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Granular Insights into Depositor Dynamics and Deposit Spreads in Japanese G-SIBs' Foreign Currency Deposits

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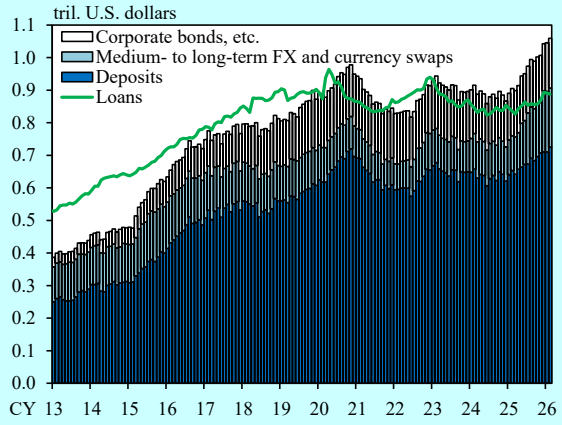
Major Japanese banks are increasingly focusing on foreign currency deposits for stable funding of overseas lending. Against this background, this paper provides a quantitative analysis using granular data on foreign currency deposits at major banks. Specifically, it decomposes recent developments in overall deposit balances into depositor dynamics to characterize their pattern, identifies factors affecting depositor attrition and tenure length, and examines the determinants of deposit spreads -- metrics for assessing deposit acquisition costs. The results confirm that recent deposit growth is driven by existing non-Japanese depositors adding to their balances. Furthermore, expanding transaction banking services that attract transactional deposits contributes to containing depositor attrition, extending tenure, and lowering deposit acquisition costs. Using these findings to engage in further discussions with major banks and foreign authorities will be important for enhancing foreign currency funding stability and advancing monitoring methods.

Introduction

Major Japanese banks have, over the long term, actively increased their overseas lending denominated in foreign currencies in pursuit of higher profit opportunities than those available domestically. [1] Enhancing the stability and managing the costs of foreign currency funding used for overseas lending are considered to be important issues for business management -- including in terms of asset-liability management (ALM). For these banks, the amount of foreign currency deposits, which are relatively superior funding methods in terms of both stability and cost, is consistently lower than their overseas lending. One reason for this is that these banks face difficulty in acquiring a stable retail deposit base overseas. The shortfall is covered by more stable, albeit higher-cost, funding methods compared to deposits, such as foreign currency-denominated corporate bonds or medium- to long-term FX and currency swaps sourced from surplus Japanese yen funds in Japan. As a result, the current foreign currency funding status of major banks can be assessed as generally stable (Chart 1).[2]

Looking ahead at the foreign currency ALM of major banks, while it is expected that their overseas lending will continue to maintain a significant presence, the environment surrounding foreign currency funding remains highly uncertain. [3] For example, regarding medium- to long-term FX and currency swaps sourced from surplus yen funds, such funds might become less likely to increase substantially due to intensifying competition for deposit acquisition in the domestic sector amid changes in the domestic interest rate environment. In addition, the stability and costs associated with funding through foreign currency-denominated corporate bonds are highly susceptible to developments in global financial markets. Against this backdrop, major banks are currently placing greater emphasis on acquiring foreign currency deposits, particularly from corporate customers. Specifically, they are focusing on building up the outstanding

[Chart 1] Major Banks' Overseas Lending and Stable Funding Balances



Note: "Corporate bonds, etc." and "Medium- to long-term FX and currency swaps" indicate funding maturing in over 1 year.

Source: Bank of Japan.

balance of deposits, expanding the depositor base, and enhancing the stability of foreign currency funding by raising the deposit interest rates offered to depositors and expanding their transaction banking operations to provide comprehensive services for customers' daily cash management needs, including funding arrangements and international remittances. Amid these efforts, as shown in Chart 1, the outstanding balance of foreign currency deposits at major banks has recently been increasing.

As one of the focal points in its monitoring of major banks, the Bank of Japan has been closely watching their foreign currency funding trends in light of these environmental changes, while continuously making efforts to enhance its monitoring methods.[4]

In recent years, particularly in relation to foreign currency deposits, the Bank, in cooperation with major banks, has been collecting granular foreign currency deposit transaction data at the individual transaction level (hereinafter referred to as "granular data") jointly with the Financial Services Agency (FSA). The data includes detailed information on depositors' individual foreign currency deposit transactions, primarily for corporate clients -- including currency, deposit amounts, interest rates, maturities, deposit types (demand or time deposits), and depositor attributes (categorized by region and by Japanese or non-Japanese firms). Using the data, the authorities have advanced their analyses and enhanced their monitoring of the characteristics and trends in foreign currency deposits. Findings from these analyses suggest that acquiring transaction deposits -- primarily non-interest-bearing deposits used to receive transaction banking services -- can contribute to enhancing deposit stickiness, that is, the extent to which deposits are retained.[5]

