spillovers: The Matrix Reloaded," BIS Working Papers, No. 757.

Bruno, V., and H. S. Shin [2015]: "Capital Flows and the Risk-Taking Channel of Monetary Policy," *Journal of Monetary Economics*, vol. 71, issue C, pages 119-132.

He, Z., and A. Krishnamurthy [2013]: "Intermediary Asset Pricing," *American Economic Review*, vol. 103, No. 2, pages 732-770.

Adrian, T., and H. S. Shin [2011]: "Financial Intermediary Balance Sheet Management," Federal Reserve Bank of New York Staff Reports No. 532.

In the Japanese corporate bond markets, it should be noted that the share of holdings by foreign investors is only about 2%. The direct impacts from foreign investors should be small.

⁸ Among the financial market-related indicators for Japan and the U.S. used in the analysis, we use the ICE BofAML MOVE Index for the U.S. interest rate volatility. The U.S. corporate bond excess premium indicates the overall environment in the corporate bond markets by removing components stemming from issuers' credit risk from spreads (calculated by the FRB; for details, see Favara et al. [2016] and Gilchrist and Zakrajšek [2012]). We use implied volatility of the 10-year JGB rate for Japanese interest rate volatility. The JGB yield curve distortion denotes the aggregate of the degree of deviation of each issue's interest rate from the estimated yield curve (calculated by Bloomberg). Swap-JGB spreads represent the differences between the 5-year LIBOR swap rate (or TONA swap rate after January 2022) and the JGB rates.

Favara, G., S. Gilchrist, K. F. Lewis, and E. Zakrajšek [2016]: "Updating the Recession Risk and the Excess Bond Premium," FEDS Notes, Board of Governors of the Federal Reserve System, October 6, 2016.

Gilchrist, S., and E. Zakrajšek [2012]: "Credit Spreads and Business Cycle Fluctuations," *American Economic Review*, vol. 102, No. 4, pages 1692-1720.

⁹ Our interconnectedness analysis refers to the framework proposed by Diebold and Yilmaz [2012, 2014] and measures the relative degree of importance in the connections between each variable based on variance decomposition with the VAR model. Specifically, following Ando et al. [2022] and Chatziantoniou et

al. [2021], we use a Quantile-VAR to capture the spillover effects of relatively large shocks (at 75th percentile).

Ando, T., M. Greenwood-Nimmo, and Y. Shin [2022]: "Quantile Connectedness: Modeling Tail Behavior in the Topology of Financial Network," *Management Science*, INFORMS, vol. 68, No. 4, pages 2401-2431.

Chatziantoniou, I., D. Gabauer and A. Stenfors [2021]: "Interest Rate Swaps and the Transmission Mechanism of Monetary Policy: A Quantile Connectedness Approach," *Economics Letters*, vol. 204.

Diebold, F. X., and K. Yilmaz [2012]: "Better to Give than to Receive: Predictive Measurement of Volatility Spillovers," *International Journal of Forecasting*, vol. 28, No. 1, pages 57–66.

Diebold, F. X., and K. Yilmaz [2014]: "On the Network Topology of Variance Decompositions: Measuring the Connectedness of Financial Firms," *Journal of Econometrics*, vol. 182, No. 1, pages 119-134.

¹⁰ In the estimation, for the JGB yield curve distortion and swap-JGB spreads, we use their residuals based on separate regressions using the Japan and U.S. financial condition indicators as explanatory variables. This allows us to capture the indirect effects of the financial conditions in Japan and the U.S., such as through the degree of functioning of the JGB market, as their own effects.

¹¹ Chart 11 includes the results of two models: namely Model 1, which does not include the outright purchases of corporate bonds by the Bank of Japan as an explanatory variable, and Model 2,

which does. In both models, the estimated coefficients on other explanatory variables satisfy their sign conditions, and most of them are statistically significant.

¹² For example, Sugauma and Ueno [2018] empirically examine the effect and the spillover channels of the Bank of Japan's outright corporate bond purchases.

¹³ See, for example, the following papers:

Gilchrist, S., B. Wei, V. Z. Yue, and E. Zakrajšek [2021]: "The Fed Takes on Corporate Credit Risk: an Analysis of the Efficacy of the SMCCF," BIS Working Papers No. 963.

Zaghini, A. [2020]: "How ECB Purchases of Corporate Bonds Helped Reduce Firms' Borrowing Costs," ECB Research Bulletin, vol. 66.

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