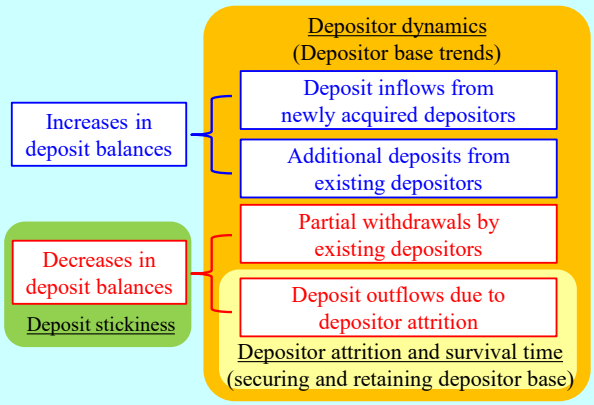
This paper uses the granular data to analyze the efforts that major banks are focusing on to strengthen the acquisition of foreign currency deposits, as mentioned earlier. These analyses will be effective in gaining insights into future evaluation and challenges from the perspective of ensuring stability and managing costs in foreign currency funding.[6] In detail, this paper conducts three types of quantitative analyses using the granular data on the foreign currency deposits of major banks: (1) developments in deposits by depositor dynamics; (2) determinants of depositor attrition and survival time; and (3) determinants of deposit spreads. These analyses aim to examine the effects of foreign currency deposit acquisition measures, as well as the impact on depositor base and acquisition costs.

Depositor Dynamics

Decomposition of Depositor Dynamics

The first quantitative analysis decomposed recent developments in the foreign currency deposit balances of major banks based on depositor dynamics -- namely, deposit inflows from newly acquired depositors, additional deposits or partial withdrawals by existing depositors, and deposit outflows due to depositor attrition, and examined developments in the depositor base and the impact of deposit acquisition measures in detail.[7] Specifically, focusing on U.S. dollar-denominated deposits (hereinafter referred to as "dollar deposits"), which account for a significant portion of the outstanding balance of foreign currency deposits at major banks, this analysis classified depositors into newly acquired depositors, existing depositors, and departing depositors based on changes in their deposit balances from the previous month.[8,9] On this basis, the year-on-year change in overall foreign currency deposit balances was decomposed into three categories of contribution: (1) inflows from newly acquired depositors; (2) changes in the outstanding balance of deposits of existing depositors; and (3) outflows due to depositor attrition. This methodology can identify the factor primarily driving the overall balance changes in a given period (Chart 2).[10] If (1) is the main driver, it highlights the importance of expanding the depositor base. If (2) takes precedence, the effectiveness of deposit acquisition efforts, including the provision of deposit interest rates for existing depositors, becomes the key focus. If (3) is dominant, the shrinking of the depositor base can be considered as a critical issue.

[Chart 2] Changes in Deposit Balances (Conceptual Framework)



Source: Bank of Japan.

Trends in Deposits by Depositor Dynamics

Upon examining the overall trends in major banks' dollar deposit balances, decomposed by depositor dynamics as described above, the recent fluctuations in balances seem to have been driven by existing depositors, primarily non-Japanese ones. Additionally, the examination showed that during past periods of decline in overall balances of major banks, there was no significant increase in depositor attrition. These findings suggest that major banks, while maintaining their depositor base, have possibly adjusted the amount of foreign currency deposit acquisition in line with changes in the balance of overseas lending by flexibly increasing or suppressing time deposit interest rates for existing depositors, particularly among non-Japanese depositors, who tend to be more sensitive to interest rates (Chart 3).[11]

In recent trends, the overall increase in the outstanding balance in dollar deposits continues to be driven by the accumulation of deposit balances by non-Japanese existing depositors. Further breaking this down by region, focusing on the key areas where major banks acquire dollar deposits, namely the United States and the Asia-Pacific region (hereinafter referred to as "APAC"), it is evident that the aforementioned growth in balances has primarily occurred in APAC. [12] Meanwhile, in the United States, even among Japanese depositors, there has been a decrease in the balances of existing depositors and outflows caused by depositor attrition, indicating that banks face intense competition from foreign banks for deposit acquisition. [13] These findings are consistent with the information gathered through discussions with major banks and other sources.

Depositor Attrition and Survival Time

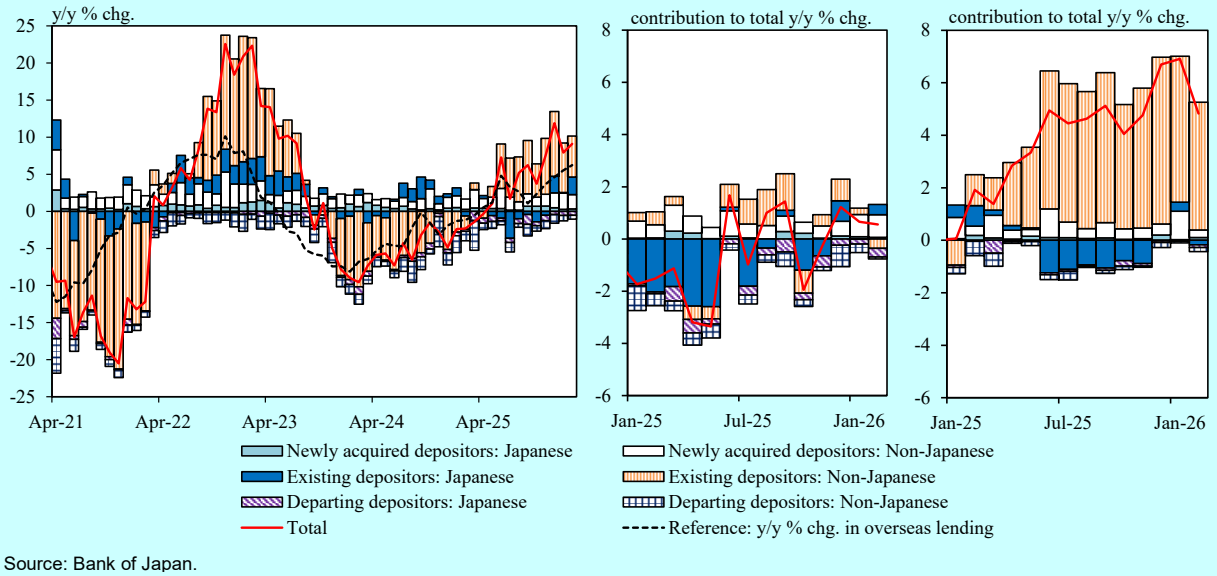
Determinants of Depositor Attrition

The second quantitative analysis focused on depositor attrition within the depositor dynamics of dollar deposits at major banks, as classified in the previous section.

When assessing the stability of foreign currency funding, it is important to assess deposit stickiness, that is, the resilience against deposit outflows (a decline in deposit balances). Although prior studies from this perspective are limited, some progress has been made. [14] However, as shown in Chart 2, a more granular examination of the decline in deposit balances reveals two components: partial withdrawals by existing depositors, and the complete withdrawal of deposits by departing depositors (depositor attrition). While earlier research has not conducted such a decomposition, it is important to focus particularly on the latter -- depositor attrition -- from the perspective of securing and retaining a stable depositor base.

Based on these considerations, this analysis examined factors affecting the likelihood of depositor attrition from dollar deposits at major banks. Specifically, it estimated a logit model using the occurrence of depositor attrition, as identified in the previous section, as the dependent variable. As the explanatory variables, the model incorporated depositor-specific quantitative and qualitative information contained in the granular data, as well as an indicator representing the degree of stress across the entire financial market (hereafter referred to as the "Financial Stress Index") (Chart 4).[15,16]

[Chart 3] Dollar Deposit Balances of Major Banks by Depositor Dynamics



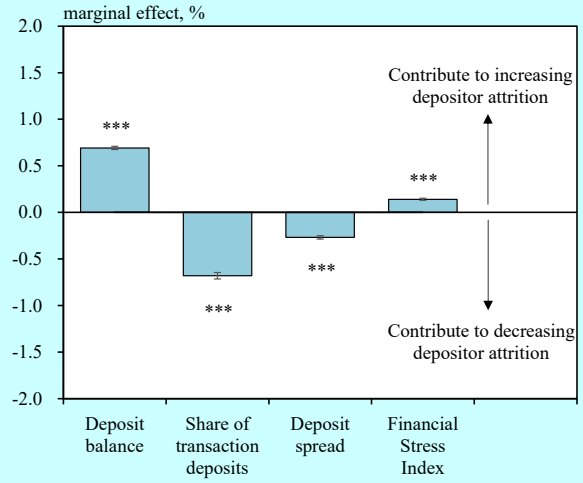
Source: Bank of Japan.

[Chart 4] Determinants of Depositor Attrition

We estimate the parameters associated with each factor using the following logit model for the attrition probability of depositor i at bank b in period t:

$$\text{logit}\,(\,P(\text{Attrition dummy}_{i,b,t}=1)\,) = \beta_1 \text{Deposit balance (logarithmic)}_{i,b,t-1} + \beta_2 \text{Share of transaction deposits}_{i,b,t-1} + \beta_3 \text{Deposit spread}_{i,b,t-1} + \beta_4 \text{Financial Stress Index}_{t} + \varepsilon_{i,b,t}$$

Sample period: Jan. 2019 – Dec. 2025, Sample size: over 2,600,000



Note: The bars show the marginal effect on the probability of depositor attrition when one standard deviation is added to each explanatory variable. The bands show the 95 percent confidence intervals, and *** indicates that the effect is statistically significant at the 1 percent significance level.

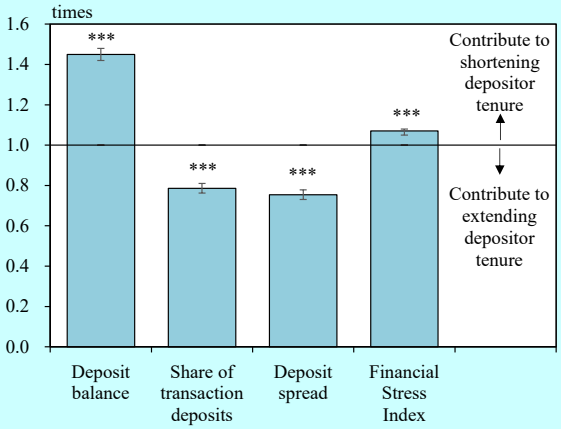
Sources: Bloomberg; FRED; Bank of Japan.

[Chart 5] Determinants of Depositor Attrition Risk

We estimate the parameters associated with each factor using the following Cox proportional hazards model, where $h(t|X)$ denotes the risk (hazard rate) of a depositor exiting its deposit relationship during the remaining tenure from period t, namely the speed until attrition, for depositor i at bank b, and $h_0(t)$ denotes the baseline hazard:

$$\log h(t|X) = \log h_0(t) + \beta_1 \text{Deposit balance (logarithmic)}_{i,b,t-1} + \beta_2 \text{Share of transaction deposits}_{i,b,t-1} + \beta_3 \text{Deposit spread}_{i,b,t-1} + \beta_4 \text{Financial Stress Index}_{t} + \varepsilon_{i,b,t}$$

Sample period: Jan. 2019 – Dec. 2025, Sample size: over 600,000



Note: The bars show how many times the attrition risk of a depositor during the tenure multiples when one standard deviation is added to each explanatory variable. The band shows the 95 percent confidence intervals, and *** indicates that the effect is statistically significant at the 1 percent significance level.

Sources: Bloomberg; FRED; Bank of Japan.

The analysis revealed that larger depositors tend to have a higher probability of attrition. On the other hand, depositors with wider deposit spreads -- i.e., those whose deposit interest rates are relatively suppressed -- exhibited lower attrition probabilities, although some depositors may exit due to diminished attractiveness of the suppressed deposit rates (details of deposit spreads are provided in the next section). This finding shows the importance for major banks of building relationships with depositors that extend beyond deposit interest rate considerations.[17] Additionally, depositors holding a larger portion of transaction deposits also showed lower attrition probabilities, suggesting that the promotion of transaction banking services associated with such deposits contributes to securing and retaining a major bank's depositor base.[18] Furthermore, the results confirmed that the probability of depositor attrition increases during periods of elevated stress in the financial markets.

Medium- to Long-Term Depositor Attrition Risk

Next, we used a Cox proportional hazards model to quantitatively assess how the aforementioned determinants of attrition affect the risk of depositor attrition over their tenure until exit, i.e., survival time.[19] While the logit model in the previous section examined whether individual factors influence a depositor's decision to exit at a given point in time, this alternative approach captures medium- to long-term effects by evaluating whether these factors increase the risk of shortening survival time of depositors until attrition (Chart 5).

The results indicated that larger depositors tend to show shorter survival time, whereas depositors with wider deposit spreads or those holding a larger portion of transaction deposits are expected to exhibit longer survival time. These findings are consistent with the impact of each factor on short-term depositor attrition, as suggested by the logit model discussed earlier. This suggests that building relationships with depositors beyond deposit interest rate considerations, as well as promoting transaction banking services, are also effective in mitigating medium- to long-term depositor attrition risks. In addition, an increase in the Financial Stress Index is likely to elevate attrition risks. In other words, even depositors who remained during a period of stress may exhibit a shortened tenure thereafter.

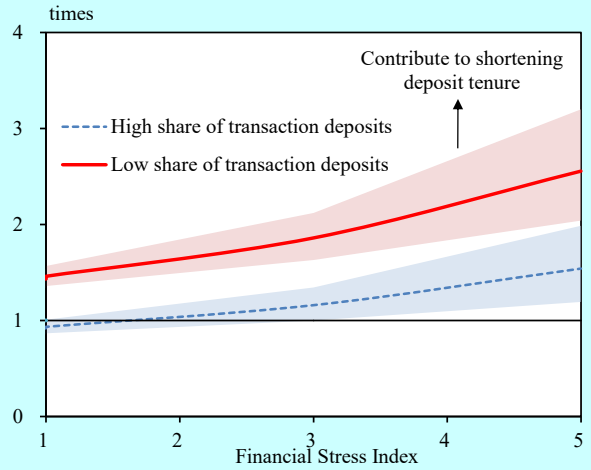
Beneficial Effects of Transaction Deposits on Maintaining Depositor Base

The amplifying effects of financial market stress on the risk of depositor attrition during tenure were particularly pronounced among non-Japanese

depositors holding time deposits when depositors were categorized by depositor attributes (Japanese or non-Japanese) and by deposit types. However, even among these depositor segments, it was confirmed that a higher share of transaction deposits held by depositors mitigated these effects relatively (Chart 6).[20]

These beneficial effects associated with the share of transaction deposits held were also seen during normal periods without financial market stress. Specifically, the Kaplan-Meier survival analysis was employed to estimate depositor survival curves using empirical data from sample groups of depositors holding time deposits categorized by the share of transaction deposits they held.[21] The results showed that the sample group with a higher share of transaction deposits maintains relatively higher survival rates over time, even as time elapsed since depositors made their initial deposits (Chart 7).

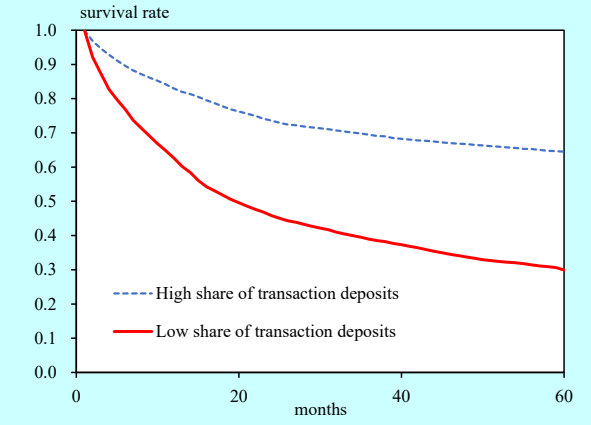
[Chart 6] Depositor Attrition Risk under Financial Market Stress



Note: Covers non-Japanese time depositors. The attrition risk is standardized at a factor of 1.0, with higher values indicating faster attrition speed (shorter tenure). The band shows the 95 percent confidence interval.

Sources: FRED: Bank of Japan.

[Chart 7] Depositors' Survival Curves by Transaction Deposit Share



Note: Covers non-Japanese time depositors.

Source: Bank of Japan.

These findings suggest that, for major banks, promoting the adoption of transaction banking services to encourage depositors to hold transaction deposits is crucial for maintaining a stable depositor base over the medium to long term, both during periods of financial stress and under normal conditions.

Deposit Spreads

Deposit Funding Cost and Deposit Spreads

The third quantitative analysis, focusing on deposit funding cost, targeted "deposit spreads," which is a commonly monitored metric in banks' ALM, as an indicator to measure the cost.

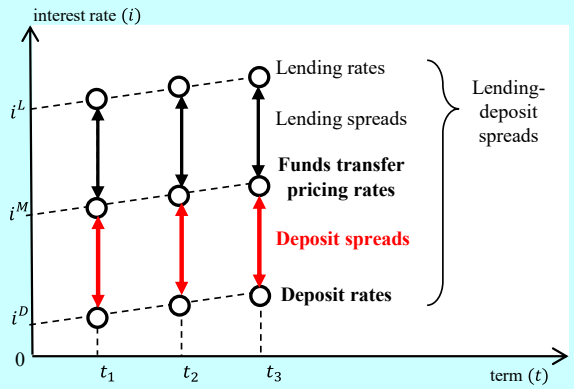
Specifically, banks refer to the interest rate as the "funds transfer pricing rate" at which they could raise the same amount for the same maturity from the funding market as the deposits acquired. The difference between this rate and the deposit interest rate is defined as the deposit spread, which represents the funding margin obtained through deposit acquisition (Chart 8).[22]

Additionally, banks manage the product of deposit spreads and the amount of deposits acquired as "deposit revenue." For example, as part of initiatives to promote the acquisition of foreign currency deposits, banks may offer clients higher deposit interest rates, particularly for time deposits, which are considered to have higher interest rate sensitivity. If deposit spreads under this initiative become excessively compressed, deposit revenue may shrink. Therefore, the tightening of deposit spreads can lead to a deterioration in profitability due to deposit funding, which should be taken into account in terms of ALM.

Determinants of Deposit Spreads

Against this backdrop, to examine the potential for

[Chart 8] Deposit Spreads (Conceptual Framework)



Source: Bank of Japan.

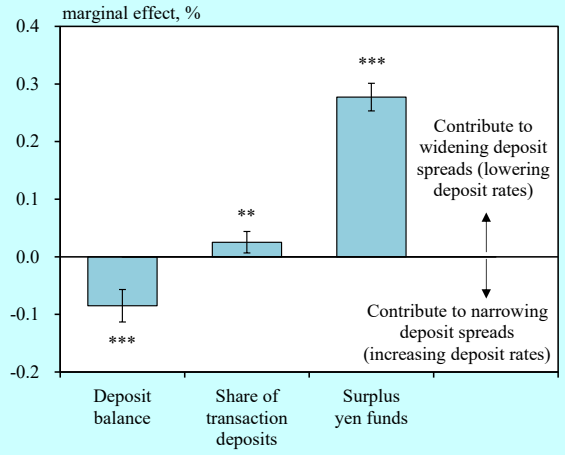
curbing costs while promoting deposit acquisition in the future, this quantitative analysis estimated the determinants of deposit spreads for time deposit holders with panel data, which included depositor-specific information from the granular data used in the previous sections, as well as information on each bank's surplus yen funding status related to their promotion of foreign currency deposit acquisition (Chart 9).[23]

[Chart 9] Determinants of Deposit Spreads

We estimate the parameters associated with each factor using the following fixed-effects model for the deposit spread on term deposits of depositor i at bank b in period t:

$$\text{Deposit spread}_{i,b,t} = \beta_1 \text{Deposit balance (logarithmic)}_{i,b,t-1} + \beta_2 \text{Share of transaction deposits}_{i,b,t-1} + \beta_3 \text{Surplus yen funds (logarithmic)}_{b,t-1} + \varepsilon_{i,b,t}$$

Sample period: Jan. 2019 – Dec. 2025, Sample Size: just under 300,000,
Fixed effects: depositor i and bank b



Note: The bars show the marginal effect on the deposit spread when one standard deviation is added to each explanatory variable. The bands show the 5 percent confidence intervals, and *** denotes that the effect is statistically significant at the 1 percent significance level and ** indicates significance at the 5 percent significance level.

Sources: AMRO; Bloomberg; FRED; Bank of Japan.

The results indicated that, for depositors with larger deposit amounts, deposit spreads tend to narrow more. This may be attributed to the relatively stronger bargaining power larger depositors hold when negotiating deposit interest rates with banks, or to the possibility that banks grant preferential interest rates to such depositors to attract substantial deposit volumes in single transactions. In any case, maintaining the deposit balances of large depositors likely entails non-negligible costs for banks. On the other hand, for clients with a higher share of transaction deposits, there is a tendency for deposit spreads to widen more. This suggests that banks can contain the interest rates offered to depositors who use transaction banking services associated with transaction deposits, thereby securing relatively wider deposit spreads.

Moreover, as mentioned at the beginning of this paper, the difference between yen-denominated deposits and loans, referred to as "surplus yen funds," has been used as a source of funds for medium- to long-term FX and currency swaps to offset the shortfall in foreign currency deposits. The analysis revealed that banks with larger surplus yen funds tend to secure wider deposit spreads. This likely stems from the reduced pressure on such banks to acquire additional foreign currency deposits by offering higher deposit interest rates, due to their room for medium- to long-term FX and currency swaps. Consequently, they can compress deposit interest rates more in comparison to the funds transfer pricing rate.

Conclusion

To examine the effectiveness of major Japanese banks' initiatives to acquire foreign currency deposits, as well as the stability of their depositor base and their funding costs, by using the granular data on their dollar deposits summarized by depositor, this paper decomposed the foreign currency deposit balances based on depositor dynamics and examined developments up to the present. In addition, quantitative analyses were conducted on depositor attrition and survival time, and the determinants of deposit spreads were examined.

The analysis revealed that fluctuations in the foreign currency deposit balances of major banks, including the recent increase seen particularly in APAC, are largely attributable to non-Japanese depositors, especially existing ones, who exhibit high sensitivity to interest rates. This finding suggests that measures to strengthen the acquisition of deposits by offering higher interest rates on time deposits during rollovers to existing non-Japanese depositors can be effective, albeit in the short term.

Furthermore, the results found no significant increase in depositor attrition during this period, and the depositor base was maintained. The results showed that the acquisition of transaction deposits associated with the provision of transaction banking services is effective in preventing depositor attrition and in extending survival time. The effectiveness has been quantitatively confirmed during periods of both macro-financial stress and normal conditions.

In addition, for depositors with a higher share of transaction deposits, the analysis revealed that banks tend to find it more likely to secure wider deposit spreads. Based on these findings, to acquire transaction deposits from a wide range of depositors by promoting the adoption of transaction banking services, even with non-insignificant investments of time and resources, it is likely to be effective not only in securing a stable

depositor base but also from the perspective of restraining deposit acquisition costs.

It is desirable to continue analyzing the funding trends of major banks, including their foreign currency deposits, while capturing the impact of changes in the domestic and global financial environment, with the aim of further enhancing monitoring activities. In addition, it is important to continue to deepen discussion with major banks and foreign authorities, based on the analytical results and implications derived from this study, including the quantitative analyses using the granular data introduced in this paper.

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[1] Major banks in this paper are the three megabanks which are classified as G-SIBs. Unless otherwise noted, figures in the charts show the totals of the three megabanks.

[2] The Bank of Japan monitors developments in the foreign currency funding and U.S. dollar funding costs of major banks in the Financial System Report. For the latest analysis, see below.

Bank of Japan. (2026). *Financial System Report* (April 2026).

[3] According to the Bank of Japan (2026) cited in Footnote 2, the share of overseas lending in total lending by major banks has remained stable at over 30 percent in recent years.

[4] For details on the efforts made by major banks thus far to enhance foreign currency liquidity risk management, see below:

Financial System and Bank Examination Department, Bank of Japan, and Strategy Development and Management Bureau, Financial Services Agency (2024), "Foreign Currency Liquidity Risk Management at Japanese Major Banks: Efforts and Enhancement," *Bank of Japan Review Series*, no. 2024-E-3.

[5] For details of the granular data for foreign currency deposits of Japanese major banks, as well as an example analysis of deposit stickiness using such data, see Funada et al. (2025):

Funada, N., Sakata, T., and Ogawa, Y. (2025), "Granular Insights into Japanese G-SIBs' Foreign Currency Deposits: Characteristics and Stickiness," *Bank of Japan Review Series*, no. 2025-E-8.

[6] Prior studies employing a broad scope of account-level data from major banks to analyze foreign currency deposits, focusing on depositor dynamics and deposit spreads as in this paper, have not been identified. However, as related analysis to the issues described in this paper, recent studies include Drechsler et al. (2017), who use bank-level aggregated deposit data in the United States to analyze the sensitivity of deposits to interest rates and the impact of deposit insurance on deposit outflows. Davenport and McDill (2006) conduct a case study on a bank failure in the United States, using account-level data to confirm the effects of deposit interest rates, depositor attributes, and banking relationships on deposit outflows.

Davenport, A. M. and McDill, K. M. (2006), "The Depositor behind the Discipline: A Micro-Level Case Study of Hamilton Bank," *Journal of Financial Services Research*, 30(1), 93-109.

Drechsler, I., Savov, A., and Schnabl, P. (2017), "The Deposits Channel of Monetary Policy," *Quarterly Journal of Economics*, 132(4), 1819-1876.

[7] While this paper uses the term of depositor dynamics because the focus is on depositors, the broader concept, which is commonly referred to as customer dynamics, has been widely applied in research on corporate marketing and customer relationship management, including studies such as Schmittlein and Peterson (1994), Thomas (2001), and Schweidel et al. (2008):

Schmittlein, D. C. and Peterson, R. A. (1994), "Customer Base Analysis: An Industrial Purchase Process Application," *Marketing Science*, 13(1), 41-67.

Schweidel, D. A., Fader, P. S., and Bradlow, E. T. (2008), "A Bivariate Timing Model of Customer Acquisition and Retention," *Marketing Science*, 27(5), 829-843.

Thomas, J. S. (2001), "A Methodology for Linking Customer Acquisition to Customer Retention," *Journal of Marketing Research*, 38(2), 262-268.

[8] Based on the granular data, dollar deposits account for over 60 percent of the total foreign currency deposit balances at major banks as of the end of 2025.

[9] Specifically, by consolidating transaction-specific data on deposit balances in the granular data by depositor, this paper defines newly acquired depositors as those with no prior deposit balances in the previous month and who established deposit balances during the current month. Existing depositors are defined as those with balances in both the previous and current months. Departing depositors are those with prior balances in the previous month but no balances in the current month. To calculate each of these categories' contribution to the year-on-year changes in total deposit balances, the definitions further assume that newly acquired depositors held no balances in the corresponding month of the previous year, while existing and departing depositors had balances in the same month of the preceding year.

[10] As shown in Chart 2, this methodology disaggregates deposit balance declines into partial withdrawals by existing depositors and deposit outflows due to depositor attrition. In this regard, this further explores deposit stickiness analyzed in Funada et al. (2025), cited in Footnote 5, which focused just on overall balance declines.

[11] The tendency of non-Japanese depositors to be highly sensitive to interest rates is confirmed by Funada et al. (2025) cited in Footnote 5.

[12] The granular data also shows that, as of the end of 2025, balances in the United States and APAC accounted for approximately 40 percent and 30 percent, respectively, of the overall dollar deposit balances of major banks.

[13] According to data from the Federal Financial Institutions Examination Council (FFIEC), even during recent periods when the deposit balances of Japanese major banks stagnated as shown in Chart 3, U.S. banks exhibited an increase in deposit balances.

[14] For reference, see Funada et al. (2025) cited in Footnote 5.

[15] This paper employs the St. Louis Fed Financial Stress Index, published weekly by the Federal Reserve Bank of St. Louis, as a measure of financial stress. This composite index, built from 18 U.S. financial market time series such as interest rates and yield spreads, is constructed with the long-term average since 1993 set at 0. Higher positive values denote higher stress levels in the U.S. financial market. In the quantitative analyses in this paper, the monthly peak value of the index was used. During the sample period, while the average hovered around -0.1, the index peaked above +5 during the COVID-19 pandemic in March 2020, saw an elevation to over +1 during the failure of Silicon Valley Bank in the United States in March 2023, and marked +0.6 around April 2025 following announcements of reciprocal tariffs in the United States. For further technical details of the index, see Kliesen and Smith (2010):

Kliesen, K. L., and Smith, D. C. (2010), "Measuring Financial Market Stress," Federal Reserve Bank of St. Louis.

[16] Although this logit model uses contemporaneous Financial

Stress Index as the explanatory variable, the potential for simultaneity bias is considered to be limited because the dependent variable is measured at the micro level by depositor, whereas the explanatory variable is a macroeconomic variable one. As an additional robustness check, when we estimate the model using the one-period lagged Financial Stress Index, the results and statistical significance remain largely unchanged.

This logit model incorporates dummy variables regarding depositor attributes, namely those of non-Japanese depositors and those of financial institutions, and quarter-end dummy, in addition to the explanatory variables presented in Chart 4. The results confirm that all dummy variables are statistically significant at the 1 percent level and contribute to raising the probability of attrition.

As the robustness of the estimation results, we estimated a probit model and fixed-effects panel data OLS model with the same samples and explanatory variables as this logit model, both of which produced consistent signs and statistical significance for the explanatory variables.

For the quantitative analyses in this paper, the cluster-robust standard errors are employed. The detailed methodologies are based on the following references:

Cameron, A. C., and Trivedi, P. K. (2005), "Microeconometrics: Methods and Applications," Cambridge University Press.

Wooldridge, J. M. (2010), "Econometric Analysis of Cross Section and Panel Data," 2nd ed., MIT Press.

[17] For many banks, depositors are often also borrowers, and it is likely that banks build customer relationships through opportunities to provide both deposit and lending services.

[18] As in Funada et al. (2025) cited in Footnote 5, this paper classified demand deposits with interest rates below 0.05 percent in the granular data as transaction deposits.

[19] The potential for simultaneity bias concerning the Financial Stress Index, which is a macroeconomic variable and one of the explanatory variables in this Cox proportional hazards model, is considered to be limited as discussed in Footnote 16. As an additional robustness check, when we estimate the model using the one-period lagged Financial Stress Index, the results and statistical significance remain largely unchanged.

The Cox proportional hazards model included dummy variables for non-Japanese depositors and financial institutions in addition to the explanatory variables in Chart 5. The results showed that the dummy variable for non-Japanese depositors increases the attrition risk, with statistical significance at the 1 percent level.

For technical details of the Cox proportional hazards model, refer to Cameron and Trivedi (2005) and Wooldridge (2010) as cited in Footnote 16, along with the following:

Cox, D. R. (1972), "Regression Models and Life-Tables," *Journal of the Royal Statistical Society: Series B*, 34(2), 187-202.

[20] The attrition risk by the level of transaction deposit share in Chart 6 was prepared using the estimation results from the Cox proportional hazards model in Chart 5, specifically the coefficient and standard error for the financial stress indicator when the depositor's transaction deposit ratio deviates by ±1 standard deviation.

[21] The Kaplan-Meier survival analysis is a method used to illustrate the cumulative survival rates for sample groups nonparametrically (here, two groups were created by dividing the samples based on the median transaction deposit ratio into high and low groups). For technical details, refer to Cameron and Trivedi (2005) and Wooldridge (2010) in Footnote 16 and the following:

Kaplan, E. L., and Meier, P. (1958), "Nonparametric Estimation from Incomplete Observations," *Journal of the American Statistical Association*, 53(282), 457-481.

[22] Since granular data does not include information on deposit spreads or funds transfer pricing rates, this paper conducts proxy estimates of deposit spreads by replacing the funds transfer pricing rate with the market-based funding benchmark. Specifically, the overnight SOFR (Secured Overnight Financing Rate) is used as the funds transfer pricing rate for non-maturity deposits, the average of three-month SOFR and BSBY (Bloomberg Short-term Bank Yield Index) is used for deposits with maturities of less than six months, and the average of six-month SOFR and BSBY is used for deposits with maturities of six months or longer. After the discontinuation of BSBY, the corresponding dollar funding premium for each term is used as a replacement.

[23] This fixed-effects model incorporates the explanatory variables and fixed-effects variables in Chart 9, along with instrumental variables for the macroeconomic environment, such as the federal funds rate and the logarithm of GDP for the deposit acquisition region. The results confirm that both instrumental variables push up deposit spreads, with statistical significance at the 1 percent level.

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